Cultural Transmission among Aka Pygmies

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Cultural transmission is a process of social reproduction in which the culture's technological knowledge, behavior patterns, cosmological beliefs, etc. are communicated and acquired. Anthropological studies of cultural transmission, socialization, and enculturation have stressed the inculcation of attitudes, values, and personality traits rather than the mundane details of the transmission of practical skills and knowledge (Fortes 1938; Mead 1928, 1942; Scribner and Cole 1973; Whiting and Child 1953; Whiting and Whiting 1975; Williams 1981). Details about the transmission of

knowledge concerning artifact production and foraging activities are rare (see Ruddle and Chesterfield 1977; Erchak 1977; Colson 1958 for exceptions).

The research in this report was stimulated in part by this lack of quantitative data, but also by a model of cultural transmission recently developed by Cavalli-Sforza and Feldman (1981), which indicates that quantitative data on mechanisms of transmission of cultural traits, such as subsistence skills, could be useful in predicting within-group variability, stability of cultural traits over time and space, and the evolutionary processes in culture. Figure 1 lists some components of their model relevant to this research. The model takes a conceptual framework based in the study of biological inheritance and evolution and applies it to equivalent social variables. As Figure 1 indicates, cultural transmission from parent-to-child is called vertical and is the closest to biological transmission; like biological transmission, it is highly conservative and may maintain the status quo, including all the individual variation in existence.

With this mode of transmission there is little difficulty accepting an innovation at the individual level; children are especially receptive, but the innovation will be very slow to spread to others in the population unless other modes of transmission are employed along with parent-to-child transmission. A more typically "cultural" mode of transmission is horizontal or contagious, in which transmission is between any two individuals irrespective of their relationship. This is very similar to the transmission of infectious diseases. The spread can be fast if contacts with transmitters and acceptance by the transmittee are frequent. In Cavalli-Sforza and Feldman's original definition, a distinction is drawn between horizontal and oblique, the first referring to transmission within and the second between generations, but we will not distinguish them here and will consider the "horizontal" term to include both. If transmission is one-toward-many, communication is

	Modes of cultural transmission			
	Vertical or parent-to-child	Horizontal or contagious	One-to-many	Concerted or many-to-one
				
Transmitter	Parent(s)	Unrelated	Teacher/ leader/media	Older members of social group
Transmittee	Child	Unrelated	Pupils/ citizens/ audience	Younger members of social group
Acceptance of innovation	Intermediate difficulty	Easy	Easy	Very difficult
Variation between individuals within population	High	Can be high	Low	Lowest
Variation between groups	High	Can be high	Can be high	Smallest
Cultural evolution	Slow	Can be rapid	Most rapid	Most conservative

Figure 1
A model of cultural transmission (after Cavalli-Sforza and Feldman 1981).

highly efficient and if acceptance follows communication cultural change may be very rapid. In many-toward-one transmission every recipient is assumed to be influenced by many transmitters, and that all transmitters act in concert so that the influence is reciprocally reinforced. Consequently, change in the frequency of a trait over time and space should be slow and variation within and between populations low. This mode of transmission tends to generate the highest uniformity within the group (see Cavalli-Sforza and Feldman 1981 for mathematical paradigms of these types of transmission).

When using the transmission models it is essential to identify quantitatively who transmits what traits to whom. One can then identify the dominant models of transmission. Moreover, ages are important, considering the existence of considerable differences in plasticity as a function of age. Also, secular changes can be detected by a study of age's effect.

The Aka

The specific aim of this study is to give a quantitative description of cultural transmission as it relates to a population of foragers, mostly focused on foraging techniques, and to examine some of the questions and hypotheses suggested by the Cavalli-Sforza and Feldman model. Aka pygmies were selected for study as an example of foragers who have been living relatively undisturbed for a presumed long interval of time in the environment to which they are adapted, the forest. The Aka were familiar to both authors, and Hewlett had previous repeated contact with most of the individuals in the study. Aka pygmies live in the tropical forest regions of the southern Central African Republic and northern Congo-Brazzaville (for a recent overview of Aka, see Cavalli-Sforza 1986). The Aka in this study are associated with the Bokoka section of the Bagandou village. There are 769 villagers in Bokoka, primarily Ngandu peoples, and approximately 300 Aka associated with villagers in this section of the village. Although the Aka net hunt in the forest the majority of the year and spend little or no time in the cultivation of plant foods, they are transitional hunter-gatherers in the sense that some 50% of their diet comes from domesticated village products (Bahuchet 1979b). The average number of individuals in a camp is 25 to 30. The family is small and childbirths are widely spaced (three to four years). Thus, the number of siblings each individual has is relatively small, and the number of age peers is of necessity limited. Practically all adults are married and those of child-bearing age have children.

