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Patterns of Cannabis Use Among Congo Basin Hunter-Gatherers

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Abstract. Congo Basin hunter-gatherers have used cannabis for nearly two centuries, yet ethnographic descriptions of its use are rare or contradictory. We present the results of two projects investigating cannabis use among Congo Basin hunter-gatherers. The first study, conducted in the 1970s, was a survey of cannabis use in three populations: Efe archers, Mbuti net-hunters, and Aka net-hunters. The second study, conducted in 2011, was an in-depth biocultural study of cannabis use among one of these groups, the Aka. Methods varied between the studies, but the integration of results from both studies provide insights into: a) common features of Congo Basin hunter-gatherer cannabis use across time and space; b) cross-cultural and intracultural diversity in use; and, c) factors influencing changes in use over time. Compared to typical cannabis research populations in Western, developed countries, cannabis use among Congo Basin hunter-gatherers involves extensive sharing, such as communal smoking, absence of gender or age proscriptions, perceived performance enhancing effects, and labor-for-cannabis exchanges with neighboring villagers. Cannabis was sometimes the first or the only plant that Congo hunter-gatherers domesticated. Consistent with cross-national studies of cannabis use, Congo Basin hunter-gatherer cannabis users were typically male, often adolescent or young adult, and (among Aka in 2011) had less material wealth than non-users. Aka cannabis users also had fewer intestinal parasites. Finally, cannabis use varied across time and space both within and between the three groups in ways that reflect differences in the demographic, cultural, and historical features of the populations, especially degree of sedentarization and market integration.

Keywords: cannabis, Sub-Saharan Africa, hunter-gatherers, psychoactive substances, performance enhancers

Introduction

Cannabis sativa (Cannabaceae) is the most commonly used illicit drug in the world, yet research on cannabis has been limited due to the social and legal consequences of admitting use. The limited research that exists is often conducted among Western, developed populations who represent an exceedingly restricted slice of humanity. Much less is known about cannabis use in the developing world (Degenhardt and Hall 2012), especially among the small-scale cultures inhabiting the rural areas of many developing countries, such as the Congo Basin. In an effort to advance our understanding of cannabis use in cross-cultural context, we focus here on cannabis use among Congo Basin hunter-gatherers.

We report the results of research among three Congo Basin hunter-gatherer populations spanning four decades, highlighting the cultural diversity and uniformity of cannabis use in these populations both in time and in space. The first study (conducted in the 1970s) was a survey of the three groups, while the second study (conducted in the 2000s) was an intensive biocultural study among one of these groups, the Aka. Although the studies were conducted nearly 40 years apart, collectively, they provide insights into the ethnoecology of cannabis use in four ways. First, we describe cross-cultural and intracultural diversity in frequency, methods, contexts, and reasons for Congo Basin forager cannabis use. Second, we are interested in identifying features of cannabis use that are unique to

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Congo hunter-gatherers, as well as features that are shared more broadly with conventional cannabis use research populations in the developed world. Third, we identify factors that have influenced changes over time in the frequency and methods of Congo Basin hunter-gatherer cannabis use. Finally, we explore general trends in cannabis use within and between the three Congo Basin hunter-gatherer groups in relation to broader themes of cannabis use research, like gender differences, motivational aspects, and political-economic features.

Congo Basin Hunter-Gatherers

Congo Basin hunter-gatherers, also called "Pygmies," are a large and diverse group of cultures represented by at least 15 ethnolinguistic groups and with a total population of about 350,000 (Bahuchet 2014). Congo Basin hunter-gatherers are generally characterized by their preference for forest life, polyphonic music, and complex social and economic relationships with farmer populations. Many are transitional hunter-gatherers, in that they spend part of each year living in forest camps (10–40 km from villages) to hunt and gather and the other part of the year living in village camps near neighboring horticulturalist communities to occasionally work in the farmers' agricultural fields. Most groups also trade their labor and/or forest products to villagers, loggers, miners, and others for access to agricultural foods, clothes, salt, axes and knives, alcohol, tobacco, and cannabis (Hewlett 2014).

Congo Basin hunter-gatherers share several features that distinguish them from typical cannabis use research populations in the developed world. For one, they are hunter-gatherers and systematic research on cannabis use among extant hunting-gathering populations is virtually non-existent outside of our previous research on the Aka (Roulette et al. 2015), a group of hunter-gatherers in the western Congo Basin. In addition, hunter-gatherers that live in remote regions of the Congo Basin have relatively limited exposure to public health warnings about cannabis (and other drugs). They also have relatively high rates of parasitic and infectious diseases (Hewlett 2014), which might relate to cannabis use in some unknown way. For example, most Congo Basin hunter-gatherer populations are heavily infected with intestinal helminthes (worms) (Froment 2014; Lilly et al. 2002; Roulette et al. 2014); cannabis contains compounds with anthelmintic effects (Mukhtar et al. 2013), suggesting that its use might impact worm burden in these populations.

Congo Basin hunter-gatherers also share three key foundational cultural schema that pervade most domains of daily life, are relatively distinct from ways of thinking in the developed world, and likely influence patterns of cannabis use: egalitarianism (gender, age, politics), respect for autonomy, and extensive sharing (Hewlett 2014). An egalitarian way of thinking means it is not appropriate to draw attention to oneself or judge others as better or worse. Political power is limited and both men and women, as well as young and old individuals, are viewed as relatively equal and have similar access to resources. Respect for an individual's autonomy means others, including children, are respected for who they are and are not coerced into particular actions. A giving or sharing way of thinking means that resources are shared with multiple others in camp on a daily basis. Aka hunter-gatherers share 50–80% of what is acquired through hunting and gathering (although all wild foods are shared, meat is shared most frequently; [Kitanishi 2000]). Sharing of childcare is also extensive (Hewlett et al. 2011); for instance, among the Aka, 90% of mothers reported other women nursed their young babies (Hewlett and Winn 2014).

