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Challenges and Opportunities for Ethical Collaborative Research: Social Contours of A'uwẽ (Xavante) Ethnobiological Knowledge

James R. Welch[1]

Abstract. *In many countries, research authorizations must be obtained before field studies begin, even though it may be difficult to anticipate community understandings of ethnobiological knowledge ownership, possession, and use that should be reflected in informed consent protocols, study methods, and publishing decisions. In this article, I draw broadly on my experience conducting ethnobiological and other kinds of research involving biodiversity in five A'uwẽ (Xavante) communities in Central Brazil since 2004 to discuss the social contours of ethnobiological knowledge in their society. My goal is to provide an ethnographic account of several illustrative configurations of knowledge possession, sharing, and secrecy that shape who rightfully has access to what kinds of information and, therefore, bear upon culturally appropriate and collaboratively formulated data collection and informed consent practices. Most specialized A'uwẽ ethnobiological knowledge is considered secret and therefore not appropriate for scientific research and publication. I conclude with a discussion of how Indigenous sovereignty issues may collide with external ethics requirements while being strengthened by community action.*

Keywords: *ethnobiological sovereignty, research ethics, research design,* cerrado*, Central Brazil*

Introduction

Ethnobiologists' overriding ethical duty to do no harm to study participants (International Society of Ethnobiology 2006) suggests that acquiring and following institutional research authorizations, including ethics or human subjects committee permissions, are inadequate measures for ensuring ethical research. Rather, studies should ideally construct their research designs and informed consent protocols from the ground up, based on local conceptualizations of proprietary ethnobiological knowledge, including the numerous cultural forms of individual and collective knowledge ownership and possession that might bear upon a particular study (Bannister et al. 2012; Hardison and Bannister 2011). Attending to this higher standard may be difficult for many researchers, as it requires ethnographic familiarity with the study population prior to developing an ethnobiological research protocol. Thus, we are left with nagging questions of how to formulate informed consent for external authorities that contemplates unforeseeable social contours of knowledge and how to protect knowledge holders and owners who were not specifically recognized by an informed consent protocol written before the start of a study.

Just meeting the requirements for obtaining formal research authorizations is often a daunting process. For example, in the case of an academic ethnobiological study conducted by a researcher at a Brazilian domestic institution with Indigenous Peoples living in a federally recognized Indigenous land (my situation), the formal authorizations required include: (1) ethics approval of the research project and informed consent form by an institutional review board (Comitê de Ética em Pesquisa) (Fonseca 2015); (2) ethics approval of the research project and informed consent form by the National Research Ethics Com-

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mission (Comissão Nacional de Ética em Pesquisa) (Barbosa et al. 2014); (3) peer reviewed approval of the research project by the National Council for Scientific and Technological Development (Fundação Nacional do Índio and Santilli 1995); (4) evaluation and authorization of the project by the National Indian Foundation (Fundação Nacional do Índio), including consultation with community leaders, in order to legally enter a federal Indigenous land (Fundação Nacional do Índio and Santilli 1995); (5) registration and certification of the project and informed consent form via the National System for the Management of Genetic Heritage and Associated Traditional Knowledge (da Silva and de Oliveira 2018; Welch 2015a); and (6) community informed consent, usually granted during public meetings in local communities and/or with Indigenous associations representing communities, signed by locally recognized leaders (Liporacci et al. 2015; Zank et al. 2019). Additionally, researchers must follow ethical guidelines established by a home or sponsoring institution, all relevant academic associations, governmental regulations, and international treaties.

Research ethics and, more specifically, informed consent are challenging topics for ethnobiology partly because they typically involve numerous points of reference. Studies may be subject to multiple ethical frameworks or authorities simultaneously, a challenge being addressed incompletely in some jurisdictions through the establishment of centralized and multicenter research ethics committees (Fitzgerald and Phillips 2006; Studdert et al. 2010; Tully et al. 2000). This heterogeneity may be especially apparent for multidisciplinary, international, multicentered, or intercultural studies. Consequently, a single ethnobiological investigation may be subject to diverse and potentially divergent standards for informed consent, fieldwork conduct, and treatment of results or products, with the potential to make certain kinds of research decisions difficult or impossible to make without failing to attend to somebody's presumably legitimate interests.