Methods

The Aka sample consisted of 40 adults, 16 children (7–12 years old), and 16 unmarried adolescents. Fifty-seven of the 72 individuals came from three forest camps that Hewlett knew well from a previous father-infant study, and the others were less known but from the same area of Bokoka. Overall, the sample represented about 25% of the total Aka population associated with Bokoka.

Fifty skills in the arts of Aka life were selected for study. Hunting, collecting, and maintenance skills dominated the list, but some child care, social, and village-oriented subsistence skills were also included. Tables 1 and 2 indicate the 50 skills investigated, clustered as follows: net hunt (7 skills), other hunt (4), food gathering (10), mating (2), sharing (3), special skill (2), dancing/singing (4). The list covers skills of importance for food, shelter, reproduction, and a few selected aspects of social life.

Each question was asked in the same form. The following clarification of 37 of the 50 skills are useful in this respect:

Chase in net—chase *mboloko* (small duiker-*Cephalophus monticola* into net)
Kill in net—kill *mosome* (large duiker-*Cephalophus callipygus*) once in net
Wash net—wash net of malevolent spirits with *mousousie* (traditional medicine)
Spear-hunt—hunt with spear on net hunt
Make poison—make *ndemele* (poison) for crossbow arrows
Elephant hunt—hunt with spear on elephant hunt
Identify monkey—identify sounds/behaviors of *kima esadu (Cercocebus galeritus agilis)*

Table 1
Percentage of male and female adults (N = 40, 20 males, 20 females) adolescents (N = 16, 8 males, 8 females), and children (N = 16, 8 males, 8 females) who know each of 50 skills.

Skill	Adult (%)		Adolescent (%)		Child (%)	
	M	F	M	F	M	F
Net hunt						
Net hunt	100.0	100.0	100.0	100.0	100.0	100.0
Make string	100.0	80.0	100.0	100.0	100.0	100.0
Make net	100.0	20.0	100.0	12.5	25.0	0.0
Chase in net	100.0	100.0	100.0	100.0	100.0	100.0
Kill in net	100.0	100.0	100.0	100.0	100.0	100.0
Wash net	90.0	10.0	75.0	0.0	0.0	0.0
Spear hunt	100.0	0.0	100.0	0.0	100.0	0.0
Other hunt						
Make crossbow	35.0	0.0	12.5	0.0	0.0	0.0
Make poison	85.0	0.0	50.0	0.0	0.0	0.0
Elephant hunt	90.0	0.0	87.5	0.0	12.5	0.0
Identify monkey	100.0	100.0	100.0	100.0	100.0	100.0
Food gathering						
Find *koko*	100.0	100.0	100.0	100.0	87.5	100.0
Find honey	100.0	95.0	100.0	100.0	100.0	100.0
Find fruit	100.0	100.0	100.0	100.0	100.0	100.0
Find mushrooms	100.0	100.0	100.0	100.0	100.0	100.0
Find nuts	100.0	100.0	100.0	100.0	100.0	100.0
Carry basket	40.0	100.0	100.0	100.0	37.5	100.0
Digging stick	90.0	100.0	100.0	100.0	100.0	100.0
Climb tree	100.0	0.0	100.0	0.0	100.0	0.0
Find igname	100.0	100.0	100.0	100.0	100.0	100.0
Vine water	100.0	100.0	100.0	100.0	100.0	100.0
Food preparation						
Make *koko*	20.0	100.0	37.5	100.0	12.5	100.0
Prepare manioc	20.0	100.0	25.0	100.0	0.0	87.5
Palm wine	100.0	40.0	100.0	87.5	100.0	0.0
Maintenance						
Ax tree	100.0	100.0	100.0	100.0	100.0	100.0
Build fire	100.0	100.0	100.0	100.0	100.0	100.0
Build cabin (hut)	80.0	100.0	62.5	100.0	12.5	100.0
Make ax	100.0	15.0	100.0	0.0	100.0	12.5
Plant manioc	55.0	100.0	12.5	100.0	0.0	87.5
Infant care						
Bathe infant	85.0	100.0	0.0	100.0	0.0	37.5
Soothe infant	95.0	100.0	100.0	100.0	100.0	87.5
Carry in sling	90.0	100.0	87.5	100.0	12.5	87.5
Carry on back	95.0	100.0	100.0	100.0	87.5	100.0
Nonaggression	100.0	100.0	100.0	100.0	75.0	100.0
Ekila medicine	25.0	20.0	12.5	37.5	0.0	0.0
Mokodi amulet	45.0	35.0	75.0	0.0	0.0	0.0
Hold newborn	90.0	100.0	75.0	100.0	0.0	100.0
Infant smile	100.0	100.0	100.0	100.0	100.0	100.0
Feed infant	90.0	100.0	50.0	100.0	0.0	75.0
Mating						
In-laws	100.0	100.0	87.5	100.0	0.0	25.0
Sex behavior	100.0	100.0	100.0	100.0	0.0	0.0
Sharing						
Share duiker	100.0	100.0	100.0	100.0	100.0	100.0
Share elephant	80.0	80.0	100.0	100.0	100.0	100.0
Share honey	100.0	100.0	100.0	100.0	100.0	100.0
Special skills						
Ntuma skills	100.0	95.0	100.0	100.0	100.0	87.5
Nganga skills	100.0	100.0	100.0	100.0	100.0	87.5
Dance or sing						
Dance *libanda*	65.0	40.0	75.0	75.0	100.0	62.5
Dance *djengi*	95.0	80.0	100.0	100.0	100.0	100.0
Hunt songs	100.0	95.0	100.0	100.0	100.0	100.0
Dance *elanda*	85.0	85.0	100.0	100.0	100.0	100.0