History and Early Ethnographic Accounts of Cannabis use among Congo Basin Hunter-Gatherers

It is uncertain when and how cannabis arrived in Africa and when Congo

Basin hunter-gatherers first started using it. Cannabis is indigenous to Asia (Hillig 2005), where it may have been used ritually as early as 2500 yrs BP (Jiang et al. 2006). Cannabis likely reached Africa by the first century AD, perhaps via an Arab (du Toit 1976, 1980) or Portuguese (Laufer et al. 1930) intermediary. The first physical evidence of cannabis in Africa comes from two ceramic pipe bowls excavated near Lake Tana in Ethiopia, which date to AD 1320 ± 80 (Dombrowski 1971). Hart (personal communication with Barry Hewlett, 1978) speculates that cannabis use had its inception among Congo Basin hunter-gatherers in the nineteenth century, when Arabs journeyed into the area in search of ivory, and that the first smokers among the Mbuti, a hunter-gatherer population in the eastern Congo, might have been traditional elephant hunting specialists. Mbuti specialists did much of the elephant hunting and probably provided ivory to their village neighbors, who then traded with the Arabs.

Ethnographic descriptions of Congo Basin hunter-gatherer cannabis use are rare, and those that exist are contradictory. Turnbull (1961, 1965) does not mention cannabis use among the Mbuti in his classic ethnographic works, whereas Anne Putman (1954:162), who lived with the Mbuti for eight years with her anthropologist husband, Patrick Putman, in the same area as Turnbull, states, "You can almost spot abandoned campsites of the little people by the marijuana crop that springs up when they leave." Putman gives the impression that Mbuti are avid cannabis users, but she does not elaborate as to how it is consumed or the social context of its use. Whereas Schebesta (1933) states that cannabis gives Mbuti the "power" to kill elephants, Turnbull (1983), in an ethnographic account published after communication about cannabis with the second author, argues that it is detrimental to hunting.

Research has also shed light on the economic costs of cannabis use among Congo Basin hunter-gatherers. Bailey (1991) writes that the Efe, foraging neighbors of the Mbuti, expend considerable time and effort to obtain cannabis (and tobacco). Twenty-nine percent of labor and material exchanges with their neighboring Lese villagers, for example, involved receipt of cannabis and tobacco (Terashima 1998), which often came at the expense of obtaining food and material items (Bailey 1991).

Study Populations

Research was conducted among three Congo Basin hunter-gatherer populations: the Efe and the Mbuti of northeastern Democratic Republic of Congo (DRC), and the Aka of southwestern Central African Republic (CAR) and northern Republic of the Congo. While the three groups share many cultural features, as described above, they also vary in language, subsistence, and other aspects of culture. The Efe are archers who speak a Nilo-Saharan language that is similar to their farming neighbors; men hunt primarily with bow and arrow while women provide the majority of calories from collecting and working for village farmers. They have relatively low (by comparison to the other two groups) fertility rates and have a population size of about 6000 in the Ituri Rainforest. Mbuti are net-hunters who, although neighbors of the Efe in the DRC, speak a language from a completely different linguistic family (Bantu). Their language is also distinct from that of their farming Bantu-speaking neighbors. Men and women net-hunt cooperatively and they have high fertility rates, with a population numbering about 30,000. The Aka are also net-hunters, but they live about 700 km to the west of the Mbuti and Efe and speak a Bantu language that is different from both the Mbuti and the neighboring Bantu-speaking farmers. Like the Mbuti, the Aka have high fertility, with a population around 40,000 (Hewlett 1996).

Methods

Study 1: Cannabis use among the Efe, Mbuti, and Aka (1973–1976)

This study was the first to focus on understanding the frequency, methods, and reasons for cannabis use in these three populations. The second author of this paper collected the Aka data while visiting more than 36 camps during eight months of fieldwork. The Ituri data was based upon the second author visiting five Efe camps and ten Mbuti camps during three months of fieldwork. Participants were recruited opportunistically because hunter-gatherer camps are small, highly mobile, and often separated by several kilometers, making random sampling difficult. The second author walked down roads and visited as many camps as possible from each ethnic group, using participant observations, key informant interviews, and informal and unstructured interviews (Bernard 2006) to collect data on cannabis use. Estimates of the frequency of cannabis use are based upon observations (i.e., observing the number of pipes, bowls, or people smoking in a camp) and interviews with whomever was present in the camps. An inductive, ethnographic approach (Bernard 2006) was used to identify key themes that emerged from the interviews, observations, and personal communications. The results were then cross-checked with ethnographers who had conducted long-term ethnographic research with the Mbuti (Colin Turnbull and John Hart) and Efe (Jean Pierre Hallet), in order to crosscheck results and general observations of cannabis use.

Study 2: Cannabis use among the Aka (2010–2012)

Study 2 was conducted with Aka residing in three communities in the Lobaye district of southwestern CAR, with a total adult Aka population of 379. All participants resided in one of 36 camps located within one kilometer of a main logging road that cuts through the communities. Qualitative descriptions of cannabis use are based on five focus group interviews conducted in 2011 with a total of 23 adult Aka (male = 18; female = 5) from five different trails (spaces used by certain bands), and are supplemented with ethnographic observations made during two separate research trips (2010, 2012). As with study one, we use an inductive, ethnographic approach to identify key themes that emerged from the focus-group interviews and observations.