Such authorizations are often intended to protect Indigenous and other local peoples from exploitation, although in practice they may be overly bureaucratic to accomplish this goal effectively (Heimer and Petty 2010). Standard institutional ethics committees and university institutional review board (IRB) practices have been criticized for perpetuating colonial relations, especially by narrowing the framing of research ethics to legalistic compliance principles and failure to engage research projects and their ethical dimensions as reciprocal constructions involving both researchers and participants (Ellis and Earley 2006; Sabati 2019). Some Native Americans, Native Alaskans, Native Hawaiians, and other native peoples in the United States have implemented their own IRBs to better protect communities and promote participation in the research process (Kelley et al. 2013). Unfortunately, not all Indigenous Peoples in developing countries are adequately organized to develop similar initiatives at the present time. Indigenous researchers challenge IRB practices through their uniquely engaged approaches, whereby they share power with participants, promote local epistemologies, and do not predetermine research topics and methods (Boutain 2008). Arguments of coloniality, paternalism, and anti-sovereignty can be made for the other types of research permissions one is required to obtain for ethnobiological research in many international settings, as they are currently configured. However, arguably, an absence of regulation would certainly do more harm, especially in countries where Indigenous communities tend to lack formal schooling and organizational infrastructure necessary to assume this function on their own terms.

The challenge of research authorization procedures potentially requiring a scholar to formulate objectives, methods, protocols,

and anticipated products before engaging in dialog with the study population is that it precludes the timely development of reciprocal research relationships and mutual understandings of research interests and cultural concepts surrounding the possession, sharing, and investigation of ethnobiological knowledge. In my own research with the A'uwẽ (Xavante) in Central Brazil, my ability to engage study communities before conducting ethnobiological research benefitted from a de facto national prohibition on such research by foreigners when I first came to the country in the early 2000s to conduct my doctoral research. This set of circumstances was largely the result of perceived abuses by a minority of foreign researchers in combination with the prevailing interest of the Brazilian government at the time, which was protection of "national patrimony" more than protecting Indigenous Peoples' intellectual knowledge. For example, researchers from the United States famously obtained a patent for *Banisteriopsis caapi*, one of the main ingredients of ayahuasca, an entheogenic tea used by Amazonian healers and shamans (Fecteau 2001). Due to the resulting political disfavor towards foreigners collecting ethnobiological data in Brazil, I was advised to avoid any kind of research that might be construed as addressing Indigenous knowledge of biodiversity or identifying organisms based on specimen collections.

As a result, I initially conducted purely anthropological and, subsequently, public health research. My first ethnobiological research that included identifying organisms and ascertaining their uses by an Indigenous population was as part of a governmental working group led by Dr. Ricardo Ventura Santos that was tasked in 2009 by the Brazilian National Indian Foundation, a federal agency, with conducting a land demarcation study. The request for our participation was initiated by local A'uwẽ leaders, who asked the federal agency to appoint us to the task on a volunteer basis due to a lack of available in-house anthropologists. By law, we were required to assess A'uwẽ use of local landscape resources, including flora and fauna, although we doubly protected ourselves by retroactively regularizing this study per terms of the 2015 "New Biodiversity Law" (Welch 2015a). By the time of this study, I was already familiar with many of the social protocols of ethnobiological knowledge among the A'uwẽ, which greatly facilitated our formulation, in dialog with the communities, of a culturally appropriate research strategy for the report.

In this article, I draw broadly on my experience conducting ethnobiological, anthropological, and public health research in A'uwẽ communities in Central Brazil since 2004 to discuss the social contours of ethnobiological knowledge in A'uwẽ society. My goal is to provide an ethnographic account of several configurations of knowledge possession, sharing, and secrecy that shapes who has access to what kinds of information. Furthermore, I address how this scenario affects researchers' ability to conduct ethnobotanical knowledge in this ethnic group, including limitations to access that might influence how they would or would not propose an ethnobiological study to the myriad of agencies and authorities overseeing research authorizations in Brazil. I do not focus on bioprospecting, commercial applications of ethnobotanical knowledge, or profit sharing, all topics deserving special attention elsewhere. This case study exemplifies how participatory research design is crucial for the success of ethnobiological studies among Indigenous Peoples. I conclude with a discussion of how Indigenous sovereignty issues may collide with external ethics requirements while being strengthened by community action.

Study Population and Expectations of Informed Consent by the Men's Council

The A'uwẽ are one of Brazil's larger Indigenous ethnic groups, mostly residing in tropical savanna (*cerrado*) lands in

Mato Grosso State, Central Brazil. There are currently ten federally recognized A'uwẽ Indigenous lands, with a total population of over 22,000. My primary research has been conducted once or twice annually, on average, since 2004 in the Pimentel Barbosa Indigenous Land, principally in Pimentel Barbosa community (village) and its child communities, which separated from the mother community since I began my research (Etênhiritipá, Paraíso, Santa Vitória, and a fifth that is dividing from Etênhiritipá as I write this article and does not yet have a name). The Pimentel Barbosa Indigenous Land (328,966 ha) is the least densely populated of the A'uwẽ lands, with approximately 2,600 residents. Consequently, over the last half century, this sub-group has been able to continue performing traditional subsistence activities and accessing wild foods to a greater degree than most other A'uwẽ who reside in more densely populated and environmentally degraded lands, or even in urban contexts (although monetarization of communities at Pimentel Barbosa has intensified in recent decades). The residents of the communities I have worked with more intensively also pride themselves as being guardians for all A'uwẽ of traditional knowledge involved in the numerous and complex ceremonies that mark important events in people's lives, such as weddings, rites of passage into adulthood, and men's spiritual rituals.