Table 2
Educators of adults (N = 40, 20 male, 20 female) who know skill.

	Father		Mother		Parents		Grand-parents		Other(s) family		Other(s) non-family		Villagers		Independent learning		Total who know skill	
Skills	m	f	m	f	m	f	m	f	m	f	m	f	m	f	m	f	m	f
Net hunt																		
Net hunt	14	2	0	7	4	6	1	2	0	0	1	3	0	0	0	0	20	20
Make string	18	2	0	3	0	10	1	0	0	0	1	1	0	0	0	0	20	16
Make net	18	2	0	0	0	1	1	0	0	1	1	0	0	0	0	0	20	4
Chase in net	12	3	1	5	1	9	1	0	0	0	5	2	0	0	0	0	20	20
Kill in net	15	4	1	8	1	4	1	1	0	0	2	3	0	0	0	0	20	20
Wash net	15	2	0	0	0	0	0	0	0	0	2	0	1	0	0	0	18	2
Spear hunt	18	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	20	0
Other hunt																		
Make crossbow	3	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	7	0
Make poison	11	0	0	0	0	0	0	0	1	0	5	0	0	0	0	0	17	0
Elephant hunt	11	0	0	0	0	0	1	0	0	0	6	0	0	0	0	0	18	0
Identify monkey	13	3	0	8	4	5	1	2	0	0	1	1	0	0	1	1	20	20
Food gathering																		
Find *koko*	6	1	8	13	4	3	1	1	0	0	1	2	0	0	0	0	20	20
Find honey	16	10	0	0	1	6	2	0	0	0	1	3	0	0	0	0	20	19
Find fruit	9	3	4	8	2	6	2	1	0	0	2	0	0	0	1	2	20	20
Find mushrooms	5	3	7	10	6	3	2	1	0	0	0	2	0	0	0	1	20	20
Find nuts	8	0	9	15	2	1	1	1	0	0	0	2	0	0	0	0	20	20
Carry basket	2	0	5	18	0	2	0	0	0	0	1	0	0	0	0	0	8	20
Digging stick	3	0	8	19	4	0	1	1	0	0	2	0	0	0	0	0	18	20
Climb tree	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0
Find igname	4	0	10	16	5	4	1	0	0	0	0	0	0	0	0	0	20	20
Vine water	12	3	0	4	6	12	2	0	0	0	0	1	0	0	0	0	20	20
Food preparation																		
Make *koko*	1	0	3	15	0	1	0	1	0	0	0	3	0	0	0	0	4	20
Prepare manioc	3	0	1	9	0	0	0	1	0	1	0	0	0	9	0	0	4	20
Palm wine	18	5	0	2	0	0	0	0	0	0	2	1	0	0	0	0	20	8

