Second Phase of Project: Methodology, Expected Findings, and Impact

Time-Line and Methodology.

Preliminary hypotheses about a cultural model of Nature can be refined and/or confirmed by the results of the analyses of cognitive data—this is a major part of the proposed second phase of this research project. The most culturally salient words obtained from the free listing tasks about the components of Nature provide the input for the sorting tasks. The latter are an effective way to elicit overall similarity judgments among a set of items. The sample's aggregate item-by-item similarity matrix (i.e., the AGPROX matrix) is then analyzed using multi-dimensional scaling and cluster analysis. The results of these two analyses supply potential categories as salient constituents of the cultural model sought for. In fact, they suggest relationships between items within a category or between categories. Thus, they contribute to a necessary refinement of the hypothesis arrived at from the analyses of the ethnographic and linguistic data obtained earlier.

A cultural model of Nature obtained by these procedures consists of a list of propositions that need to be validated (D'Andrade, 2005). The propositions form the basis of a fixed-format, 'strongly agree to strongly disagree' questionnaire. Validation of the hypothesized elements of the model is done by univariate analyses of the questionnaire's items. And, because culture is seldom distributed uniformly among individuals in a community (see Atran & Medin, 2008), the degree to which these models are shared is assessed through consensus analysis of the questionnaire data (Weller, 2007). This methodological step is a major part of the proposed second phase of this research project.

Time-Line.

There will be five parts in the proposed project. The first part requires a visit to the field for data collection (minimum of 3 weeks, in summer 2018). The second part includes a period of data analyses (estimated 3 weeks, also in summer 2018). The third part requires a second visit to the field (minimum of 3 weeks, in summer 2019) for data collection. The fourth part includes another data analysis period (estimated 3 weeks). The fifth part is the dissemination of the findings.

The results of the analyses of the semi-structured interviews and the free-listing tasks from the prior phase provided the necessary baseline knowledge to formulate hypotheses about cultural models of Nature. These hypotheses can now be refined using the results of a number of tasks to collect cognitive data. For instance, categorization processes, i.e., use of categories to group contents of domains of knowledge, that participate in the construction of cultural models can be investigated by administering *sorting tasks* using the data obtained by the free listing tasks. The results of these tasks should provide further insights towards an understanding of the content, i.e., categories, of each cultural model of Nature. This data collection and data analysis comprise the first two parts of this new phase of the project.

The third part of the second phase involves conducting a questionnaire survey at each research site. These questionnaires will be based on the propositional content of a given site's cultural model of Nature plus a battery of items that will be included for all the research sites (see draft in

Appendix B). This systematic data collection has a dual purpose. First, for each research site, univariate analyses of the questionnaire items will validate (or fail to do so) each proposition in the researcher's hypothesized model. And, consensus analyses of the site-specific questionnaire items will reveal the extent to which the cultural model of Nature is actually shared among respondents from the community. Second, consensus analyses of the items to be included for all the sites will reveal the extent to which there are similarities or differences in the cultural models of Nature across the communities investigated. We expect some fundamental similarities across sites, but also variation due to specific subsistence modalities, farming vs. fishing, and other socio-cultural factors.

Data Collections and Data Analyses.

The primary goal of this proposal is to sharpen and clarify the content of the cultural models of Nature evinced from the results of our prior research (with analyses mainly of ethnographic and linguistic data). Three types of information are sought: **A**) information about categories that are used in the construction of the cultural models; **B)** information about possible consensus (both local and cross-cultural) about the cultural models; and **C)** information about context/s (e.g., linguistic) in which these cultural models are used.