The A'uwẽ are also among the country's most visible Indigenous groups within the academic literature, largely because some A'uwẽ communities have developed extensive collaboration networks with researchers from many countries and diverse academic fields (Dent 2016; Santos et al. 2013; Welch 2014; Welch and Coimbra Jr. 2014). Through this ongoing engagement with science, many A'uwẽ leaders have reasonable familiarity with Brazilian, North American, and European informed consent mechanisms. They recognize their legal and bureaucratic importance and are amenable to coordinate their presentation to community members and sign them, provided the community has an underlying interest in participating in the project.

Researchers and other visitors to A'uwẽ communities are usually expected to introduce themselves and their proposals at men's council meetings (*warã*). Held most mornings and evenings in the central plaza, these political events can be viewed from the doors of peoples' houses, located around the perimeter of the community. As the most overtly political setting in A'uwẽ communities, where issues of community-wide importance are discussed and settled through a culturally unique form of consensus, these meetings are where community research authorization should be requested in accordance with local cultural conventions. Some people, most notably women and younger men, express their voices through indirect means despite not actively participating in council debates (Graham 1995). In Brazil, collective informed consent forms are allowed to meet the legal requirement that local decision-making processes in culturally distinct communities, such as Indigenous People, be respected while not prejudicing individual consent (Conselho Nacional de Saúde 2016).

I was nervous and awkward the first time I presented a research project in one of these meetings, but have grown to find it a pleasurable, even comforting, experience. Elder A'uwẽ men are skilled cultural ambassadors who seem to intuitively find ways to make visitors feel at ease while also demanding of them accountability through public discourse. Community debate occurs before, during, and after researchers present their projects, periodically facilitated by elders' formal speeches, and sometimes spanning several days (Graham 1993). If consent is granted by the council, consent forms are signed and word spreads quickly throughout the community. Typically, the researcher will subsequently be approached privately by individuals

who were not present in the council, have additional questions, or want to address uncertainties and concerns.

In the following four sections, I discuss different A'uwẽ configurations of knowledge possession, sharing, and secrecy that figure prominently in their routine ethnobiological practice and may affect how information may or may not be accessed by researchers.

Generalized Knowledge

Some ethnobiological knowledge is generalized within and between communities and is known by many or most adult men and women. Generalized knowledge does not belong to anyone in particular, being "owned" (or possessed) by the collectivity. For example, some healing herbal teas, health related dietary proscriptions for major classes of individuals (parents of unborn or recently born children, men, and women of reproductive age), and even some sorcerous formulas are widely known. Also, some herbs used to rub into scarification cuts to reduce bodily pain (arthritis, headache) are common knowledge. Other forms of widely known ethnobiological information are not health related. For example, the identities of animal and plant foods (game meat, fish, edible fruits, heart of palm, insect larvae, edible ants, honeybees) are knowable by all who engage in procuring these foods. Plants used in architecture and common technologies are also not limited in who from the community may access information.

Although generalized ethnobiological knowledge does not have individual or group owners, some of it is considered privileged knowledge that should be retained by the A'uwẽ and not shared with outsiders. This is particularly the case with biological samples, which are often discouraged from being taken from a community for such purposes as identification or seed banks for fear they will be stolen and used for other people's benefit without due compensation to the community who supplied them. This restriction is of relatively recent origin, deriving from rumors of researchers who stole ethnobotanical resources from other ethnic groups (Conklin 2002). It is also a restriction that may be overcome through dialog and trust between all parties that the purpose of taking collections is in the interest of the consultant community. It should be noted that A'uwẽ communities are politically autonomous, there being no effective intercommunity councils or associations that might make decisions to release information or materials on behalf of more than one community. Thus, each community acts autonomously regarding these kinds of decisions, and no other community has the prerogative to interfere or claim a right to benefits deriving from an agreement to share information.

Women's and Men's Knowledge

A'uwẽ women and men have somewhat different repertoires of ethnobiological knowledge for similar reasons to other cultures and societies in which gender influences peoples' productive activities, social groups, and life experiences. Gender affects the knowledge people have because it contributes to differences in how and with whom people go about their lives. For example, among the A'uwẽ, women are likely to have more familiarity with weaving burden baskets and men with sleeping mats, since these are considered female and male productive activities, respectively. In a pinch, many men can weave carrying baskets and women can weave sleeping mats, but they prefer not to do so. These distinctions do not necessarily involve secrecy but rather are a matter of customary gendered practice.