Maintenance																		
Ax tree	17	5	1	6	1	8	1	0	0	1	0	0	0	0	0	0	20	20
Build fire	14	4	1	11	4	4	1	0	0	0	0	1	0	0	0	0	20	20
Build cabin (hut)	8	0	1	20	0	0	0	0	0	0	0	0	7	0	0	0	16	20
Make ax	19	2	0	0	1	0	0	0	0	1	0	0	0	0	0	0	20	3
Plant manioc	1	0	5	13	1	0	1	0	1	0	2	2	0	5	0	0	11	20
Infant care																		
Bathe infant	6	0	7	17	4	2	0	0	0	0	0	1	0	0	0	0	17	20
Soothe infant	8	0	6	13	3	4	1	1	0	0	1	2	0	0	0	0	19	20
Carry in sling	6	0	8	16	3	4	1	0	0	0	0	0	0	0	0	0	18	20
Carry on back	8	2	5	11	4	5	1	0	0	0	1	2	0	0	0	0	19	20
Nonaggression	14	1	1	8	2	10	1	0	0	0	2	1	0	0	0	0	20	20
Ekila medicine	2	0	0	1	0	1	0	0	0	0	0	1	3	1	0	0	5	4
Mokodi amulet	7	0	2	5	0	1	0	0	0	0	0	0	0	1	0	0	9	7
Hold newborn	6	0	7	14	2	0	1	2	1	0	1	3	0	0	0	1	18	20
Infant smile	9	0	3	11	4	2	1	1	1	0	1	1	0	0	1	0	20	20
Feed infant	5	1	6	15	3	1	1	2	0	1	2	0	0	0	1	0	18	20
Mating																		
In-laws	14	1	1	4	4	11	1	1	0	1	0	2	0	0	0	0	20	20
Sex behavior	11	2	0	10	3	1	1	2	0	3	3	1	0	0	2	1	20	20
Sharing																		
Share duiker	14	0	0	11	4	4	1	1	0	2	1	2	0	0	0	0	20	20
Share elephant	11	2	2	9	1	0	1	1	0	2	1	2	0	0	0	0	16	16
Share honey	13	0	1	13	5	4	0	0	0	1	1	1	0	0	0	1	20	20
Special skills																		
Ntuma skills	10	3	0	6	1	2	1	0	0	1	8	7	0	0	0	0	20	19
Nganga skills	9	2	1	9	1	2	2	0	0	1	7	6	0	0	0	0	20	20
Dance or sing																		
Dance *libanda*	4	0	0	0	0	0	1	0	0	0	8	8	0	0	0	0	13	8
Dance *djengi*	10	0	0	7	1	0	1	1	1	0	6	8	0	0	0	0	19	16
Hunt songs	18	4	0	5	1	3	0	0	0	0	1	7	0	0	0	0	20	19
Dance *elanda*	10	1	0	2	0	1	0	1	0	0	7	12	0	0	0	0	17	17

Find *koko*—identify *koko* (leaves of *Gnetum* sp.)
Find fruit—find *botende* (species unknown)
Find mushrooms—identify edible mushrooms
Find nuts—find *piyu* nuts *(Irivingia gabonesis)*
Carry basket—carry *yukwa* (collection basket)
Climb tree—climb large tree with liana to get honey
Vine water—collect water from forest liana
Make *koko*—preparation of *koko* by shredding
Prepare manioc—make manioc into flour
Palm wine—prepare palm tree for *mbolu* drinking (type of procedure to get wine at base of tree)
Bathe infant—bathe infant of three months or less
Soothe infant—soothe infant that is crying and mother is gone
Carry in sling—carry infant in sling on net hunt
Carry on back—carry older child (*mona*, a 3–4-year-old) on back
Nonaggression—train child not to hit another child
Ekila medicine—make traditional medicine for infant with *ekila* (convulsions)
Mokodi amulet—make *mokodi* (cord woven from special vines) for good luck or protection
Hold newborn—hold infant of five days
Infant smile—make infant of four months smile
Feed infant—feed food to infant of five months
In-laws—directions on appropriate behavior for living in camp of spouse (time of bride service for males and after bride service for females)
Sexual behavior—intercourse with mate
Share *mboloko*—divide *mboloko* (small duiker) with others
Share elephant—divide an *njokou* (elephant) with others
Ntuma skills—powers and knowledge of *ntuma* (great elephant hunter)
Nganga skills—powers and knowledge of *nganga* (traditional healer)
Dance *libanda*—type of dance for enjoyment
Dance *djengi*—type of dance done after elephant kill (of great ritual significance)
Hunt songs—sing while walking to net hunt
Dance *elanda*—type of dance for enjoyment

Each Aka was asked about each skill, if he or she possessed it, and, if so, if there were any particular person(s) or group (friends or adults, for example) who had shown them how to perform the skill. No prescriptive categories were presented from which they had to select a "teacher" of the skill. Aka seemed quite comfortable with the questions and often gave detailed descriptions of whom they watched doing the skill, and the few things the educator did or said to transmit the skill knowledge. They also often remembered the setting in which this occurred.