A) Sorting Tasks. In order to administer the sorting tasks, we select the most salient items in the various free lists, that is, those items most frequent and strictly related to any local component of Nature. The name of these items is transferred on to sets of cards—laminated photos can be used for plants and/or animals (also birds, fish)—and each set is presented to 30 individuals per site (see D'Andrade, 2005:99). Then, they are asked to sort the cards according to overall similarity, i.e., an unconstrained, single pile-sort (see Weller and Romney, 1988; de Munck, 2009). At the end of the task, the content of the piles are recorded and the explanations about the sorting strategy/ies (e.g., naming the groups) used are solicited (and recorded). There will be as many sorting tasks in each site as the number of free lists already administered in the first phase. A careful analysis of the results—we use frequency, multidimensional scaling (MDS) and hierarchical clustering—provides insights into individual and collective categorization processes, that is, categories that are salient. In other words, we detect the underlying semantic dimensions that shape the internal structure of relationships among items in each of the sorting task.

In Tonga, a preliminary administration of a sorting task about plants was carried out using 27 informants. The task yielded a total of 43 categories used (average = 9.67; range 4-14). They were grouped in this way: human use=27; plant features=15; and don't know=1. An MDS/clustering analysis run on the data confirmed these findings by providing four major groups: garden (cultivated plot), fruit/eat, medicine, and sweet smelling. That is, three groups of human uses (garden, fruit/eat, and medicine) and one group of a plant feature (sweet smelling). Any hypothesis about a cultural model of Nature in Tonga needs to take into consideration such a finding. And this is true for any of the other investigation in the communities included in this project once all the results of the sorting tasks will be available. That is, the results of the sorting tasks in each field site clarify the conceptual content of the hypothesized cultural model of Nature. It must be said that these results are comparable across sites at the level of categories used to sort, even though the members of the sets may differ among sites. The sorting tasks are administered during the first field visit.

B) Questionnaire-Survey for Consensus Analysis: Two Goals, One Tool. Following D'Andrade's suggestion (2005:87), we implement a "verification stage" in our research attempting to reach as reliable a description of the cultural models of Nature as it is possible. Once the hypothesized models have been enhanced by the results of the cognitive data, we feel it necessary to ascertain their validity. By validation we mean that we want to find out if members of the community agree with our representation of their cultural model. First, the list of propositions making up the cultural model is almost doubled—at times some propositions do not need to be negated—by introducing propositions that represent the opposite content (counterbalancing the tool, see Gatewood and Cameron, 2009). For example, if the hypothesized model contains the proposition "*Humans are just one kind of animal,"* a proposition is added that states "*Humans are very different from animals."*

Second, interviewees are asked to indicate the extent to which they agree or disagree with each proposition on a five-point scale (strongly agree, agree, no opinion/neutral, disagree, strongly disagree). The propositions are assembled in a few coherent sections. For example, propositions about the relationship between humans and plants/animals, the relationship between humans and physical environment, the role of weather, hard work vs. lack of it affecting output, i.e., crop yield or fishing success, external factors (e.g., technology, types of soil) vs. internal factors (e.g., growing rate) affecting the world make up these sections. The propositions are presented randomly within sections to ensure that each one is addressed in relative isolation, rather than in relation to the preceding one. That is, we attempt to avoid priming. However, the organized sections provide a space for the interviewees to engage in a deeper/longer way with the subject matter represented by each group of propositions. Often, to avoid priming, this cognitive aspect is disregarded. Instead, we consider it as essential in providing an appropriate engagement of one or more than one cultural model and consequently making them more detectable.

The questionnaire is administered to a sample of the population in the communities investigated. We use purposive sampling to include informants of different ages, genders, and other locally-relevant distinctions. The sample sizes will be from 30 to 50 people per community. We also use a second sample (a 'comparison group') of people in each location, where possible, who are not primary food producers. Thus, we give the consensus questionnaire to two groups of folks in each site. We would then be able to tell whether the cultural models of Nature we develop based on our research with primary food producers are the same as or different from those among non-food producing folks in the same locales. That is, we will be able to tell whether the models are specific to food producers in each local culture or they are a 'specific local culture' model.