Surveys and Analyses

Two semi-structured questionnaires (Bernard 2006; Schensul et al. 1999) were administered to evaluate (i) self- and peer-reported cannabis (and tobacco) use among all Aka residing in the 36 camps (called "Cannabis Use Survey") and (ii) cultural, demographic, subsistence, and settlement features that might impact cannabis use (called "Self-Report Questionnaire"). For the Cannabis Use Survey, we visited all 36 Aka camps and asked each adult present to provide their age, gender, and smoking status, and the ages, genders, and smoking statuses of juveniles residing in the camp and of other adults residing in the camp but that were not present during the interview. Aka do not keep track of age; adult ages were estimated by an Ngandu research assistant with lifelong associations with these Aka populations, whereas age of juveniles was assessed using Aka age categories (*mona*, or a young child up to about 6 or 7 years; and *bokala/ngondoa*, male and female adolescents, respectively, aged roughly 7 to 18 years).

Results of the Cannabis Use Survey revealed that the prevalence of cannabis use among females was very low, so we restricted data collection for the Self-Report Questionnaire to adult men (n = 67). These participants represent the complete population of adult men residing in a single sub-section of the largest of the three

communities and that agreed to participate in the study. We examined 15 variables in five domains (demographic, settlement, subsistence, health, and cannabis use). Cannabis use included self-reports of cannabis smoking status (1 = uses cannabis, 0 = does not use cannabis) and use frequency. Use frequency was number of cannabis cigarettes (*mobinzas*) consumed on a normal day, converted to Central African Francs (CFA) (500 CFA is equivalent of about USD $1.00). (For a detailed description of the remainder of the variables included in the survey, and for a complete list of items included in both surveys, see Supplemental Material 1.) We then performed a number of exploratory quantitative bivariate analyses to detect independent variables (demographic, subsistence, settlement, and health) that might account for intracultural variation in cannabis use.

Results

Table 1 summarizes general features of cannabis use among the Efe, Mbuti, and Aka in the 1970s and the Aka in the 2010s, including how cannabis is acquired, implements used to smoke cannabis with, perceived effects of cannabis use, and frequency and demographics of use. In the following sections we provide detailed descriptions of these features of Cannabis use for each of the populations, and then we present the results of our quantitative analyses of intracultural diversity in Aka cannabis use in 2011.

Study 1: Cannabis use among the Efe, Mbuti, and Aka (1973–1976)

Efe Archers

The archers smoked cannabis, known as *bangui* or *ndjemu*, in bamboo (*Bambusa* sp.) and gourd water pipes called *tete* (Figure 1). A small bit of tobacco is often mixed with the cannabis and placed in the pipe bowl. Each archer family had one or two pipes, with both husband and wife possibly having their own pipe. The Efe archers had many pipes due to their frequent use of cannabis. The archers smoked the water pipe every day both communally in small groups and individually. The men often smoked communally before the start of a

Table 1. Comparison of Cannabis use among Efe, Mbuti, and Aka in the 1970s, and Aka in 2011.

Component of Cannabis use	Efe (1970s)	Mbuti (1970s)	Aka (1970s)	Aka (2011)
Primary mode of acquisition	Grow; Trade with villagers	Trade with meat traders/villagers	Trade with meat traders	Trade or purchase
Mode of ingestion and materials used	Smoked; bamboo/gourd water pipe with clay bowl	Smoked; banana leaf/bark stem pipe with clay bowl	Smoked; variety of pipes with clay bowl; or rolled in leaves	Smoked; rolled in leaves/paper
Mixed with tobacco?	Yes	Yes	Yes	Sometimes
Perceived (*emic*) effects	Increase warmth, strength, bravery	Enhance health, but can be "bad" and "dull" reaction time	No Data	Increase warmth, strength, bravery; intoxicating; makes some lazy/tired
Demographics	Adult men and women	More adult men than women	Primarily male hunters	Primarily young men
Smoked Primarily Communally or Individually	Both	Communal	Communal	Both
Frequency of use	Frequent	Occasional	Sporadic	Frequent