The accuracy of these self-reports is also indicated by the following considerations: (1) in the behaviors involving parent-infant interaction there were direct systematic observations confirming self-reports; (2) the general patterns of observed Aka enculturation fit well with the self-reports; and (3) within the sample of 72 individuals there were 13 mother-father-child triads and 28 mother-child or father-child dyads, with which it was possible to measure the reliability of the child's responses. If the child said his or her mother, father, or both parents instructed him or her in a skill, it was then checked to see if the mother and/or father, in fact, knew the skill being transmitted. Of 1,400 responses checked, only 3 deviations were found.

Results

Tables 1 and 2 list the 50 cultural traits/skills, the percentage of male and female adults, adolescents, and children who knew the skill (Table 1), and the reported educator(s) by those adults who knew the skill (Table 2). Similar traits/skills are clustered for the purpose of analyses. Mother, father, parents, and grandparents are consanguineous relatives, not classificatory kin. "Other family" refers to aunt, uncle, brother, sister, husband, or wife, and "other non-family" includes Aka responses such as watching adults in camp, watching others with skill, watching women, etc. Independent learning means Aka reported learning the skill on his or her own.

Summary and analyses of Tables 1 and 2 are found in Tables 3–6. Table 3 combines skilled adult male and female responses and identifies the major contributors to transmission by skill cluster. Father, mother, and parent responses have been consolidated into the category of "parent." Unquestionably, parents are the primary contributors. Their overall

Table 3
Contributors to transmission (adults, $N = 40$). Percents are calculated on individuals who know skill.

	Parent	Grand-parent	Other family	Friend	Villager	Others	Self
All traits	80.7	3.8	1.4	0.7	1.6	10.0	0.9
Net hunt	84.5	3.6	0.4	0.4	0.4	9.5	0.9
Other hunt	70.7	4.9	2.4	0.0	0.0	19.5	2.4
Food gather.	89.3	4.6	0.3	0.8	0.0	3.8	1.1
Food prep.	76.3	2.3	1.3	2.3	11.8	5.3	0.0
Maintenance	86.5	1.8	1.8	0.0	7.1	2.9	0.0
Infant care	85.6	3.9	0.9	0.3	1.5	6.9	0.9
Mating	77.5	6.2	5.0	1.2	0.0	6.2	3.7
Sharing	83.9	3.6	4.5	0.0	0.0	7.1	0.9
Special skills	58.2	3.8	2.5	0.0	0.0	35.4	0.0
Dance or sing	51.9	3.1	0.8	2.3	0.0	41.9	0.0

contribution is 80.7% and the level of contribution ranges from 89.3% in food-acquisition skills to 51.9% for dancing and singing skills. "Watching others" follows in importance but its significance is limited to the trait clusters of other hunt, special skills, and dancing/singing. Skills within the other hunt and special skills categories often involve learning situations where there are relatively few skilled individuals. For instance, the crossbow is a relatively new hunting technique (acquired less than 40 years ago), and less than one-third of the adult males know how to make one (see Table 2). Therefore, a boy whose father does not know the skill must watch other skilled males to learn. Many Aka today acquire a crossbow through trade. Elephant hunting and knowledge of *ntuma* and *nganga* abilities also belong to this category. On the elephant hunt, some boys learn primarily by watching their fathers on the hunt, but other boys pay special attention to the *ntuma,* the great elephant hunter. Knowledge of *ntuma* and *nganga* abilities is obtained by talking to parents and watching the few *ntumas* and *ngangas* in action. Poisoned arrows have been used with bows for a long time and all Aka males know how to make them, so boys usually learn the skill from their fathers (see Table 2).

Dances are frequently learned by watching others and take place in a setting unlike many others. While most hunting, gathering, and maintenance activities take place in and around the nuclear family, dancing takes place where other members of the band are as available as one's parents.

The overall contribution by "villagers" is minimal, but is significant for three skills (see Table 2): building rectangular cabins for males, and manioc planting and manioc flour preparation for females. In contrast to adult females, all skilled adolescent females stated they learned manioc planting and preparation from their mothers, a possible indicator that Aka are doing more cultivation and manioc flour preparation than in the past. About 40% of the adolescent males who knew how to build a village-style forest cabin indicated their "patron" instructed them, the same percentage of adult males that indicated villagers contributed to their acquisition of the skill.