There are also other kinds of A'uwẽ ethnobotanical knowledge held by women and men according to stricter cultural understandings of gendered knowledge. Some knowledge is actively maintained in secret from members of the opposite

gender because it is considered a female or male prerogative susceptible to inappropriate stealing. In these cases, members of a gender, including those who do not pertain to the community or ethnic group, may not freely access or reproduce the privileged information. A key example of this kind of secret gendered knowledge are the wild root vegetables (roots and tubers) that only women collect (Figure 1). This entire class of food, which once comprised the main starchy staple of the A'uwẽ people, before the introduction of rice in the 1970s, is particularly difficult to identify and locate in the landscape. Distinct wild root vegetables grow in specific kinds of vegetation and soils (*cerrado* scrublands, grasslands, bamboo forests, gallery forests, swamps, and fallow gardens), of which only women have extensive knowledge. Furthermore, they are identified by their leaves, which wither and fall to the ground seasonally, making it impossible to trace them via the fine serpentine stem to the cache of underground vegetables at the other end. This sophisticated knowledge is considered by women to be their prerogative, which they, rather than men, transmit between generations and protect from non-A'uwẽ. Women may share this secret knowledge with A'uwẽ men, especially under contemporary circumstances of partial gaps in intergenerational transmission, but they are responsible for its protection and perpetuation. For example, under the auspices of an audiovisual heritage project, women asked a male A'uwẽ videographer to observe the collecting process in order to film it so that the recordings could be archived for the benefit of future generations and thereby mitigate against intergenerational loss of the knowledge.

Another example of women's secret knowledge is that related to pregnancy and childbirth. Prior to childbirth, a pregnant woman looks to her elder female family members for advice on how to maintain her own and her child's health. During child-

Figure 1. A'uwẽ women excavating wild root vegetable in the *cerrado*. Photograph by James R. Welch, 2016.

birth, only women are present and only they know how to assist the mother and ensure an uncomplicated birth. There are no specialized midwives in A'uwẽ society, rather this knowledge is held by all elder women, who assist their daughters, granddaughters, nieces, and other female members of the extended family. Associated ethnobiological knowledge is considered to be a closely held secret from men, who are generally excluded from any participation in this specialized arena of female proprietary knowledge. Only occasionally, when a birth has involved grave complications and a life is at stake, might a male elder be called to help using his own forms of healing practice. Currently, young mothers also consult at the local health post and many opt for caesarean deliveries, causing a potential generational gap in women's secret pregnancy and childbirth knowledge.

Men's secret knowledge takes many forms, but perhaps the most explicit is that associated with men's spiritual rituals (Welch 2010), which involve the use of a large diversity of plant and animal substances. These rituals are considered spiritual by A'uwẽ men because it is through them that they seek to acquire spiritual power and endurance. They are considered categorically different than other rituals that do not have a spiritual objective, such as weddings and rites of initiation into adulthood. The spiritual system involves unnamed age sets (cohorts) that pass between age grades (stages) over the course of approximately 45 years. Adjacent age sets belong to opposite spiritual moieties, which are each therefore comprised of a chain of alternate age sets bound to one another by trust and mentorship relationships. Secret spiritual knowledge is transmitted by mentors to their protégés (two age sets younger) out of sight of others and in hushed voices. The use of plant and animal products to prepare the body and fabricate myriad spiritual objects is also taught by mentors to their protégés. This information is kept in the strictest confidence from all non-initiates, including all women, whether A'uwẽ or non-A'uwẽ. Traditional punishment for a woman who came to know men's spiritual secrets was severe, although these measures seem to have largely fallen out of favor in recent years.

Secular Age Set Moiety Knowledge

There is a second age group system in A'uwẽ society, comprised of eight named age sets arranged through alternation into secular age set moieties. I call this system secular to distinguish it from the spiritual system mentioned above, because it has no overt spiritual objectives. This is the age group system that includes rites of passage into adulthood, which transforms girls and boys into responsible and respectful women and men. As in the spiritual system, the secular age set moieties are formed of chains of mentors and protégés who share a special sense of trust, intimacy, and camaraderie. Mentors indulgently guide their protégés while members of the next oldest adjacent age set treat them with rivalry and keep vigil over them. The special relationship of camaraderie that develops between mentors and their protégés extends through mentorship links to the entire moiety, such that it forms a block of solidarity that encompasses half of society. Within this framework, mentors pass privileged ethnobiological information down to their protégés, who in turn pass it along to their protégés some years later. This information is widely shared within each moiety but is not shared with members of the opposite moiety. Being a sodality, a secular moiety includes members who reside in any community, among whom this secret information may be freely shared. An example of the kind of secret ethnobotanical information taught to protégés by their mentors are powerful plant materials, which are rubbed on the legs immediately after scratching or "scarifying" them in order to become stronger and faster runners (Figure 2). By using these plants, the

Figure 2. Secret plant products are rubbed into the freshly scratched legs of young runners to promote speed and endurance. Photograph by James R. Welch, 2005.

mentors and protégés believe they will have better chances of winning running races against their rivals from the opposite secular moiety.

