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Abstract In the second half of the 20th century, investigations of indigenous environmental knowledge have been the subject of broader anthropological debates over how knowledge and experience are formed. Many such approaches have focused on environmental nomenclature and taxonomy, or what Roy Ellen has called "formal lexical knowledge" (1999). Such knowledge is readily available to an ethnographer and also more easily transmitted through language between subjects. These characteristics of formal lexical knowledge have led to considerable attention given to differences in environmental knowledge between cultures and have possibly resulted in the inflation of the efficacy of language in forming knowledge. However, if a different form of environmental knowledge is examined are there differences that emerge within communities and other processes beyond symbolic systems that shape knowledge? To address these questions, individuals in two Balinese agricultural communities were asked to construct food webs by linking photos of plant and animal species according to ecological interaction. The results showed significant variation in subjects' knowledge by gender, which corresponds to labor experience in Balinese wet rice agricultural systems. By shifting attention toward emic models of ecological interactions, this article attempts to demonstrate (1) that environmental knowledge differs within a single community; and, (2) the role of labor experience or praxis has in forming environmental knowledge.

Keywords Environmental knowledge · Labor · Praxis · Southeast Asia · Ethnoecology

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Inquiries into how knowledge is gained through symbolic transmission and environmental interaction are central to anthropological study (Rivers 1901; Lévy-Bruhl 1923 [1922]; Lévi-Strauss 1966; Berlin and Kay 1969; Hunn 1982; Valeri 2000). This paper addresses the differences in knowledge of ecological interactions within a single Balinese community. It aims to delineate the role of labor experience, or *praxis* (Marx 1978[1886]) in shaping a specific category of environmental knowledge. To investigate folk understandings of ecological interactions, men and women in a Balinese agrarian community were tested using a standardized ecological model building exercise. An analysis of constructed ecological models across labor types showed that male farmers and female "housewives" ("ibu rumah tangga" in *bahasa Indonesia*)[1] had significant differences in knowledge of ecological interactions. Specifically, their knowledge of which trophic levels where emphasized in the ecological model varied greatly. Because both men and women work in the field, freely share information about rice agriculture, but perform different types of labor, these findings suggest that labor experience rather than symbolic transmission is primary for the creation and retention of this specific form of environmental knowledge in Bali.

Formal Lexical and Substantive Knowledge

In the 1970s, the study of knowledge of the environment, or what was termed *ethno-science* became a recognized field of anthropological research. The subject matter of these types of studies also has often been termed "indigenous environmental knowledge" by contemporary anthropologists (Ellen *et al.* 2000).

[1] The English term "housewife" was retained in this article because it is so closely coterminous with the Indonesian term "ibu rumah tanagga," which directly translates as "woman of the house stairs." Both carry the meaning of a woman who runs and has knowledge of the household domain.

Classic studies by Berlin (1974) and Conklin (1975) investigated the ways in which different cultures create taxonomies of plants and animals, focusing on the structure of phylogenies and principles of classification. These studies married the perspectives of systematics in biology with Lévi-Straussian structuralism, leading to discoveries about the ways formal lexical knowledge of the natural world is logically codified. Ellen (1999) later criticized the initial emphasis on taxonomic principles, observing that this approach neglects substantive knowledge (for example, information about the behavior of species). Ellen warned ecological anthropologists that a shift in folk knowledge content is also a transition from one type of knowledge to another. He noted that folk-taxonomic information is a type of formal lexical knowledge and is thus likely the most apparent and readily shared kind of environmental knowledge possessed by an individual or community. Because taxonomic nomenclature is the most easily transmitted form of knowledge within a community and between informants and anthropologists, it is also the shallowest form of knowledge about a species; yet, also the most commonly used for ethno-biological data within anthropology (Ellen 1999). Consequently, Ellen distinguished formal lexical knowledge from other types of environmental knowledge, which he terms substantive knowledge. Substantive knowledge includes information about a species' reproductive habits, uses for humans and position in food webs. Two questions emerge from Ellen's thesis: First, what substantive knowledge exists within a community; and second, what are the processes that shape this type of knowledge. Here we examine these issues in the context of the substantive knowledge of Balinese farming communities about their rice paddies.

The analysis presented here proceeds in four steps. First, an explicit formal model of indigenous knowledge is defined. Second, a subject's knowledge of the structure and functional relationships in food webs are treated. Third, variation in men and women's substantive knowledge is analyzed. Fourth, the causes of this variation are investigated from the standpoint of praxis: the effects of differing experiences of social labor (Blakeley 1979; Rasmussen 1979). This approach shifts the analytical focus from formal to substantive ecological knowledge, and from variation between cultures to variation within them.