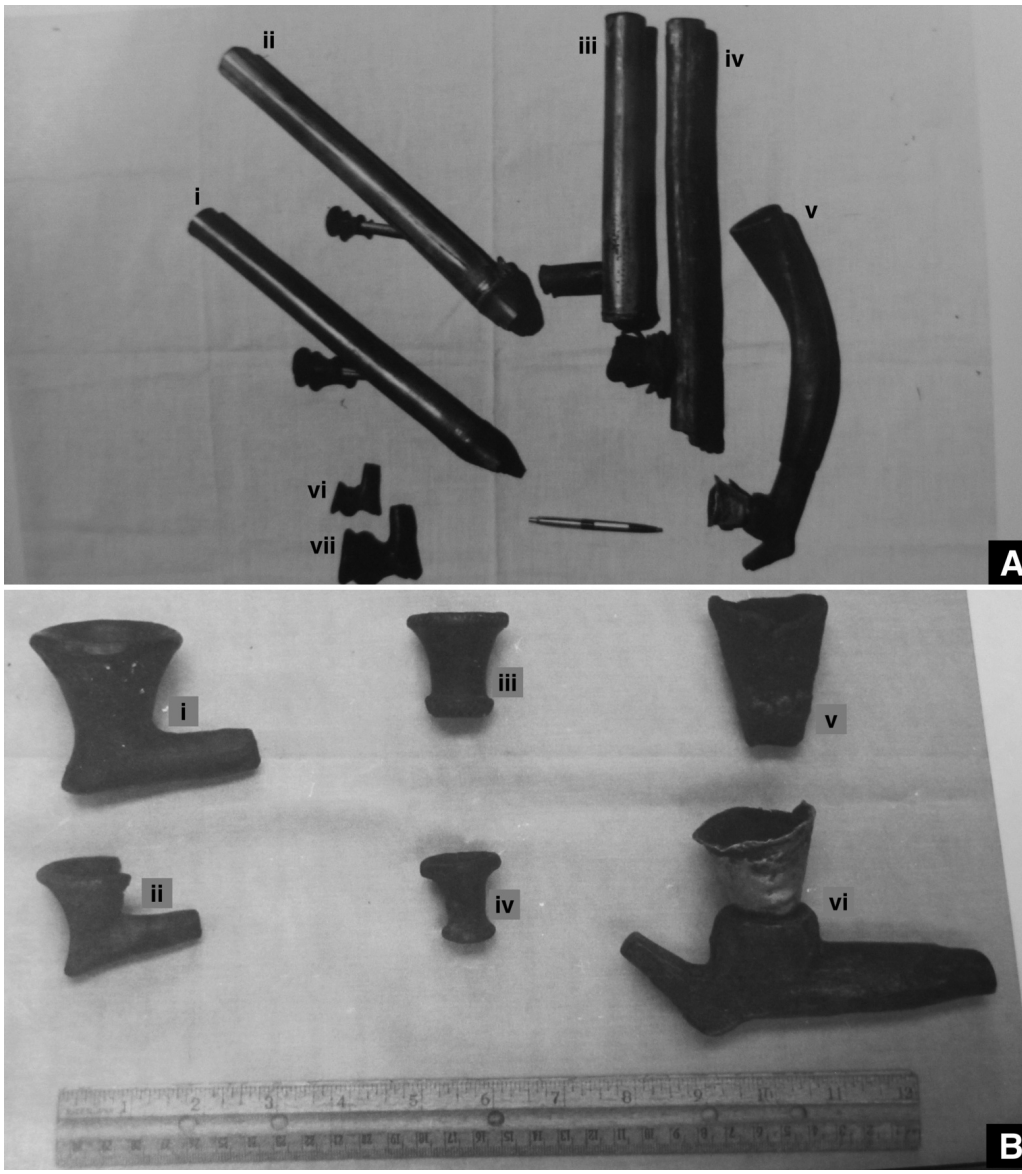

Figure 1. (A) Efe, Aka, and Mbuti pipes. Efe water pipes (**i** and **ii**) are constructed from a section of bamboo about 47centimeters in length with one full node left at the bottom about seven or eight centimeters from the lower end so water may be placed in the pipe. On the lower one third of the pipe an eight-centimeter long hollow piece of wood is inserted at about a thirty- to forty-degree angle, and a clay bowl is placed on the tube. If a bamboo stem is not available, a gourd or Bongo horn is used. Aka pipes (**iii**, **iv**, and **v**) are made of a large antelope horn, or a section of a tree vine 27 to 33 centimeters in length and anywhere from one and one-half to four centimeters in diameter. Mbuti pipe is made of a one-half meter long hollowed banana leaf stem (the petiole), with a clay bowl (**vi** and **vii**) stuck into the stem. When banana leaves were not available, such as when the net-hunters were deep in the forest, a pipe stem was made from a piece of bark coiled into the shape of a cone. (B) Efe, Mbuti, and Aka pipe bowls with reference scale (ruler). Mbuti clay bowls (**i** and **ii**), Efe clay bowls (**iii** and **iv**), and Aka clay bowls (**v** and **vi**). Photos courtesy of Barry Hewlett.

daily hunt around the traditional fire built in close proximity to the hunting grounds for that day.

The Efe archers were more avid smokers of cannabis than were the net-hunters. Of five archer camps, the majority of individuals in each camp were using cannabis daily in both the forest and village camps. In a 1977 personal communication with Barry Hewlett, Hallet stated that the archers actually smoked more cannabis in a forest camp than in the village camp. Archers said they smoked cannabis to help to keep them warm, increase their energy, courage, and sharpness in hunting game, especially large game such as elephant.

The archers acquired their cannabis either by growing their own (usually the only plant they grew) or by exchanging forest goods for cannabis grown by villagers, the latter being more common. One band of archers encountered near the Uganda-DRC frontier consisted of exceptionally heavy smokers of cannabis. Some in this camp referred to cannabis as "opium," and farmers in the nearby village stated that the archers preferred opium to food, that they could do without food but not "opium," and that the archers smoke "opium" every hour.

The Mbuti Net-Hunters

Although Mbuti net-hunters speak a different language than Efe archers, the net-hunters used the same terms for cannabis as the archers. Mbuti smoked cannabis in a pipe made out of a banana (*Musa* sp.) leaf stem, with a clay bowl placed into the stem (Figure 1). Green leaves were placed in the large end of the cone to act as a filter, and cannabis was usually placed in the bowl on top of a bit of tobacco. People wishing to smoke gathered around the pipe and after the person contributing the cannabis had taken one or two inhalations from the pipe, the pipe was passed on to anyone who wanted a puff—each person taking one deep inhalation. Since cannabis smoking is entirely communal among the Mbuti net-hunters, only one or two clay bowls are usually found in a camp. If one acquires cannabis, they can use any available bowl. Hart indicates that the Mbuti in the 1970s did not roll cannabis into cigarettes for an individual to smoke, but that this was common among neighboring farmers.

The second author observed men smoking cannabis most often at the end of the day near sunset, just before the evening meal, or around the traditional hunting fire often, but not always, in the morning. According to Hart (personal communication with Barry Hewlett, 1978), more men than women smoked cannabis (40% versus 29%), although the difference was not significant. Both spouses used cannabis in 26% of married couples, compared to 55% in which neither spouse smoked ($\chi^2 = 8.6$, $p = 0.003$). In 19% of couples, only the male used cannabis, whereas there were no couples in which only the female used cannabis. Of adults who smoked, male smokers were significantly more likely than female smokers to be heavy versus regular or occasional smokers (58% versus 13%; $\chi^2 = 8.4$, $p = 0.004$).