Third, we use *Anthropac* to analyze the data using the 'informal' model of consensus.[1] If consensus emerges—key indicators of a consensus are: mean first factor loading ≥ 0.50; few

[1] The 'informal' consensus model (see Weller, 1987) is appropriate for scalar responses and uses the Pearson correlation coefficient as the measure of similarity between pairs of respondents. By contrast, the 'formal' consensus model (Romney, Weller & Batchelder, 1986) is appropriate only for nominal-scale responses (dichotomous or multiple-choice) and uses the percentage of agreement between pairs of respondents as the measure of similarity, which is then corrected-for-guessing. In practice the two models produce highly convergent results, as Gatewood (2012) has shown by analyzing data from his credit union studies in multiple ways. Thus, our questionnaire(s) will ask respondents the extent to which they agree or disagree with propositions entailed in the hypothesized cultural models (rather than forcing dichotomous responses), and the analyses will be

negative first factor loadings (< 5% of sample); and the ratio of first to second eigenvalue ≥ 4.0—then we consider the content of our hypothesized cultural model of Nature as shared by the members of the community investigated. In addition, we will explore the extent to which knowledge of the shared cultural model is related to people's motivation to act in accordance with the model. For example, Gatewood and Lowe (2008:58-59) found that how much employees know about credit unions, as reflected in their first factor loadings from consensus analysis, was positively correlated ($R = +.57$, $p = .000$) with how much they care about credit unions and engage in various behaviors, such as recommending credit unions to others.

On the other hand, if the initial analysis's key indicators show only marginal or no consensus, we then look for systematic differences in the ways respondents answered the questions—i.e., look for multiple 'answer keys' that might underlie such intra-cultural variation (see Gatewood & Cameron, 2009:55-78, for ways of doing this). And, if different 'answer keys' are identified—an empirical question, but a common reason for non-consensus—we then analyze sub-samples separately with respect to possible relations between knowledge of their cultural model and motivations/behaviors.

The cross-cultural nature of the project allows us to find answers for questions that have a broader reach and may imply universal categories. For example, do all the communities investigated share a common content of their cultural models of Nature? If they do, then this finding in itself adds considerably to our understanding of local knowledge of primary food producers in communities affected by climate change all over the world. If they do not, then local peculiarities of their models can be highlighted and possibly found related to specific characteristics of the communities such as subsistence practices, social organizations, and belief systems.

We propose to investigate these hypothesized commonalities in the cultural models of Nature by aggregating a number of propositions about items and relations about Nature that researchers in the studied areas have found salient and constructing a broad consensus analysis. In this way we can use consensus analysis to shed light on both local cultural (verification stage) and more extensive cross cultural (discovery stage) data. The informing questions are: Is there a cross-culturally shared, potentially universal cultural model of Nature? Or are there subsets of the local cultural models that are universal? We use consensus analysis to verify and discover the content and relations that constitute local and global cultural models of Nature.

The cultural consensus questionnaire consists of two parts. The first part contains a list of propositions (counterbalanced) about local specific aspects of the cultural model as arrived at by the results of the analyses of the ethnographic, linguistic, and cognitive data collected. This part also addresses causal relations among local/emic components of Nature, thus possibly providing validation of the results of the causality analysis conducted on the linguistic data. This part necessarily varies across communities. The second part contains a list of propositions (also counterbalanced) that all the researchers consider to be possibly shared both within their community and across all the other communities—these propositions were selected after laborious discussion during the workshop held at NIU in May 2017 titled *Methods in Cultural*

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based on the 'informal' consensus model. This approach makes questionnaire construction easier than devising multiple-choice instruments—where there would have to be, say, four culturally plausible answers to choose among for each question.

Model Research. The rationale behind this suggestion is that the first part with local propositions engages the interviewees' knowledge in a more personal way, thus being possibly conducive to a similar engagement when relating to the more abstract propositions in the second part. This latter is divided in sections about: humans; human activities; internal features of nature; animals (fish, birds) and plants; physical environment; physical environment and climate change; weather; supernatural (see Appendix B).