Limitations of Formal Lexical Studies of Whole Cultures

Until now, studies of what Ellen calls substantive ecological (or ethno-scientific) knowledge have largely been carried out from within the paradigm of *formal lexical knowledge* (Berry 1966; Bird-David 1990; Ji *et al.* 2000; Kitayama *et al*. 2003; Nisbett 2003; Miyamoto *et al.* 2006) by focusing on differences between two or more cultural groups. By not attending to intra-group variation, these approaches may mask several of the processes that are critical to the formation of substantive knowledge.

Scott Atran and colleagues (2002), who compare the ecological models of food webs of three groups sharing the same forest in Guatemala, focus on *substantive ecological knowledge* though they also compare variation between cultures rather than within groups. They argue that by isolating the "sociocultural factors" of social networks, the proximity to experts in ecological knowledge and cognitive models of ecological interactions, one can determine the importance of culture in the use of the forest, a relevant question for conservationists and development projects Fig. 1 spatially represents the findings from one of their experiments. Each section on the grid shows the percentage of informants within the group that stated that a specific plant had a positive effect on a specific animal: the higher the section of the grid, the greater the percentage of informants who considered that the plant had a positive effect on the animal. Though there are clear differences among the three groups, their results show differences in the distribution of knowledge within the three groups. However, they do not offer a specific explanation for such variation within each group, and consequently cannot offer an explanation for the observed variation.

Atran and colleagues do address the internal character of the Itza', Ladino and Q'eqchi communities from which these folk ecological models are taken by conducting social network analysis. Informants were asked to list those upon whom they relied in the community for ecological knowledge. Their findings are demonstrated in Fig. 2, which shows the variance in the interconnectedness of communities. These diagrams in visually illustrate the degree to which these groups are socially integrated regarding sharing ecological knowledge.

The networks above demonstrate how connected subjects are in each group regarding the sharing of ecological knowledge. However, as Ellen contends, substantive knowledge of which information about which species eat which species is less easily transmitted through language and thus more likely to differ within communities. The graphs also show large variation in subjects' knowledge of species interactions. Variation in knowledge content between and within groups is also not addressed. The absence of information about knowledge content and the differences in knowledge within groups follows the paradigms and goals of earlier research in indigenous nomenclature and taxonomy which compare multiple cultural groups to find the importance of culture in environmental knowledge. Moreover, the connectedness within these communities does not correspond to a more uniform knowledge of ecological interactions or conformity regarding which species aides other species. Though the Itza' have the least connected social network regarding sharing ecological information, they have what appears to be the most uniform set of ecological knowledge. Their frequency table is characterized by the high peaks showing that nearly 100 % of informants responded that

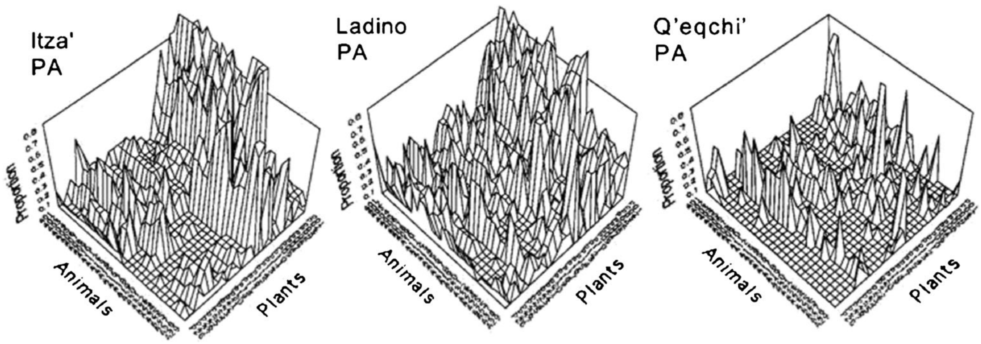

Fig. 1 Atran *et al.*'s (2002) x and y tables representing the proportion of informants from three groups that thought a given plant helped a specific animal

the respective plant helps the respective animal, or flat squares showing no informants thought there was a positive interaction between the two species. That social connectedness does not correlate to the uniformity of ecological knowledge suggests that processes in addition to social transmission shape individual's knowledge of ecological interactions. The study by Atran and colleagues briefly addresses the intra-cultural variation in knowledge that was not accounted for by social integration. They state that such differences in knowledge are the result of "multiple pathways" (Ibid, 434) of acquisition. More specifically, they suggest that "independent discovery" may shape ecological knowledge. The research and analysis from this Balinese case study attempts to more precisely demonstrate that direct experience can result in ecological knowledge; that variation in experience creates divergent substantive knowledge; and, the divergence in content of ecological knowledge may be patterned based on the type of interaction.