Heritable Proprietary Knowledge: Prerogative Ownerships

Some ethnobiological information is the intellectual property of specific women and men, generally passed down between generations according to the pattern of parallel inheritance. Thus, men often teach their secret information to their sons and women to their daughters. These ownerships, generally marked with the suffix *-tede'wa* ("owner"), were once understood by ethnographers to be lineages (Maybury-Lewis 1967) but have subsequently been reinterpreted as heritable prerogatives involving proprietary knowledge ownership (Welch 2022). Part of the problem with calling them lineages was they exhibited ample "fluidity" with people joining or leaving them for political reasons independently of genealogical ties. In my research, these ownerships were shown to me to be quite diverse and flexible, in the sense that despite a presumption of parallel inheritance, they can also be given to others as gifts, loaned to others, or be stolen from their original owners. Thus, they must be protected by entrusting them only to one's most dependable beneficiaries, who are usually a man's sons and a woman's daughters. This presumption makes all of one's parallel heirs potential owners. In other words, they can use the ownership term to identify themselves whether or not they have actually acquired the knowledge required to exercise the prerogative. Additionally, heritable prerogatives make exceptional gifts. For example, if someone saves one's life, they are owed

a debt of gratitude. A heritable prerogative would be worthy of the debt.

Types of proprietary heritable knowledge vary tremendously, but often are associated with ceremonial prerogatives, specialized technologies, animals and landscape features, healing practices, and poisoning. An abbreviated list of men's ethnobiological prerogative ownerships include Peacekeepers (*wamãri'tede'wa* or *wamaraĩzu'tede'wa*), Owners of the Sun Ceremony (*pahöri'wa'tede'wa*), Snake Owners (*wãhi'tede'wa*), owners of the *tebe* mask and ceremony (*tepé'tede'wa*), and White-lipped Peccary (*Tayassu pecari*) Owners (*uhö'tede'wa*) (c.f., Lopes da Silva 1986; Maybury-Lewis 1967; Müller 1992).

These ownerships may be considered ethnobiological because they involve ownership of an animal taxon or secret knowledge involving the use or manipulation of plant or animal substances. For example, Peacekeepers have exclusive rights and knowledge to prepare a white powder out of a local variety of wood, which they dust on the back of the heads of their patrilineal kin and other special designees (Figure 3). This substance and the knowledge that accompanies it allows its owners to have the clarity to intermediate conflicts between others while maintaining an independent posture towards both sides. This wood can also be used to achieve clairvoyance and communicate with the dead (Maybury-Lewis 1967).

I also ran across heritable men's knowledge regarding the fabrication of special ear plugs worn by men. A'uwẽ men wear ear plugs made of specific woods believed to produce desirable effects. For example, owners of game animals use specific ear plugs during hunts, which are broken off

Figure 3. Sacred powder prepared by Peacekeepers (*wamãri'tede'wa* or *wamarĩzu'tede'wa*) is dusted on the backs of the heads and necks of lead mourners during a funeral procession. Photograph by James R. Welch, 2005.

the branch uncleanly and inserted into the ear-piercing green with the bark still on, in stark contrast to usual A'uwẽ ear plugs, which are dried and finely sanded. I cannot speculate about their precise function but presume they are used to improve the success of the hunt. Another example is a secret wood worn as an ear plug by men desiring sexual encounters with women because it causes women to find the wearer irresistible. Men who are not owners of that particular knowledge domain were allowed to use those ear plugs but did so by placing orders with senior knowledge owners. I was told this specific type of ear plug was particularly sought by some young men while living in Brazilian cities.

As a male researcher inserted into the A'uwẽ social matrix, I did not have comparable exposure to information about female heritable prerogatives. This information was usually kept from me by women who considered it none of my (male) business. However, I did have the opportunity to learn about my adoptive grandmothers' ownership of pottery, which they learned as young women but discontinued many decades ago due to the availability of metal pots and pans. Only one of them remains alive today and she has not yet passed the knowledge of how to produce pottery to her daughters, granddaughters, or other appropriate members of younger generations. The secret knowledge included the proper clays, tempers, construction of the pot, and firing techniques. When pottery-making was still practiced, Pottery Owners surrounded their work area with a brush fence to ensure that non-owners could not watch and thereby steal their techniques. When other women desired pots, they would place orders with these women. During a trip to the field in 2009 I was accompanied by an ethnoarchaeologist, who was not aware that pottery production was secret women's heritable knowledge. When he asked what they used as temper, the immediate response was "We are not accustomed to telling others that sort of information."