Mbuti acquired *bangui* from meat traders who exchanged cannabis for the game meat the net-hunters captured on a hunt. Mbuti could also trade other forest products, such as honey and forest lianas, for cannabis brought to them by the meat traders or local villagers. While in a village camp for an extended time, the net-hunters sometimes cultivated a few of their own plants in or near the village plantation. In the central Ituri, the second author never saw Mbuti net-hunters smoke cannabis in a forest camp. Turnbull (personal communication with Barry Hewlett, 1974) concurs when he states: "in my experience among the net-hunters, it [cannabis] is still pretty well confined to use when they are in the village on a stop-over, *not* in the forest." In contrast, Hart (personal communication with Barry Hewlett, 1978) revealed that,

among the net-hunters of the southern Ituri, the largest number of cannabis smokers was among a band that stayed in the forest over twelve months. Meat traders would bring cannabis into the forest camp in order to acquire the net-hunter's game meat. Hart also encountered a band in the central Ituri in the Epulu area that used *bangui* while in the forest on a net-hunt.

Turnbull (personal communication with Barry Hewlett, 1977) reported the net-hunters do not smoke cannabis to increase their bravery. Turnbull states: "I have *never* come across it being used to give strength or courage before an elephant or any other kind of hunt. On the contrary, I have always heard that it is bad before hunting as (it) makes one's reactions unpredictable… sometimes sharpening them (which would be just fine) and sometimes dulling them, which could be fatal" (emphasis Turnbull's). Hart (personal communication with Barry Hewlett, 1978), who also worked with Mbuti (but 20 years later), disagreed with Turnbull, and indicated that Mbuti regularly used cannabis while net and elephant hunting.

According to interviews with the neighboring horticulturalist villagers and personal correspondence with Mbuti researchers (i.e., Hart), cannabis use among the villagers is seen as illegal, heavy users are often considered to be somewhat anti-social, and, for some, it may even have religious associations (cannabis has no religious function among Mbuti and other Congo Basin hunter-gatherer populations). Hart (personal communication with Barry Hewlett, 1978) gives a case of a villager, Omali, who used cannabis as the "food of the *eshumba*" (an Mbuti ceremony resembling the *molimo* described by Turnbull), in order to "see the enemies." For the Mbuti located in the southern Ituri, the *eshumba* has a totally different significance—that of joy.

Cannabis use was not widespread among the Mbuti net-hunters in the 1970s. In five of the ten camps in which the second author stayed, Mbuti smoked *bangui* on occasion. In some instances, people in one camp of net-hunters would state that they smoked *bangui* because they enjoyed it and it made them healthy, yet the adjacent camp of net-hunters, possibly only a few miles away, would not smoke *bangui* because they simply thought it was bad. Turnbull suggests that the use of cannabis has increased since he was first there in 1951 and, in a 1979 personal communication with the second author of this paper, Turnbull states:

> The use of cannabis has been changing over the past ten years in a dramatic way, from its virtual exclusion from a forest hunting camp, and only limited usage in a neighboring village to much wider usage in the village and occasional use in a hunting camp. This is of much wider significance than the mere usage of cannabis…it relates to greater approximation between village and forest worlds in economic, political, and religious terms.

The Aka Net-Hunters

In contrast to the Efe and Mbuti groups, during the study period, the majority of the Aka infrequently or never smoked cannabis, only smoking it when meat traders occasionally brought it into their forest or village camp. The Aka exchanged their game meat for the merchants' cannabis. Normally, for half blue duiker (*mboloko*; *Cephalphus monticola*), the Aka received a small, round one-centimeter diameter, pouch of cannabis wrapped in phyrinium leaf (*Megaphrynium* sp.), which was enough to make two cigarettes or to fill two small pipe-bowls. In some forest areas, close to large towns where Aka had regular cash income from selling their game meat, the Aka used money to acquire cannabis. Aka smoked cannabis in a pipe, *makundu* (Figure 1). The stem of the pipe was filled with damp wood shavings, which help to cool and filter the usually green and harsh

cannabis, and, in some areas, tobacco was mixed with cannabis. Compared to Efe water pipes, the Aka pipes were of simple construction. Aka also smoke cannabis rolled up like a cigarette in a leaf, the same manner in which they would smoke tobacco, *ndako*.

If and when *bangui* was acquired, male hunters smoked it communally, each man taking one deep inhalation, sometimes so deep it heated the coals on top of the cannabis and produced a flame from the pipe bowl. As with the Efe and Mbuti, a chestfull of cannabis smoke was held for a few seconds and then slowly exhaled through the nose. Cannabis was smoked both in the forest and village camps.

In contrast to most Efe archer camps, there were only a few Aka groups where the majority of the individuals used cannabis daily. In only two out of the thirty-six camps visited did the majority of the individuals in that camp smoke cannabis regularly. Most camps reported only sporadic experiences with *bangui*. Where cannabis was used regularly, it was associated with sedentarization and contact with a market economy. In one high-use camp, Aka were farming, no longer net-hunted, and relied on guns from villagers to hunt. The other camp of heavy smokers consisted of men who worked for a lumber company (they identified mahogany trees [*Khaya* sp.], cleared forest overgrowth so the trees could be cut, and repaired roads for the lumber trucks). These men hunted occasionally and had a substantial cash income with which they bought *bangui* from meat traders. In contrast to hunter-gatherers, villagers that regularly used cannabis belonged to lower socio-economic groups. In the village of Ndele, in CAR, for example, the most sedentarized group of hunter-gatherers, and the most looked down upon by villagers for being lazy, were the Bofi, neighbors of the Aka who speak a different language, and were known by the Pande and Yangere villagers to be the heaviest users of cannabis.