Applying the analytical techniques and research organization that arose within formal lexical knowledge to studies of substantive knowledge can result in only a section of the potentially significant findings to be examined and given exegetical treatment by anthropologists. As social connectedness does not necessarily correlate to ecological knowledge in the study by Atran and colleagues (2002), it suggests that some amount of substantive knowledge may be transmitted by non-discursive processes. Though certain parts of substantive knowledge appear to be the result of communication between people, a study of Itza', Ladino and Q'eqchi' environmental nomenclature and taxonomy would certainly be more uniform within cultural groups and show more rigid distinctions between them. To address what other factors shape substantive knowledge, the following study in Bali attempts to find patterns of knowledge variation within a single community and connect these differences with divergent modes of labor.

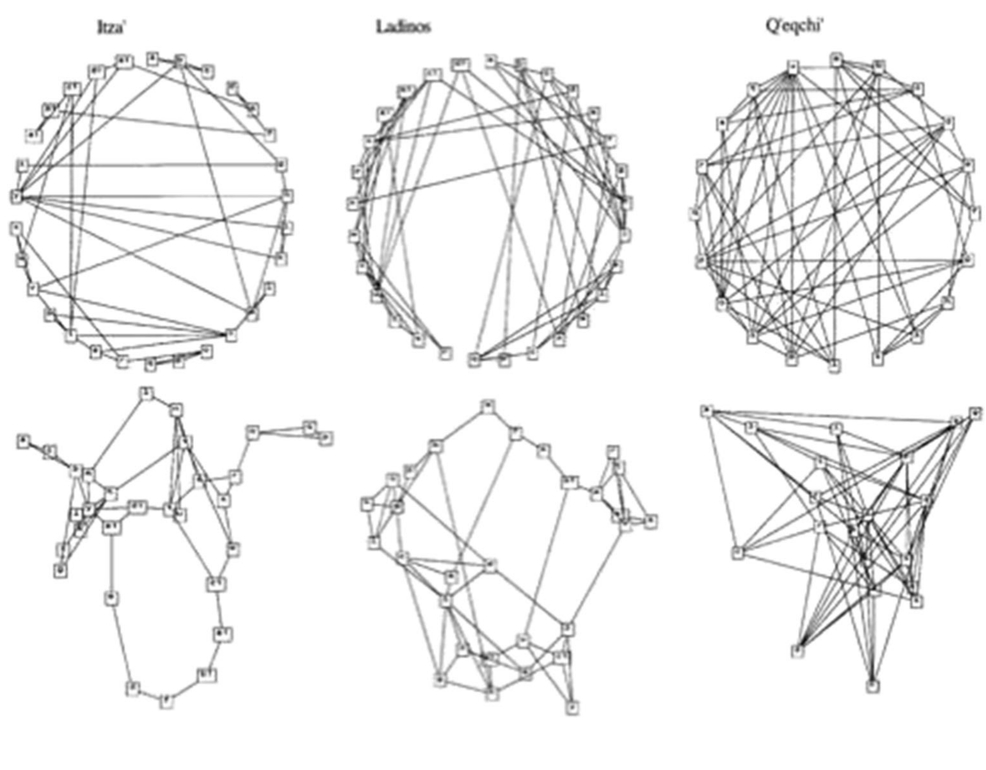

Fig. 2 Networks within Itza', Ladinos and Q'eqchi' from Atran *et al.* 2002

Methods

In the wet rice agricultural communities surrounding of Bebalang and Kawan in the Regency of Gianyar in central Bali, 28 male farmers and 18 housewives[2] took a test to demonstrate their knowledge of ecological interactions. Informants were asked to link species found in Bali with the species they ate and the species that ate them on a uniform page containing images of species. There were a total of 36 species: 17 vertebrates including mammals, birds, reptiles, amphibians and a fish; 11 invertebrates including a crustacean (crab), mollusk and nine insects; eight types of plants and one species of algae and an image of manure (listed in Table 1). After informants were given directions, explained the species that were difficult to visually represent (#27: mustard greens, #32: grass, #34: rice and #35: algae) and shown an example of "the mouse eats the rice and the cat eats the mouse;" they had 15 min to complete their food webs. The resulting food webs were then digitized by recording each of the connections made and representing each food web as a 36×36 adjacency matrix, where a 1 at position (i, j) represents a connection in the food web indicating species i eats species j. All statistics and comparisons were then computed using these matrices in Matlab.