Discussion and Conclusion

The four types of ethnobiological knowledge discussed in this article, generalized knowledge, gendered knowledge, secular age set moiety knowledge, and heritable proprietary knowledge, illustrate that virtually no A'uwẽ cultural ethnobotanical information is free from constraints on who may have access. Even generalized knowledge is considered A'uwẽ knowledge, not to be collected and exported without full community consent, including a solid mutual understanding of how the study is in a community's best interest. The remaining three categories illustrate that much of A'uwẽ specialized ethnobiological knowledge is considered a secret to be kept from someone, whether it be members of the opposite gender, members of the opposite secular age set moiety, or heritable prerogative nonowners. In these three cases, even if a researcher gains access to privileged information, it would not be usable in a study or publishable. My participation in the community in the spiritual and secular age group systems for the last 17 years exposed me to abundant secret information, none of which could be used in this article or any other due to the confidence knowledge holders placed in my discretion. Keeping these secrets is my obligation according to the fundamental ethical standard of doing no harm.

It is notable that not all ethnic groups in lowland South America have such complex social contours of ethnobotanical knowledge ownership and access as I have described for the A'uwẽ. The example of strictly gendered knowledge, for example, does not appear to have close parallels in some Indigenous societies in the region. This point is illustrated by examples of ethnobiological publications researched, written, and published by or in collaboration with Indigenous Peoples. For example, the book *Una Isi Kayawa: Livro da Cura do Povo Huni Kuin do Rio Jordão* (Ika Muru et al. 2011) presents a marathon of Huni Kuin ethnobiological remedies that include treat-

ments for men's and women's afflictions with no apparent proprietary restrictions based on gender, sodalities, or proprietary ownerships. Among the Sanöma Yanomami, fifteen varieties of edible mushrooms are generally collected by women but are also known to men and may be collected by them when the occasion arises (Coimbra Jr. and Welch 2018; Sanuma et al. 2016). Another book written by Bruce Albert and William Milliken (2009) addresses diverse Yanomami botanical foods, technologies, body decorations, psychotropics, and medicines without specifying that they are limited by intracommunity restrictions on knowledge or access.

Regarding the A'uwẽ case, it is possible that permission could be obtained to reveal limited portions of the more protected forms of ethnobiological knowledge. For example, for a time I entertained with some members of the community the idea of asking the last living Pottery Owner to demonstrate her craft and allow it to be filmed in order to preserve the knowledge. Although we have yet to follow through with the idea, community leaders considered it possible she would allow it, mainly because the knowledge had not been actively used for decades and had not been passed on to any of her younger female relatives. It is less likely that women, men, moiety members, and prerogative owners would release information for public consumption that is actively used and protected from segments of the population. In effect, these social contours of ethnobiological knowledge serve as rail guards against collecting and disseminating the better part of specialist information that exists in A'uwẽ society. In other words, irrespective of permissions granted by external authorities to conduct a study, A'uwẽ social conventions would prevent most attempts to collect such data. The greater danger exists when friends of the A'uwẽ learn secrets in confidence and fail to handle them with due care. Examples exist, which I will not cite, of publications by long-time friends to the A'uwẽ that included secret knowledge. I can only assume the authors believed that since it was shared with them it was knowingly being released for publication as part of a study, although their collaborators informed me this was not the case.

These knowledge contours also help identify who should be contacted for informed consent to collect and utilize ethnobiological data within an A'uwẽ community. Generalized knowledge should be accessed through informed consent of the regular men's council, which usually meets twice a day. However, for a heritable prerogative, such as pottery making, the senior owner within the community must provide consent, independently of whether community permission was granted. Similarly, women's and men's knowledge would require a community meeting with either just women or just men to obtain collective consent by members of the relevant gender. Accessing secular age set moiety knowledge would require a meeting with all adult members of the moiety. None of these protocols could be anticipated without prior ethnographic familiarity of the cultural terrain and are not contemplated by usual human subjects informed consent procedures.