Study 2: Cannabis use among the Aka (2010-2012)

General Patterns from Focus Group Interviews

Whereas in the 1970s cannabis use was infrequent among the Aka, it had increased dramatically by 2011. According to our Cannabis Use Survey, in 2011, 39% of adults and 36% of juveniles used cannabis. In contrast to the high rates among adults and juveniles, no one under the age of eight years used cannabis and we have never seen young children request to smoke cannabis, despite it being always available (although Aka do not punish their children for using cannabis, when asked, many adults say they do not want their children to use it because it can harm their health). In addition to an increase in the overall prevalence of use, we have observed that patterns of use are also changing in that *individual* (as opposed to communal) smoking of cannabis is increasing.

These observed changes in cannabis use relate to other social and economic changes since the 1970s. For example, Aka spend considerably less time in the forest camps today than in the 1970s, which has increased their access to cannabis. Use of a shotgun, which although is less common than hunting with a net, has increased as well (based on our 30 years of ethnographic observations). This might relate to declines in communal smoking since Aka hunters, who are provided guns by their village trading partners, often hunt alone at night, during which time they smoke tobacco and cannabis to help increase courage and bravery and stay warm in the cool forest.

The method of use has also changed. Whereas in the 1970s the Aka primarily used antelope (*Tragelaphus eurycerus*) horn pipes, in the 2000s, Aka usually smoked cannabis in a cigarette (*mobinza*) rolled up in a number of different species of forest leaves or an available piece of paper, such as the brown paper in which the cannabis was sold. Some Aka also still smoked

cannabis with a pipe, and say that it makes them more *mboma* (intoxicated) than smoking a *mobinza*. Cannabis was sometimes mixed with tobacco. Aka also use cannabis medicinally. Roots of cannabis are infused in water and ingested to treat what the Aka call "yellow fever" (when one has "red urine, yellow eyes, a fever, and is very tired"). Cannabis is also rubbed on the face to treat pimples.

Aka still acquire their *bangui* by trading forest goods and labor to villagers, loggers, and miners, but they are also increasingly purchasing it with money (after being paid in cash for their labor and/or goods). Villagers sometimes grow cannabis hidden in their agricultural plots, and then trade or sell the cannabis directly to Aka or other villagers. Cannabis cost 50 CFA for a small pack, usually sold in a piece of brown paper rolled up like a ball, with the paper twisted at the top to secure the *bangui*. A large pack of *bangui* cost 100 CFA. The Aka rolled anywhere from one to two cigarettes with a small pack and two to four cigarettes with a big pack. Some Aka also reported that they grow cannabis, both in the forest and in the village, although this was rare.

Our survey of self- and peer-reported cannabis use found that 71% of adult men (out of 164) use cannabis, compared to only 6% (out of 215) of adult women. There was also a large gender difference among juveniles, with 58% and 8% of males and females, respectively, reportedly using cannabis. Female cannabis users clustered in two villages located near the main road on the outskirts of the largest of the three villages. In general, camps with the greatest number of adult female cannabis users also had the greatest number of juvenile female cannabis users (Pearson's $r = 0.76$). Gender differences in cannabis use relate to broader cultural models of cannabis and other drugs and their perceived effects on performance. Men reported that they use cannabis because it makes them warm, and it gives them strength and courage for climbing, spear hunting, and working hard. One informant stated that Aka smoke the most *bangui* while working, such as hunting or working in the field, and dancing. Since cannabis is associated with success in hunting, climbing, and working, and these are all skills that are important for attracting a spouse, several Aka mentioned that it is important for young men to smoke. However, some women reported that cannabis is more like a "drug" than tobacco is, and because tobacco is also associated with success in hunting, climbing, working, and dancing, these women were less attracted to men that smoke *bangui* and more attracted to men that smoke tobacco. Moreover, some women did not like their husbands to smoke because their husbands spend all of their money on cannabis, and because some men smoke and then fall asleep, which is unattractive. In contrast, most Aka (men and women) said that women do not use cannabis because it is for men and not for women. Men mentioned that they do not like their wife to smoke because a) smoking makes their wife attractive to other men, which makes the husband jealous, and b) it contributes to women working less and being tired or not able to control themselves.

Self-Report Questionnaire

Of our 67 participants, 60% self-reported that they use cannabis, and smokers reported consuming a mean of about 2–3 cannabis cigarettes per day (or about USD \$0.15 worth of cannabis; refer to Supplemental Table 1 for a complete list of the summary characteristics for the Self-Report Questionnaire). In comparison to participants that reported that they do not use cannabis, the group that did report using cannabis consisted of fewer *kombeti* (camp elder, typically, but not always, male; $\chi^2 = 5.76$, $p = 0.016$), more smokers of tobacco ($\chi^2 = 6.70$, $p = 0.01$) and the indigenous plant, *tunga* (*Greenwayodendron suaveolens*; $\chi^2 = 11.15$, $p = 0.001$), and more individuals that climb trees for honey ($\chi^2 = 6.07$, $p = 0.014$) and spear

hunt ($\chi^2 = 4.43$, $p = 0.035$); they were also overall younger than the non-users ($z = -2.82$, $p = 0.005$). Cannabis use frequency also had negative rank correlations with age ($r_s = -0.41$, $p = 0.019$), and Aka men that were not *kombeti* reported using more cannabis per day than men that were *kombeti* ($z = 2.28$, $p = 0.023$). We found no significant associations between cannabis use and being a traditional healer, duration in current camp, spending more or less time in the forest, perceived overall health, and frequency of climbing trees for honey and spear hunting.