Results

In comparing the food webs of men and women, the most apparent difference is that men made significantly more ecological connections than women, with men averaging 57.9 connections compared to an average of only 37.3 for women (Fig. 3) (t-test, $p<0.001$). In addition, the women as a group drew fewer of the possible connections than men (193 vs 318),[3] with an overlap of 161 connections drawn by both groups.[4]

In general, men focused these additional connections on the lower trophic levels (insects and plants) (Fig. 4). Housewives gave greater prominence to animals both as the species being eaten (45 % vs 28 % for men) and as predators (78 % vs 59 % for men). In contrast, men focused a larger proportion of their connections on insects, which they see as both important predators and prey. This difference in proportions results from additive knowledge, in that men made many ofthe same connections between animals as the women, but added in many additional connections to/from insects. There was not a large difference in the proportion of connections made to/from plants, and the majority of connections made coming *out* of plants went to manure. It is unclear if this was meant to indicate the opposite, that manure can be used to fertilize plants, or if this represents something else.

Due to the large number of possible connections, comparing two food webs generally results in less than 50 % shared connections. Somewhat surprisingly, only two connections were drawn by all of the women (python→frog, cow→grass), and no connections were drawn by all of the men (the closest were 26/28 for human→pig and bee→lotus flower). However, while individual food webs do not tend to share exactly the same set of connections, there is widespread agreement on

Table 1 List of species included in the food web

1. Python reticulatus (Asian python)
2. Canis lupus familiaris (Dog)
3. Feli catus (Housecat)
4. Bos primigenius (Cow)
5. Small Garden Snake (species unknown)
6. Capra aegagrus hircus (Goat)
7. Homo sapiens (Balinese Man)
8. Sus scrofa (Domesticated Pig)
9. Mus musculus (Mouse)
10. Grus (Crane)
11. Litoria infrafrenata Frog
12. Freshwater Fish
13. Anas plytyrhynchos domesticus (Bali Duck)
14. Freshwater Crab
15. Gallus domesticus (Rooster)
16. Hemidactylus frenatus (House Gecko)
17. Viviparidae bellamyinae (Asian Water Snail)
18. Black Ant
19. Centipede
20. Spider
21. Dragonfly
22. Bumblebee
23. Blattella ashinai (Asian Cockroach)
24. Mosquito
25. Gryllotalpidae Mole Cricket (Gaang)
26. Orthoptera acridiadae (Asian Cricket)
27. Brassica juncea (Mustard Greens)
28. Cocos nucifera (coconut tree)
29. Thelypteris decursive-pinnata (Asian Fern)
30. Toxicodendron (Asian Ivy)
31. Nelumbo nucifera (Lotus)
32. Poaceae (Grass)
33. Zea mays (Corn)
34. Oryza sativa (rice)
35. Cyanobacteria (algae)
36. Manure

[2] All informants had been raised in agricultural villages in this part of Bali.

[3] There are $36 \times 35 = 1,260$ possible connections in the food web, excluding self-connections, though many of these are ecologically invalid. A "correct" food web including all plausible connections was not constructed nor were food webs evaluated for "correctness."

[4] There were 32 connections drawn by women not drawn by men and 157 connections drawn by men not drawn by women.