This set of responsibilities for authorizing access to specialized knowledge is a little more complex than it may appear. In the first place, a researcher who is new to the A'uwẽ may not know to which category of knowledge and, therefore, to which owners a specific piece of information pertains. Second, these emic categories of knowledge are not congruent with Western scientific ethnobiological ordering of information. For example, a comprehensive study of A'uwẽ ethnoornithology in a single community would require accessing all four categories of knowledge after obtaining consent from their respective owners, which might entail consultation with hundreds of individuals, some more than once. This is because knowledge of the cultural uses of

diverse birds and their feathers is complex and abundant, some of which is in the general purview while the rest is the property of heritable prerogative owners, men who have been initiated into the spiritual age group system, or age set moieties. Third, A'uwẽ social convention disfavors people who seek other people's secret information, who are considered disrespectful or ungracious. This is even true when a prospective researcher presents a project at an initial council meeting that addresses protected dimensions of ethnobiological knowledge. I observed one such meeting during which such a proposal was not only refused for such reasons, but the community replied by presenting an alternative topic that did not attend to the researcher's disciplinary interests and would have required restarting the entire process of seeking funding and obtaining research permissions. Fourth, the likelihood of receiving favorable responses to a request to access secret knowledge for a scientific study is extremely low for the simple reason that people keep their secrets for their own good reasons.

These circumstances suggest the importance of collaborative study design, in part to avoid such possibilities as arriving in a community to do fieldwork after acquiring all relevant external permissions only to find one's topic is a closely held secret that will not be shared. In the A'uwẽ case study, only ethnobiological studies that respect the four categories of knowledge discussed in this article and steer clear of sensitive areas would have reasonable chances of gaining community approval. Furthermore, community authorization to work with sensitive information, even generalized knowledge, will be much more likely if the project is designed from the outset to attend to community needs and interests. Thus, beginning a collaboration early and finding common ground with the community will go a long way towards ensuring a successful study.

Alternatively, such investigation should occur during fieldwork such that project design and informed consent protocols may be adapted accordingly, always with the ultimate goal being to do no harm to participants by protecting their secret knowledge. For example, different kinds of information may require informed consent from different sets of people or their representatives. A study protocol should be designed with enough inherent flexibility that informed consent for specific cultural content categories can be sought from distinct and unforeseen knowledge holders or owners, as these are encountered and incorporated into the study. Thus, both researchers and their informed consent protocols must be agile enough to adapt to circumstances as they unfold in the field.

The issues discussed in this article linking social contours of ethnobiological knowledge with research ethics permissions and informed consent protocols have implications for Indigenous and other local peoples' cultural and biological sovereignty. An important recent publication argued that decolonizing the ethnobiological enterprise by repatriating biological heritage, providing for the accessibility of publications, and supporting community-driven research are important steps for moving the field forward (McAlvay et al. 2021). Other scholars have similarly emphasized the centrality of social justice for maximizing the relevance and potentials of ethnobiology (Armstrong and Veteto 2015; Blair 2019; Hardison and Bannister 2011). Part of this agenda involves leveraging ethnobiological research to further Indigenous or local peoples' sovereignty even (or especially) where legal mechanisms are insufficient. One uneasy aspect of Indigenous People's sovereignty is their right to conduct or collaborate with research addressing their social and biological knowledge whether or not external authorities have deemed it worthy of institutional authorization.

In the A'uwẽ example discussed in this article, Brazil does not grant Indigenous Peoples full sovereignty over their territo-

ries, their productive enterprises, or the research projects they wish to support. Brazilian Indigenous lands are federally owned, while the right to occupy and subsist on them (but not to access timber or mineral resources or to rent the land to commercial interests) is constitutionally recognized (Carvalho 2000). Recently, under the Bolsonaro presidential administration, even the basic right for Indigenous Peoples to occupy their traditional lands, which is granted in the constitution and supported by important international treaties (Pasqualucci 2009), has come into question (Chiavari and Lopes 2020). One consequence of the legal arrangement, whereby Indigenous lands are owned by the federal government, is that the government, not local Indigenous communities, retains the right to authorize all ingress by non-Indigenous people into Indigenous lands. Thus, in the case of academic researchers, it withholds from Indigenous communities the right to select researchers and research projects to work with them on their lands; rather, they are afforded only the right to refuse ingress to whom the federal government already determined presented adequate projects and qualifications. In practice, this means the federal government retains responsibility for peer-reviewing research proposals, authorizing ethics protocols, and issuing permissions to conduct ethnobiological re-search. Governmental authorization for ingress into Indigenous lands is predicated on successful completion of each of these steps, as well as ample review by Fundação Nacional do Índio of one's qualifications, institutional support, and a medical certificate that the researcher "does not have an infectious disease" (a well-intentioned but vague requirement that cannot be legitimately met by any qualified doctor). Only after all these governmental hurdles are overcome does the local Indigenous community have the right to accept or deny a particular research project. Thus, Indigenous Peoples receive preprepared research "packages" to which they may adhere, should they so desire, rather than engaging with researchers in developing projects that serve their self-defined interests and provide them with benefits of their own choosing. Collaborative research formulation is, thereby, a practical impossibility.