Other family, friends, and independent learning contribute minimally to skill development and their influence is not demonstrated in any specific skill(s), as is found with villagers' contributions.

Table 4 summarizes the age effects by skill category. By late childhood (10 years of age), males have attained a skill level in gathering, food preparation, sharing, special skills, and dancing that will not change much in adolescence or adulthood. In adolescence and adulthood males will increase their basic skills in net

Table 4

Effect of age (adults, $N = 40$; adolescents, $N = 16$; children, $N = 16$), showing proportion of individuals in each age group who know traits within the cluster. Chi-squares measure significance of differences between ages.

Trait cluster	Males				Females			
	Child	Adoles.	Adult	Chi-sq.	Child	Adoles.	Adult	Chi-sq.
Net hunt	0.75	0.96	0.99	34.9[a]	0.54	0.59	0.59	0.4
Other hunt	0.28	0.63	0.66	13.8[a]	0.25	0.25	0.25	0.0
Food gather.	0.99	1.00	0.98	0.3	0.90	0.90	0.90	0.0
Food prep.	0.38	0.54	0.47	1.8	0.94	0.94	1.00	0.0
Maintenance	0.48	0.75	0.87	24.3[a]	0.78	0.80	0.83	0.5
Infant care	0.36	0.70	0.82	55.0[a]	0.69	0.84	0.86	10.5[b]
Mating	0.00	0.94	1.00	66.0[a]	0.13	1.00	1.00	61.4[a]
Sharing	1.00	1.00	0.90	3.4	1.00	1.00	0.90	3.4
Special skills	0.88	1.00	1.00	5.0	1.00	1.00	0.98	0.7
Dance or sing	1.00	0.94	0.86	5.3	0.91	0.94	0.80	4.1

[a] $p < .005$.
[b] $p < .01$.
All have 2 df.

hunting, other hunting techniques, maintenance skills, infant care, and mating. Females on the other hand will have acquired by late childhood most of the skills they will ever learn in net hunting, other hunting techniques, gathering, food preparation, maintenance, sharing, special skills, and dancing. Only basic skills in infant care and mating will increase.

Examining specific skills by age and sex, we find that females know more than males by late childhood, pick up few skills in adolescence and none as adults, and never learn a number of hunting skills. Conversely, males know less than females at 10 years of age, pick up a number of skills in adolescence and a few as adults, and at least a few males learn every skill. A female-biased selection of skills, which might generate this result, is not apparent: 13 of the skills are usually performed by women, 12 skills are generally male skills, and 25 skills are undertaken regularly by both sexes.

Although males know slightly fewer skills at age 10 than do females, both sexes by this age know the majority of foraging skills. Children seldom contribute economically to the family or band and have none of the assigned responsibilities that village children do. If need be, however, Aka 10-year-olds have the skills to make a living in the forest.

Table 5 compares the sexual division of labor and the sexual division of teaching labor. "Sexual division of labor" refers to male/female differentiation in skill knowledge, not necessarily to differences in who performs the skill more often. "Sexual division of teaching labor" is limited to mother or father teaching of those skills. For two trait clusters, maintenance and sharing, there is equality in skill knowledge as well as in teaching labor. In two trait clusters males know more than females—net hunt and other hunt—but males (i.e., fathers) also contribute more to skill acquisition in these categories. As for food preparation skills, females know more than males but fathers contribute just as often as mothers in the transmission of these skills. In five trait clusters, there is male-female equality in knowledge but inequality in male-female contribution to teaching labor. Mothers contribute more to the teaching of gathering and infant care and fathers provide more teaching labor in mating, special skills, and dancing/singing traits.

Table 6 compares cases for which mother or father is cited as the educator and indicates a strong relationship between sex of skilled individual and sex of

Table 5
Sexual division of labor and division of teaching labor (adults only, $N = 40$).

Cultural traits	Division of labor by sex (percentage skilled)			Division of teaching labor (percentage teaching by:)		
	Males	Females	Chi-sq.	Father	Mother	Chi-sq.
All traits	86.9	77.8	.54	42.5	38.3	3.04
Net hunt	98.6	58.6	9.49[a]	65.0	19.5	46.56[a]
Other hunt	77.5	25.0	11.03[a]	50.0	14.6	11.71[a]
Food gather.	93.0	89.5	.15	37.8	51.5	6.95[b]
Food prep.	46.7	80.0	4.79[b]	35.5	40.8	.22
Maintenance	87.0	83.0	.12	46.5	40.0	.73
Infant care	81.5	85.5	.12	30.8	57.8	19.57[a]
Mating	100.0	100.0	.00	46.2	31.1	1.89
Sharing	93.3	93.3	.00	43.8	40.2	.15
Special skills	100.0	97.5	.00	32.4	24.1	.98
Dance or sing	86.3	75.0	.81	38.8	13.2	10.98[a]

[a] $p < .005$.
[b] $p < .05$.