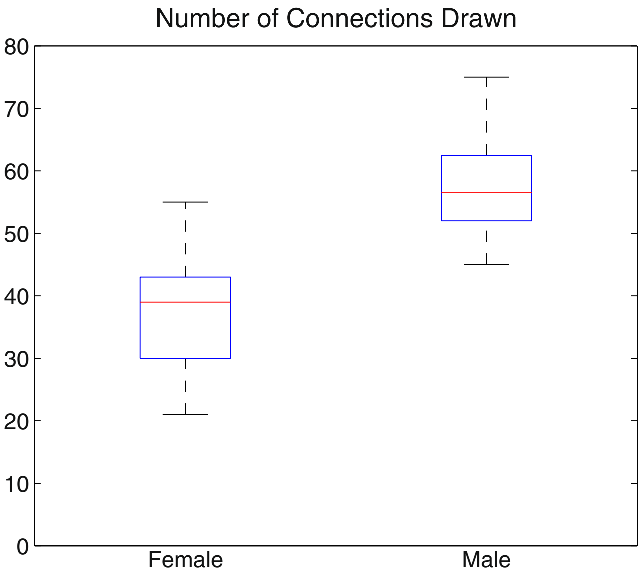

Fig. 3 Boxplot of connections by gender

which species are most important (Table 2). Both men and women viewed humans and roosters as the top two predators, but five of the top ten predators are insects for men, while women view the top predators as predominantly animals. Similarly, both men and women view fish as the main prey, but women have four animals in their top ten, while men only have one. Both groups also shared the connections drawn by the most individuals (%women, %men): cow→grass (100, 89), python→frog (100, 82), and bee→lotus flower (94, 93).

Shared ecological knowledge can also be compared in the consensus food webs of men and women. To construct consensus webs at a given threshold, we summed the adjacency matrices for men and women, and then examined those connections that were drawn by a proportion of individuals greater than or equal to the threshold. Figure 5 shows the 50 % level consensus food webs, meaning at least 50 % of individuals marked that connection. In addition, this shows that women's knowledge of ecological interactions is a subset of that of men. Given the larger number of species, connections and trophic levels given by men in the food web exercise, men understand wet rice ecosystems as more interconnected than women.

Discussion

These findings, combined with labor roles in Balinese agrarian villages, suggest that men place greater focus on insects when constructing food webs as a result of labor experience or what the Marxian tradition has referred to as *praxis*. Although there are clear differences in knowledge that are correlated to gender, these differences are not *because* of gender. Rather, for reasons not likely linked to biology or physiology, men and women have patterned variation in labor experience in wet rice agriculture in Bali. The use of draft animals and ploughs, often associated with the division of labor in agricultural communities (Boserup 1970; Alesina *et al.* 2011), is largely absent in Bali and women do more physically strenuous labor in the field that takes place during planting and harvesting. In this study, the gender division also corresponds to different locations where each gender conducts most of their work (Jha 2004). For this reason, the difference in ecological knowledge could be attributed to the fact that women do not have a familiarity with the rice paddy setting. However, as discussed above, women do work in the fields and thus come into contact with most of the species that male farmers do. Additionally, all species with the exception of the crane are found around the household including algae and fish in small ponds. It is not that women do not come into contact with these species, but that the context in which they interact with species differs from that of men.

Differences in ecological knowledge between men and women could also be the result of isolated networks that share distinct information about the environment. Balinese male farmers could transmit information about ecological interactions to other male farmers while not speaking with their wives or other women in the villages who work in the field about these dynamics. While some information about ecological interaction is undoubtedly shared among men, such information is also shared between men and women. Although

Fig. 4 Proportions of connections going *into* and coming *out of* species by category