Our human biological studies (Roulette et al. 2015) also provided insights into intracultural variability of cannabis use among Aka men. Using an immunoassay for D9-tetrahydrocannabinol-11-oic acid (THCA), a urinary biomarker of recent cannabis consumption, we found that more than two-thirds (n = 42) of adult men were cannabis smokers (i.e., their THCA concentrations exceeded a 50 ng/ml cut-off point; [SAMHSA 2008]), and that odds of being a smoker were inversely correlated with age ($z = -3.328$, $p = 0.0009$) and wealth ($z = -2.825$, $p = 0.0047$). We also found that THCA levels were inversely correlated with helminth (intestinal worm) burden ($z = -2.05$, $p = 0.041$) and worm reinfection one year following treatment with a commercial anthelmintic ($r_s = -0.43$, $p = 0.02$), suggesting that cannabis use might help reduce helminth infections in this population.

Discussion

Our study identified several features of Congo Basin hunter-gatherer cannabis use that distinguish them from conventional cannabis use research populations. Despite vast cultural-ecological differences between Congo hunter-gatherers and developed, Western nations, we also found several similarities in cannabis use between the two groups. Finally, Congo hunter-gatherer groups share numerous cultural features, yet patterns of use between the three populations varied in both time and space.

Congo Basin Hunter-Gatherer Cannabis Use: Distinguishing Characteristics

Congo Basin hunter-gatherers display three foundational schema that might influence patterns of use: egalitarianism, autonomy, and sharing. The strong sharing ethos is indeed reflected in the social contexts of their use of cannabis. By comparison to neighboring farmers, the Congo Basin hunter-gatherers were more likely to smoke communally. That is, when they gather to smoke cannabis, a pipe or cigarette is typically lit and shared with everyone in the group.

Egalitarianism and respect for autonomy also influence cannabis use in that anyone who wanted to smoke can request it, including women and middle-aged children (generally boys). Second, out of respect for the autonomy of individuals, hunter-gatherers seldom criticize someone who smokes. Efe, Mbuti, and Aka see cannabis use, even heavy cannabis use, as nothing unusual; it is well within the range of normative behavior.

Unlike most Western populations, Congo Basin hunter-gatherers also use cannabis as a labor, or performance, enhancer. Cannabis smoking does not create what has been termed in the literature as the "amotivational syndrome," which is a narrowing of focus of interest, increasing apathy and lethargy, withdrawal, and decreasing motivation (Brill and Nahas 1984; Smith 1968). Congo hunter-gatherer cannabis use instead supports the hypothesis that, in non-Western societies, cannabis use produces a "motivational syndrome" (Rubin 1975), in that it enhances some aspect of labor and performance. In Jamaica, for example, Rubin and Comitas (1975) found that after farmers smoked cannabis, they engaged in more intense and concentrated labor. In general, Congo Basin hunter-gatherers perceive cannabis to have similar performance enhancing effects, in

that they use it to increase courage on a hunt, vital force, and work capacity, and to make one dance better.

Prior ethnographic works provide contradictory accounts of the effects of cannabis use on hunting. Our data support Schebesta's (1933) claim that Congo hunter-gatherers associate cannabis smoking with hunting success. Moreover, many, but not all, Aka females indicated that men who use cannabis are attractive because cannabis use is associated with success in male subsistence activites. Thus, young men might smoke cannabis to attract women and to improve their success in hunting and honey collecting. However, a few women claimed that cannabis is more like a "drug" than tobacco and reported that it can make men lazy or fall asleep, which is unattractive. In group interviews, Aka camps associated with missions or individuals that strongly identified with a global religion were more likely to believe that cannabis is a "drug."

A consistent theme throughout the colonial and post-colonial eras has been the use of psychoactive substances as a tool to exploit the labor of indigenous populations (Jankowiak and Bradburd 1996, 2003). Congo Basin hunter-gatherers are no exception. The primary way of acquiring cannabis, tobacco, and alcohol is by providing their labor and/or forest products to neighboring villagers, loggers, and miners, but, in most cases, the exchanges are asymmetrical, in that hunter-gatherers provide more highly valued resources, such as meat, in exchange for just a few cigarettes or a few cents worth of cannabis. Although the primary mode of obtaining cannabis in all three groups is in labor and/or forest good exchanges with villagers and others, in some cases, cannabis is also grown and is thus one of the first plants Congo Basin hunter-gatherers domesticate.

A final distinguishing feature of Congo Basin hunter-gatherer use is the relationship between their high rates of parasitic and infectious diseases and the peoples' conscious and unconscious medicinal applications of cannabis. In our research among Aka hunter-gatherers, we found cannabis (and tobacco; Roulette et al. 2014) smoking is inversely related to intestinal parasite infections, suggesting that, in areas where helminthiases are endemic, psychoactive drug use might moderate infections. The Aka, however, do not think that smoking tobacco or cannabis prevents or treats parasite infections.

Although Congo Basin hunter-gatherers perceive cannabis to have beneficial performance enhancing and medicinal attributes, this does not mean that its use never has its ill effects. Stories exist of individuals falling into a fire under the influence of cannabis, and one Aka man went hunting for a gorilla under the influence of cannabis and returned with serious gashes in his back from the gorilla. Hart (personal communication with Barry Hewlett, 1978) reports that, in the Ituri, heavy cannabis users were occasionally afflicted with bouts of coughing and chest pains, termed *bafu,* that sometimes totally incapacitated the user for a week.