At this stage of the project, the contribution of John Gatewood is significant. While all the researchers in the group are trained in and some have previously used consensus analysis in their research, there is a need to assure consistency in protocol construction and in the interpretation of the results. Then, In addition to the scholars' own knowledge, expertise, and experiences (including publications), Gatewood will be available for consultation to team members during the construction of the questionnaires, the analyses of the data collected, and the interpretation of the results. The consensus analysis can be conducted only during a second field visit after the results of the analyses on the data obtained in the first visit have been used to refine the content of the cultural models. Thus, the research spans a two-year period.

C) Context/s of Use of Cultural Models. An important finding of the project is that many individuals used more than one cultural model while answering questions about various aspects of their daily food production activities. As previously noted, this is to be expected given that cultural models, both robust and flexible, are deployed in response to specific contextual clues and as an intentional response to those clues (see Strauss, 2012). Thus, it becomes imperative to investigate not only which different types of cultural model of Nature individuals entertain, but also which one/s they employ in responding to specific contextual clues. Keeping in mind the cultural models we have constructed, we can now return to the texts of the interviews and find passages that indicate the use of those cultural models (see Strauss and Quinn, 1997; Strauss, 2012). We can, then, substantiate their emic validity. Furthermore, the contextual use of a specific model may highlight the possible reason/s why the preference shifts from one to the other.

Summary of methodology: 1) we use the results of the free listing tasks to administer sorting tasks; 2) we conduct MDS and clustering analyses whose results enrich and revise the hypothesized cultural models; 3) we conduct a consensus analysis with a local/global questionnaire that allows us to likely validate the revised cultural models and possibly find commonalities across the sites; 4) we use the validated cultural models to identify the linguistic and cultural contexts in which they were employed—these contexts may have triggered those uses.

Expected Findings and their Relevance.

We expect to clarify the hypothesized characteristics of a number of cultural models of Nature that typify each community investigated. These cultural models will represent specific organizations of the constitutive categories underlying the concept of Nature, that is, humans, animals, plants, weather, physical environment, and the supernatural (including local variations). In addition, we expect causal relationships to be one of the major forces weaving together these constitutive categories. A revised typology of causal models in cultural models of Nature is

expected. We also expect to obtain insights on how primary food producers in general, i.e., shared characteristics of the model, may typically construct a cultural model of Nature. Cross-cultural similarities and local variations are hypothesized, investigated, and expected via the implementation of a cultural consensus analysis used both as a discovery and a verification procedure.

Intellectual Merit.

A number of cultural models of Nature by primary food producers and the similarity they may share should enrich the already conspicuous literature about cultural models. At the same time, they would foster an appropriate attention to these community cultural models of Nature, that can be investigated only via an interdisciplinary approach, i.e., Cultural Model Theory, and methodologies part of anthropology, linguistics, and (cognitive) psychology (see Bennardo and de Munck, 2014). The common protocol should validate the proposed and here implemented methodology. This latter represents a major innovation insofar as it blends ethnographic, linguistic, and quantitative (e.g., MDS and consensus analysis) approaches. Ethnography and methodology play paramount roles in the project. The comparative aspect of the project is a major contribution to cross-cultural research in its potential universal findings.

Broader Impact.

Climate Change Policies.

Policy makers engaged in solving problems caused by climate change would find this novel aspect of local knowledge useful both in the content highlighted, i.e., cultural models of Nature, and in the methodology that leads to the discovery of this content. Typically held out of one's or a community's awareness, a cultural model of Nature is fundamental to the generation of behaviors that respond to or result from a rapidly changing physical environment. This cross-cultural investigation will obtain insights into such knowledge organizations. Team members and sympathetic colleagues may add these insights to a number of classes that they teach.

The possible finding of shared characteristics within the models elicited makes it conceivable that this core part is shared more widely than just the sites investigated by other similarly structured communities. Thus, the results may become a component of the plan by any individual, NGO, and/or Institution that is interested in local knowledge as a necessary prerequisite to their action intended to ameliorate the conditions of communities stricken by climate change effects. The cultural models elicited—both those shared cross-culturally and those specific to a local content—represent a solid ground from which to plan policy development and implementation about climate and environmental change in many parts of the world.