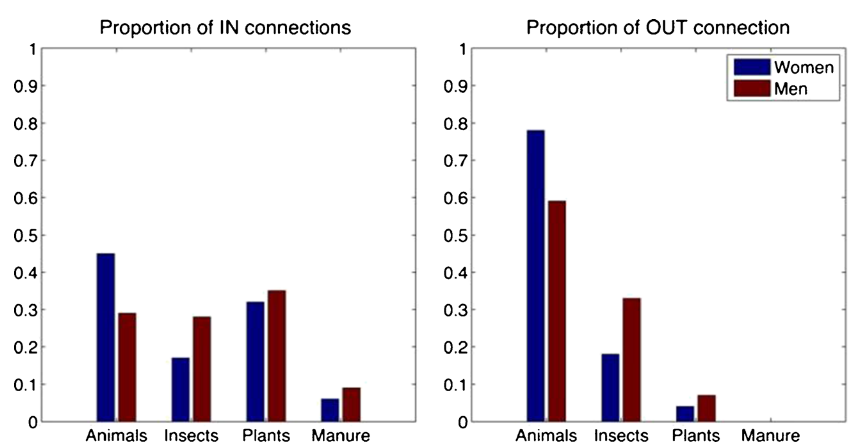

Table 2 Average number of connections (*N*) drawn by individuals

	Females			Males		
Rank	Species	Category	*N*	Species	Category	*N*
Species with most connections going OUT						
1	HUMAN	ANIMAL	6.33	HUMAN	ANIMAL	7.18
2	ROOSTER	ANIMAL	3.56	ROOSTER	ANIMAL	5.64
3	CRANE	ANIMAL	2.61	CENTIPEDE	INSECT	3.39
4	DUCK	ANIMAL	2.39	SPIDER	INSECT	2.82
5	PYTHON	ANIMAL	2.11	DUCK	ANIMAL	2.57
6	DOG	ANIMAL	1.61	ASIAN GRASHOPPER	INSECT	2.54
7	GARDEN SNAKE	ANIMAL	1.28	GRASSHOPPER	INSECT	2.54
8	PIG	ANIMAL	1.28	PYTHON	ANIMAL	2.50
9	BEE	INSECT	1.28	BEE	INSECT	2.32
10	COW	ANIMAL	1.22	CRANE	ANIMAL	2.25
Species with most connections going IN						
1	FISH	ANIMAL	3.89	MANURE	MANURE	5.18
2	MANURE	MANURE	2.22	FISH	ANIMAL	3.68
3	CRAB	ANIMAL	2.11	CORN	PLANT	2.82
4	MOSQUITO	INSECT	2.11	GRASSHOPPER	INSECT	2.79
5	CORN	PLANT	2.06	MOSQUITO	INSECT	2.75
6	FROG	ANIMAL	1.94	GRASS	PLANT	2.64
7	GRASS	PLANT	1.94	ASIAN GRASHOPPER	INSECT	2.54
8	MOUSE	ANIMAL	1.83	IVY	PLANT	2.50
9	IVY	PLANT	1.56	RICE FIELD	PLANT	2.43
10	LOTUS FLOWER	PLANT	1.44	DRAGONFLY	INSECT	2.21

male farmers in each Balinese agricultural village form *subaks*, in which they organize irrigation and harvesting to manage pests (Lansing 1991), evidence of such formal structures does not explain the differences in ecological knowledge as the information and acts associated with *subaks* extend throughout the entire village across gender lines. Additionally, after completing the model building exercises, both male and female informants were asked how they knew about such

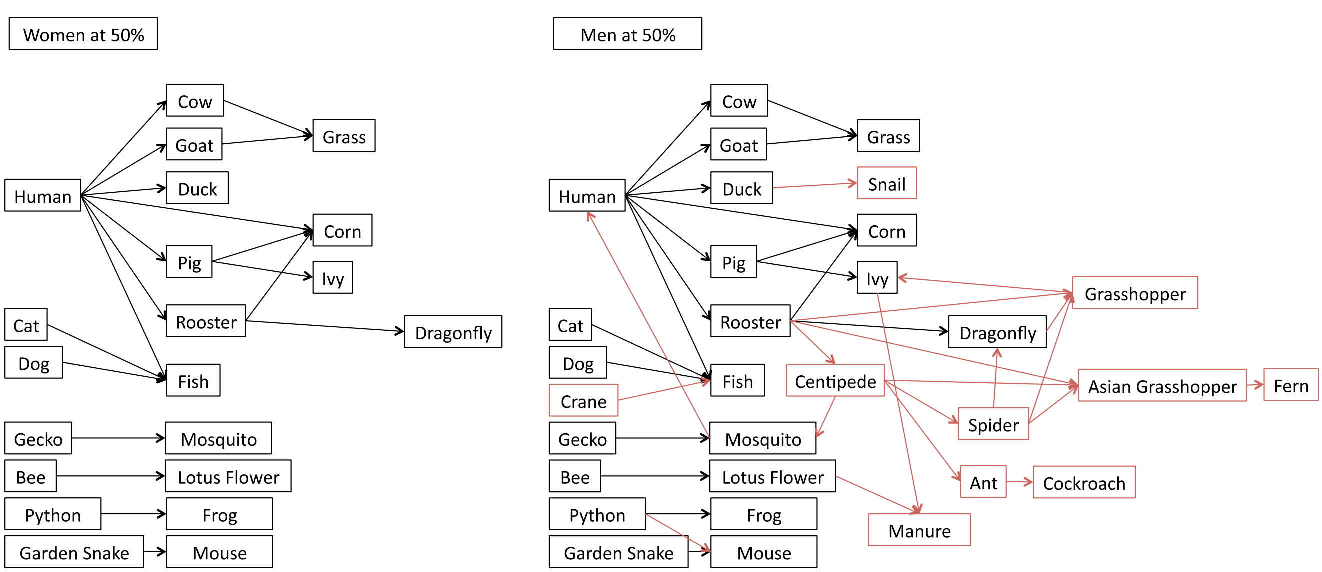

Fig. 5 Consensus food webs at 50 % level for women (*left*) and men (*right*). Species and connections present in the consensus web for men are highlighted in *red*

ecological interactions. They responded that their knowledge was the result of watching such processes unfold while they worked in the field rather than learning this by word of mouth.