Congo Basin Hunter-Gatherer Cannabis Use: Features Consistent with Cross-National Studies

Congo Basin hunter-gatherer cannabis use also shows several features that are consistent with patterns of use observed in larger cross-national studies. First, despite the foundational schema of egalitarianism and autonomy, and marked gender equality (Bahuchet 2014; Hewlett 2014), there is usually a male-bias in cannabis use among Congo Basin hunter-gatherers, and this is true both today and in the 1970s. The gender differences are consistent with national and cross-national studies that find male-biases in cannabis (and other drug) use (Degenhardt et al. 2008), although the differences are not always as pronounced as they are for groups like the Aka. The

observed gender difference among the Aka likely relates to mate attraction and the cultural model of cannabis use discussed above. Alternatively, Hagen et al. (2013) offer a biocultural framework that suggests that sex differences, especially in the developing world where reproductive-aged women are often pregnant or lactating, are due in part to women's avoidance of toxic and teratogenic substances during their reproductive years.

Despite the high value placed on autonomy and equality, and an absence of cultural proscriptions against children smoking, we also found large age differences in cannabis use. As with national and cross-national data (e.g., Degenhardt et al. 2008), smoking among Congo Basin hunter-gatherer children exists but it is infrequent; it becomes regular in early adolescence. Aka cannabis users are primarily *young* men, which is consistent with cross-national data (Degenhardt and Hall 2012). In developed Western populations, cannabis use typically begins in adolescence but then declines in adulthood as users age, get married, have children, and enter the workforce. Among hunter-gatherers, the age effect might be related to mate value. In order to attract a wife, men must demonstrate their ability to acquire resources, especially meat and honey, and many (but not all) believe that using cannabis improves one's performance in these activities. Relatedly, we have hypothesized elsewhere that adolescent and young-adult use of psychoactive substances, like cannabis, might be an "honest signal" of sexual maturation (Hagen et al. 2013).

Finally, studies in Western populations often find an inverse relationship between socioeconomic status (SES) and cannabis use (Daniel et al. 2009). Congo Basin hunter-gatherers do not have socioeconomic classes, but variability exists in material wealth, and our biomarker-validated data indicate that cannabis use is inversely correlated with material wealth. Unlike cross-national studies, in which low SES is often considered a risk factor for cannabis use, low wealth among Congo hunter-gatherers may be a consequence of frequent cannabis use. When providing labor and forest products to trading partners, cannabis users forego other material goods in favor of cannabis and, thus, have fewer accumulated goods. Indeed, among Aka smokers, about half of all daily "wages" (which is about US $0.50 per day, keeping in mind that Aka are infrequently paid in cash) is spent on cannabis and/or tobacco (Roulette et al. 2016).

Variation in Congo Hunter-Gatherer Cannabis Use in Space and Time

We found several features of cannabis use that varied across time and space, both within and between the three cultures studied. In the 1970s, for example, there were several differences among the three populations, including mode of smoking cannabis and frequency of use. There was also variation in whether cannabis was smoked individually or communally, and this seemed to reflect differences in hunting technique. For example, in the 1970s, Efe were the only group that smoked *and* hunted individually, whereas Mbuti and Aka both hunted communally with nets and rarely smoked individually. There was also substantial variation in gender differences. Both men and women frequenty used cannabis among the Efe in the 1970s, whereas, among the Aka, in 2011, there was a large male bias in cannabis use.

More generally, we have observed substantial increases in cannabis use among the Aka over time. The reasons for the diffusion of cannabis into the Congo Basin hunter-gatherer lifestyle and how it takes place would be a worthwhile topic for future research. Our ethnographic and field observations indicate that the Aka and Mbuti bands with the greatest number of heavy cannabis smokers are more likely to have a highly developed market econ-

omy with meat traders. In the 1970s, although most Aka seldom smoked cannabis, where it was smoked extensively, it, in part, appeared to be associated with Aka decisions to decrease their cooperative hunting-gathering life and adopt a more sedentary farming way of living. Over time, more and more Aka have settled near the village for longer periods of time. Indeed, 91% of Aka participants in our 2011 study reported spending more time in the village rather than forest camps. We suspect that the rise in cannabis use rates among the Aka and other Congo Basin hunter-gatherer populations reflect increased sedentarization and access to market activities, such as bush meat trade, logging, and mining.

Conclusion

To obtain a holistic understanding of the cross-cultural uniformity and diversity of cannabis ethnoecology, it will be necessary to conduct more research outside of developed, urban populations who represent an exceptionally small slice of humanity. Hunter-gatherers and other small-scale populations, in contrast, are diverse and represent ways of living that were characteristic of most of human history. Yet, we know little of how cannabis is viewed and used in these populations. We suggest several areas of inquiry for future cannabis research among Congo Basin foragers specifically, and hunter-gatherers more generally. We need more research on age and gender differences in cannabis perceptions and use to tease apart the relative contributions of personal (e.g., aversions, dislikes) and social (i.e., cultural models about who should use, roles in mate attraction) factors in shaping patterns of use. We did not collect data on the medicinal use of cannabis among the Mbuti and Efe. In light of increased scientific and societal interest in the medicinal uses of cannabis, it is essential to have comparative data among the Mbuti, Efe and other related Congo Basin foragers groups (e.g., Baka and Twa), including more detailed research testing hypotheses predicting the association between cannabis use and intestinal helminth infections. More research is also needed on the perceived links between cannabis use and hunting and working. Why do Congo Basin hunter-gatherers associate cannabis with performance enhancing effects? Does smoking cannabis actually improve, or hinder, hunting and working? What are the actual hunting or work return rates for men who use cannabis versus men who do not use cannabis? Finally, more research on the economic costs of cannabis (along with tobacco and alcohol) is needed, especially within the context of forager-farmer relations and market integration. This will help us to understand the conditions that give rise to high rates of cannabis use and the potential social and economic tradeoffs of using cannabis.

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