Table 6
Sex of educator/sex of skilled individual interactions for Aka of all ages ($N = 72$) who were instructed by mother or father (correlations of 2 × 2 tables and their significance by chi-square).

Trait cluster	Percentage males taught		Percentage females taught			
	by mother	by father	by mother	by father	r	Chi-sq.
All traits	25.7	74.3	83.5	16.5	.58	23.97[a]
Net hunt	1.6	98.4	67.2	32.8	.74	39.42[a]
Other hunt	2.0	98.0	80.0	20.0	.91	59.18[a]
Food gather.	49.0	51.0	85.0	15.0	.38	10.49[a]
Food prep.	21.3	78.7	87.1	12.9	.66	31.58[a]
Maintenance	14.9	85.1	89.1	10.9	.74	39.82[a]
Infant care	49.5	51.5	91.9	8.1	.48	16.25[a]
Mating	3.0	97.0	86.4	13.6	.85	51.84[a]
Sharing	27.1	72.9	87.3	12.7	.61	26.67[a]
Special skills	9.1	90.9	39.6	60.4	.35	8.91[a]
Dance or sing	1.7	98.3	75.0	25.0	.79	45.18[a]

[a] $p < .001$, 1 df.

teacher. Fathers generally transmit skills to sons and mothers transmit skills to daughters.

Grandparents' contribution is generally small and grandmothers contribute significantly more than grandfathers. This is expected because men marry women two to five years younger than themselves. Male mortality is higher than female mortality, and consequently the sex ratio for Aka over 40 years old heavily favors females. There is a tendency for patrilateral grandparents to teach more than matrilateral grandparents. This also seems reasonable as Aka usually practice patrilocal residence after a few years of matrilocality in bride service. Half of the overall contribution by grandparents is accounted for by the responses of a small percentage of individuals who were primarily raised by their grandparents. Finally, grandparents contribute primarily

to food gathering and infant-care skills (45% of all responses).

Aka cited secondary educators in 5% of all responses (155 of 3,600). In these instances Aka would point out who primarily influenced their learning a skill and then would add that a particular other(s) also assisted them in their learning. On occasion Aka cited two educators who contributed equally. Since the number of cases is small (41 of 3,600 responses), no special analysis has been attempted.

Discussion

This paper contains a quantitative description of cultural transmission in a group of foragers of the tropical forest in Africa. Many of the cultural traits selected are of importance for survival and reproduction, and others are of social significance. It is difficult to collect a list of traits truly representative of the ensemble of culturally transmitted skills of this population, but it is believed that many of the most important and characteristic ones are included.

It would be impossible to review here the implications of the theoretical model, its relevance to existing ethnographic or educational literature, or even to see in sufficient detail how it applies to our observations. One conclusion, however, seems inescapable on the basis of the data: vertical (parent-child) transmission is by far the most important mechanism, accounting for about 80% of the cases studied. This is, according to the model, a conservative mode of transmission; it assures slow evolution while allowing individual variation. Such variation is indeed observed, in that not everybody always acquires the same traits, but the percent of individuals knowing a skill is usually neither 0 nor 100%. When analysis is carried to a finer level (e.g., variation in length and condition of nets made by single individuals, heights of women's digging sticks, preferences for investing time in one or another activity, strategies during the net hunts) even more individual variation appears, which may in part be a consequence of being transmitted vertically. Among other modes of transmission that were observed one notes that transmission by others, probably the whole social group, is important for sharing and dancing. For these two activities uniformity is essential, and they are almost inevitably transmitted by the many-toward-one mode, which ensures not only high conservation but also high uniformity. Apart from these cases in which the transmission seems to be of the many-toward-one type, there are only a few traits in which individuals other than parents act as transmitters. Some of these, like crossbow construction, are of recent introduction. Ethnohistoric records (Bruel 1910; Regnault 1911) show the crossbow being used in the region by Bantu farmers in the late 19th and early 20th century but not by Aka, who continued to use the bow and arrow. Demesse (1958) noted that by 1958 some Aka used the crossbow in the Sangha region, but many still used the bow and arrow. In 1965 most Aka were reported using the crossbow and today all Aka use the crossbow and no Aka use the bow and arrow.