Instead of varying social networks, such differences in emic models of ecological interaction likely are the result of different labor experience. In Bali, male agriculturalists manage the rice fields throughout the planting, growing and harvesting seasons. Women, working in groups comprised of family members and village residents, plant and harvest rice (Jha 2004). Unlike the Achuar Indians of Ecuador in whose communities men hunt in the forest and women remain near home to tend gardens from which two forms of knowledge emerge (Descola 1996), Balinese men and women both experience rice fields. Moreover, there are no taboos against women knowing ecological information, the sharing of environmental knowledge within the village, or a bicameral organization of knowledge within Balinese society based on gender. Differences in ecological knowledge between men and women in Balinese agrarian villages is not the result of gender, or other differences stemming from observational experience of the natural world, but rather from differences in the experience of agricultural labor.

Balinese men's agricultural labor involves planning for the growing of rice and managing fields during multiple stages during growing and fallow periods, which require extensive periods of interactive experience within rice fields (Lorenzen and Lorenzen 2011). Women's labor in the field involves the physical manipulation of rice stalks into straight lines at the correct depth in the wet paddy fields. Such work takes place during the planting season and they cut stalks and sift grain in the harvesting season. Although both men and women work in the fields, their labor differs, as women's labor is largely mechanistic. Men's work, though it involves materially manipulating the fields, is largely comprised of knowing about how to alter the rice's growth within an ecological system comprised of plants, animals and insects. The difference between Balinese men and women's labor in the rice field reflects Marx's distinction in *Capital Vol. 1* between the architect and the bee (1978[1886]). The time they spend observing and working in rice fields enhances ecological knowledge for Balinese men. When asked how they knew that spiders ate crickets or that crickets ate green vegetation, Balinese farmers explained that they continually watch such things take place in the fields.

That Balinese farmers know more about ecological interactions at the trophic levels of insects and plants does not necessarily mean that this knowledge is functional and thus adaptive. Though observational experience and interaction with rice increase a subject's knowledge of insect and plant interactions among Balinese, this knowledge may not increase rice yields. Other than birds,[5] rice pests are not actively managed by the individual actions of Balinese farmers. As studies by Stephen Lansing have shown (1991, 2006), pests in Balinese agrarian villages are mostly managed by the traditional association of farmers, or *subaks*, through their coordinated flooding and harvesting of rice fields. Balinese farmers do not employ traps for mice or other pests in fields. Moreover, farmers regularly kill snakes found in the fields and are often hostile towards cats and other animals that prey on rice pests. There are Balinese who rent out large numbers of ducks to farmers to live in the fields in between harvesting and planting rice. The ducks are known to eat insects in the rice paddies but are not managed by rice farmers but rather by duck herders (*perternak bebek*). Perhaps the only ecological interaction to be encouraged by individual farmers is the addition of fish to their rice paddies. Given the limited agency a Balinese farmer has for controlling pests by increasing the number of spiders in his rice field for example, whether knowledge of ecological interactions at the trophic level of insects and plants is functional and thus an adaptation or simply emerges from experience interacting with plants within a rice field remains unknown.

Although there has been a shift from formal lexical knowledge to substantive knowledge, studies of folk models of ecological interactions (Atran *et al.* 2002; Atran and Medin 2008) still organize much of their research according the principles of formal lexical knowledge. They do so by focusing on both differences between cultures and the social mechanisms through which ecological information is transmitted to the exclusion of other formative processes such as experience and labor. This article's study of folk food webs within Balinese villages takes an alternative approach to ethno-biology by focusing on variation within communities, the differences in specific content of a subject's ecological knowledge (which species eat which species) and the non-discursive processes by which such information is acquired. The greater importance placed on insects by men creating models of food webs illustrates the importance of praxis and non-discursive processes for knowledge formation.

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References

Alesina, A., Giuliano, P., and Nunn, N. (2011). Fertility and the Plough. American Econoic Review: Papers & Proceedings 101(3): 499–503.