For instance, policy makers who read our reports on cultural models gain information about how primary producers in general, or in specific locations agree or even vary in terms of how they perceive causal relations between the constitutive components of Nature. If food producers consider themselves to be a part of Nature and that Nature has a transcendental supernatural quality then it would make sense to develop policies that recognize these local ideas rather than to disregard them. Food producers who reify or personify nature are likely to be motivated by

different explanations or narratives regarding climate change than those who view it as a resource. In order to maximize trust and cooperation between policy makers and food producers it makes good sense to understand how farmers perceive Nature. Local knowledge has contributed to successful climate change policies when it was adequately investigated, made explicit, and taken into account by policy makers. Similarly, lack of such a strategy has led many projects towards a path of local resentment and eventually to failure.

The PIs want to underline that a number of young scholars, undergraduate and graduate students are involved in this project. Some are representative of minority groups (e.g., Adem, Zhang, Shimizu), and some are first-generation college (e.g., Mughal, Marchi). Providing additional scientific training, (e.g., consensus analysis), and varied research experiences for this diverse group of young scholars is another important aspect of the research project here described. In addition, a number of members of the communities investigated will be involved in the project either by assisting scholars in the field (e.g., Lithuanian, Zambian, and Ethiopian assistants) or by becoming research assistants at the home institutions of some of the scholars (e.g., a Tongan graduate student at NIU; an Italian research associate at University of Verona, Italy).

This is not the first time that the PI and some CoPIs have provided opportunities for members of the communities they study to pursue higher education goals. The researchers for this project intend to continue along this line. They will make sure that a great benefit is gained by the communities investigated. In fact, when well-trained and experienced professionals come back to their communities of origin, they enhance the chances for those same communities to move in the direction of modernity they choose to take.

Dissemination of Results.

Regarding the dissemination of the research findings, papers about the results of the research will be read in major conferences, local, national, and international. These may include the *American Anthropological Association*, the *Cognitive Science Society*, the *European Association of Social Anthropologists*, the *Association of Social Anthropologists of the UK and Commonwealth*, the *Society for Applied Anthropology*, the *American Association for the Advancement of Science*, and the *Society for Anthropological Sciences* (among others).

Articles, either individually or in a collection as a special issue, will be submitted to major Journals like *American Anthropologist*, *Ethnology*, *Ethos*, *Current Anthropology*, *Journal of Anthropological Research, Journal of Cognition and Culture, Nature Climate Change, Brain and Behavioral Sciences, Journal of Cultural Cognitive Science,* and *TopiCS in Cognitive Science.* A proposal for an edited volume will be submitted to major publishers like Cambridge UP, Oxford UP, Routledge Books, Wiley Blackwell, and the MIT Press. The PI has already initiated discussions with the editors of these journals and presses.

In addition, and most importantly, we will distribute hardcopies of our results to local Agencies, either NGO or State-run, involved in policy making about climate change, most of which have already been contacted and in some cases supported the implementation of the research. At the same time reports will be distributed to members of the communities investigated. We have also started a web page (https://culturalmodels.wixsite.com/cmsofnature) where the reports will be

available, including blogs and contact addresses for free consultations with each researcher in the form of meetings with policy makers, small group and/or community-wide presentations and discussions.

This intense dissemination process will contribute in making accessible to a large audience the findings of the research project. Importantly though, in addition to the official reports that NSF makes available to the United States Congress, policy makers of any nationality will find (e.g., from the content of the web page) in the cultural models of Nature presented a valuable contribution to their continuous process in elaborating remedial interventions in areas affected by climate change. Since cultural models of Nature are a crucial constitutive part of any local knowledge, this newly acquired knowledge should be helpful for the elaboration of policies that will and can now pay keen attention to local knowledge.