Because of the recent diffusion, not everybody could have learned from their fathers. Hence, it appears likely that horizontal transmission has played an important role initially in determining a relatively fast introduction from the outside and can probably be superseded now by the vertical one.

In the elephant hunt the *ntuma* plays an important part; this hunt carries great prestige and is a traditional ritual activity going back for an unknown number of centuries. Transmission by others here has probably the meaning of a many-to-one, and therefore highly conservative, transmission.

For a clear distinction between the simple horizontal type (one-to-one) and many-toward-one transmission when observed transmitters are not related, a supplement of research might be useful; it is clear, however, that there is a difference between dances like *djengi* (a traditional sacred dance found with pygmies across a vast area) and other like *elanda* and *libanda* which were learned from Congolese villagers and are known by the authors to be short-lived. Prestige is likely to be a factor

of importance in the permanence of a tradition, probably through social group pressure and many-toward-one transmission. One-to-many transmission, which favors rapid change, seems very rarely if ever found, not surprising considering the relatively egalitarian structure of pygmy society and the absence of schools.

Given these facts one would expect high conservation (slow variation) of pygmy activities and social structures. Although there is no, or very little, historical or archeological information about pygmies, their foraging activities probably have not changed substantially except for fairly recent, partial replacement by manioc cultivation. Although only Central African Republic pygmies have been investigated so far, there seems to be high similarity of pygmy cultural traits across a vast area in central Africa, indicating substantial conservation despite nontrivial genetic differences. In part, this must be a direct consequence of the relative homogeneity of the habitat, which exerts a similar pressure and helps to maintain unaltered cultural traits that probably were obtained through a long period of cultural adaptation. There certainly are other factors of conservation, i.e., constraints of environmental, social, and economic origin (see LeVine 1977, 1982; Ogbu 1981 for ecological models of cultural transmission), yet, in part, conservation must also be a consequence of the prevalent transmission mechanisms that favor it highly. Moreover, enculturation of pygmies is early; about 70% of all skills have been acquired by age 10, and more than 80% (practically all those of significance for survival) by age 15. Acquisition of most skills and, presumably, habits by an early, more plastic, age may also help to mold them to an extent that is scarcely compatible with later changes in modes of living, thus contributing to high conservation.

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Complementarity and the Structures of Parallel-Cousin Marriage

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In this report I describe some unusual features of systems of parallel-cousin marriage and briefly discuss a way to incorporate these systems into an overall analytical framework of kinship and marriage. I believe that before a comprehensive scientific explanation of marriage can be attained, the significance of the structures of cousin marital relationships must be made explicit. Not only is cousin marriage practiced in almost half of the world's societies (Pasternak 1976:68), but the analysis of the nature of marriage between close relatives is essential to an understanding of the prohibitions against such marriage (see Goody 1984). In order for this to be accomplished there must be a theoretical framework that includes both parallel- and cross-cousin marriage systems.

Theories of cousin marriage currently provide only a partial explanation for cross-cousin unions. They do not account for marriage between parallel cousins. Consequently, this form of marriage has been ignored or has been treated as little more than an "anomalous system of kinship and marriage" (Fernea and Malarkey 1975:188).

To explicate the significance of their structures, parallel-cousin marriage systems are analyzed by means of computer simulations in ideal relationships with unilineal descent and residence patterns.[1] Parallel cousins are any two individuals descended from siblings of the same sex. Systems of parallel-cousin marriage are structured genealogical relationships whereby every kintype is provided parents who are parallel cousins. Each system is uniquely defined by its type. One feature specified by the type is the shortest genealogical distance between spouses. (Genealogical distance is computed by summing the number of parent-child links from each spouse to the common ancestor.) In second-cousin marriage systems, for example, each male is married to a parallel second cousin (to the grandchild of his grandparent's same-sex sibling). In these systems, spouses are never more closely related than a second cousin no matter how the genealogical relationship is traced. This does not preclude other kinship ties, however, and marriage partners may also be third or more distant cousins. Likewise, in first-cousin systems, the married couple may be second or more distant cousins at the same time they are first cousins, but they will have no closer kinship ties than that of parent's sibling's child.

The type of a marriage system also specifies the parent through which the shortest genealogical distance is traced from a kintype to his or her spouse. For each distance, there are three possibilities: matrilateral, patrilateral, and double. In matrilateral systems, the shortest genealogical distance between spouses is traced through the male's mother. In patrilateral systems, it is traced through his father. In double-cousin marriage, the shortest distance between husband and