Atran, S., Medin, D., Ross, N., Lynch, E., Vapnarsky, V., E., Ucan Ek', E., Coley, J., Timura, C., and Baran, M. (2002). Folkecology Cultural

[5] Balinese place bamboo reeds into the ground with attached flags whose movement in the wind sometimes prevents birds from feeding on the rice in the field.

Epidemiology, and the Spirit of the Commons. Current Anthropology 43(3): 421–450.
Atran, S., and Medin, D. (2008). The Native Mind and the Cultural Construction of Nature. MIT Press, Cambridge Mass.
Berlin, B., and Kay, P. (1969). Basic Color Terms: Their Universality and Evolution. The University of California Press, Berkeley.
Berlin, B. (1974). Principles of Tzeltal Plant Classification: An Introduction to the Botanical Ethnography of a Mayan-speaking People of Highland Chiapas. Academic, New York.
Berry, J. W. (1966). Temne and Eskimo Perceptual Skills. International Journal of Psychology 1: 207–229.
Bird-David, N. (1990). The Giving Environment: Another Perspective on the economic system of gatherer-hunters. Current Anthropology 31: 189–96.
Blakeley, T. (1979). Praxis and Labor in Jürgen Habermas. Studies in Soviet Thought. 20(3): 291–294.
Boserup, E. (1970). Woman's Role in Economic Development. George Allen and Unwin, Ltd., London.
Conklin, H. (1975). Hanunoo Agriculture: A report on an Integral System of Shifting Cultivation in the Philippines. Elliots Books, New York.
Ellen, R. (1999). Models of Subsistence and Ethnobiological Knowledge: Between Extraction and Cultivation in Southeast Asia. In Atran, S. (ed.), Folkbiology. MIT Press, Boston.
Ellen, R., Parkes, P., and Bicker, A. (2000). Indigenous Environmental Knowledge and its Transformations; Critical Anthropological Perspectives. The Gordon and Breach Publishing Group, New York.
Descola, P. (1996). In the Society of Nature: A Native Ecology in Amazonia. Cambridge University Press, Cambridge.
Hunn, E. (1982). The Utilitarian Factor in Folk Biological Classification. American Anthropologist 84(4): 830–847.
Jha, N. (2004). Gender and Decision Making in Balinese Agriculture. American Ethnologist. 31(4): 552–572.
Ji, L.-J., Peng, K., and Nisbett, R. (2000). Culture Control, and Perception of Relationships in the Environment. Journal of Personality and Social Psychology 78(5): 943–955.
Kitayama, S., Duffy, S., Kawamura, T., and Larsen, J. (2003). Perceiving an Object and its Context in Different Cultures: A Cultural Look at New Look. Psychological Science 14(3): 201–206.
Lansing, J. S. (1991). Priests and Programmers. Princeton University Press, Princeton, N.J.
Lansing, J. S. (2006). Perfect Order: Recognizing Complexity in Bali. Princeton University Press.
Lévi-Strauss, C. (1966). The Savage Mind. University of Chicago Press, Chicago.
Lévy-Bruhl, L. (1923) [1922]. Primitive Mentality. Translation by Lilian A. Clare. The Macmillan Company, New York, NY.
Lorenzen, R., and Lorenzen, S. (2011). Changing Realities—Perspectives on Balinese Cultivation. Journal of Human Ecology. 39: 29–42.
Marx, K. (1978) [1886]. Capital Volume 1. In Tucker, R. C. (eds.), The Marx-Engels Reader. W.W. Norton & Company, New York.
Miyamoto, Y., Nisbett, R., and Masuda, T. (2006). Culture and the Physical Environment; Holistic Versus Analytic Perceptual Affordances. Psychological Science 17(2): 113–9.
Nisbett, R. E. (2003). The Geography of Thought; How Asians and Westerns Think Differently…and Why. The Free Press: New York, NY.
Rasmussen, D. (1979). Marx: On Labor, Praxis and Instrumental Reason. Studies in Soviet Thought 20(3): 271–289.
Rivers, W.H.R. (1901). "Vision". In Physiology and Psychology, Part I. Reports of the Cambridge Anthropological Expedition to Torres Straits (Vol. II). Cambridge University Press, Cambridge.
Valeri, V. (2000). The Forest of Taboos: Morality, Hunting, and Identity among the Huaulu of the Moluccas. The University of Wisconsin Press, Madison.