Scientific sovereignty is a practical impossibility in Indigenous Brazil for the reasons described above, although some groups have become experts at cultivating researchers and research projects that attend to their goals of producing knowledge and developing expert networks of collaborators through affective relationships of friendship, camaraderie, and voluntary kinship. The A'uwẽ are such a group. They are well known for befriending and even "adopting" scholars in diverse academic fields, through whom they build research activities that meet their needs and interests (Dent 2016; Graham 1995; Welch and Coimbra Jr. 2014). As may occur with other Indigenous groups who seek to establish relationships of confidence with scientists, the A'uwẽ exert control over the research agendas of known and tested scholars by means of several strategies. Researchers may be incorporated into kinship networks, whereby solidarity, reciprocity, and provisioning of goods and services are expected of them and, thus, they are seen as potential allies in communities' struggles. Occasionally, communities invert the usual relationship of observer-observed and demand that researchers accommodate community needs at the expense of their own research agendas. Although the A'uwẽ with whom I have worked never did so with me, communities also plausibly could make explicit demands of researchers in order to offer their cooperation (as occurs among some other Indigenous ethnic groups in Brazil). In each of these examples, Indigenous communities chose to participate in research as influential actors and, thereby, may establish more horizontal relations with researchers despite government agendas and legal systems.

Despite the numerous relationships the A'uwẽ have developed with scientists over the years, relatively few ethnobiological studies have been undertaken with this Indigenous group (as compared to the hundreds of non-ethnobiological articles and books published about them) (Azanha 2013; Fragoso et al. 2000; Leeuwenberg 1997; Leeuwenberg and Robinson 2000; Marimon and Felfili 2001; Melo and Saito 2011, 2013; Prada and Marinho-Filho 2004; Urébété 2017; Vieira 1999; Villalobos 2002; Welch 2014, 2015b, 2020; Welch et al. 2013). This discrepancy may be due to the cultural limitations on who may legitimately have access to secret information, which entails a substantial portion of A'uwẽ ethnobiological knowledge, as well as the federal government's gatekeeping regulations, which serve to limit the ethnobiological research projects individual communities may come to consider. Thus, ethnobiological sovereignty is a right exercised within the bounds of Indigenous access to researchers and their studies. However, as exemplified by the A'uwẽ case, institutional and governmental efforts to protect Indigenous Peoples from ethnobiological foul play are ineffective insofar as they do not contemplate collaborative project development, including ethics protocols and access to traditional knowledge regarding biodiversity.

Some Indigenous groups in Brazil are not waiting for governmental initiative to implement their own ethnobiological projects that involve their own forms of research and knowledge sharing. For example, the Krahô of Maranhão, Brazil, have been organizing and hosting traditional seed markets since 1997 (Londres et al. 2014). These events, which are open to members of other Indigenous ethnic groups and the general public, involve much more than seed exchange. For example, they include a busy schedule of Indigenous-led talks, workshops, debates, and experience sharing. More recently, since 2007, the Xingu Seeds Network (Rede de Sementes do Xingu) has been collecting and distributing native plant seeds (especially trees) for the main purposes of reforestation and community development (Marimon and Lima 2019). The network relies on participation from family agriculturalists, rural producers, Indigenous communities, researchers, NGOs, governmental organizations, social movements, and schools. It has also produced a wealth of public information in the form of guidebooks, many of which are available for free download (Campos Filho 2009a, 2009b). Also, the multiethnic Upper Rio Negro region has been fertile in the development and promotion of community associations promoting ethnobiological knowledge, production, and marketing, some of which have succeeded at breaking into the North American and European commodities markets (Chernela 2011; Garnelo and Baré 2009).

Ethnobiological scientific sovereignty remains out of reach for many Indigenous Peoples in Brazil and other developing countries with paternalistic legal frameworks or even authoritarian regimes and insufficient access to formal higher education for residents of local and autonomous Indigenous communities. Nevertheless, through their own actions to promote desirable culturally appropriate ethnobiological initiatives, as well as their conscientious efforts to train non-A'uwẽ scholars on the emic social contours of ethnobiological knowledge ownership and access within communities, they both protect and share their intellectual resources in ways they deem appropriate. Such efforts are well informed by existing tensions between the open data movement and Indigenous data sovereignty, which should be considered interlinked with ethnobiology. This state of affairs is not ideal. Significant public policy improvements in Brazil and elsewhere could strengthen Indigenous Peoples' rights to participate in collaborative research designed from the ground up based on their own notions of appropriate access to cultural information.

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