

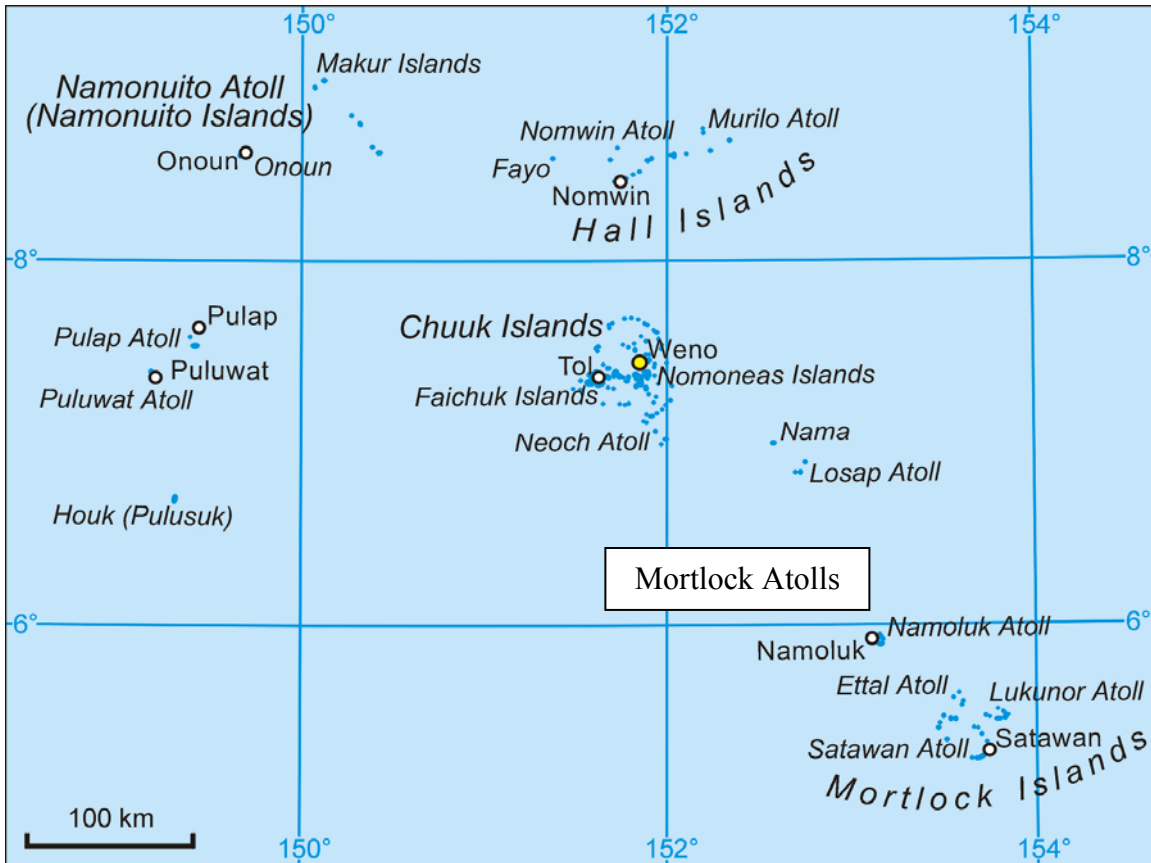
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**“Indigenous Cultural Mathematics
in the Mortlock Atolls, Chuuk State”**

by

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Map of the Mortlock Atolls, Chuuk State.



Chuuk State occupies an area about 600 miles east-west from 148 degrees to 154 degrees East Longitude and about 600 miles north-south from 4 degrees to 10 degrees North Latitude.

The Mortlock Atolls lie in a northwest direction for about 300 miles from 153 degrees to 154 degrees East Longitude, southeast of Chuuk Lagoon, and 300 miles from 4 degrees to 7 degrees North Latitude.

Indigenous Cultural Mathematics in the Mortlock Atolls, Chuuk State

INTRODUCTION

There is very little published information on indigenous cultural mathematics, as practiced by the Mortlockese people in the State of Chuuk, Federated States of Micronesia. Part of the reason is that cultural mathematics in the Mortlocks is not public knowledge. Rather, it is knowledge almost exclusively reserved to and for members of particular clans. To be sure, all clans in the Mortlocks have such knowledge, but variations on this theme exist from clan to clan, and so each clan attempts to maintain a kind of sacrosanct secrecy of what it knows. It is traditionally believed that sharing of such family or clan secrets with non-family member results in a lessening of family or clan wealth and power and increases vulnerability to poverty and famine.

Another reason is, of course, that the study of cultural mathematics, or sometimes called ethnomathematics, in the fields of cultural anthropology and sociology is recent. For instance, there is an association called NASGEm, or North American Study Group on Ethnomathematics, which publishes the Journal of Mathematics and Culture. Its first publication was in May 2006 (NASGEm). In addition, the author was not even aware that PREL itself had only begun its ethnomathematics project more than a decade ago.

Purpose of This Paper

The purpose of this paper is to describe common cultural practices of indigenous cultural mathematics among Mortlockese people. Such practices are indeed common, or commonplace, among the people themselves, and so this paper does not pretend to be a revelation of deep secrets. It is merely a simplistic description of what certain key members of a Mortlockese clan might know about the use of mathematics in daily practice.

They would undoubtedly not even consider this description as special. It may indeed be special and helpful to field researchers in cultural anthropology who might find knowledge contained herein to be awesome – to say the least. So, let us begin this paper by seeing how indigenous cultural mathematics works in the Mortlocks.

BUILDING A THATCHED-ROOF HOUSE

Here is a sample of how Mortlockese people use mathematics in their daily lives – by building a thatched-roof house. Before the actual work of building a thatched-roof house starts, the landowner will seek out a local expert builder, known in the Mortlocks as *sou-auchamw*, and give him a *cheenipou*, some kind of pre-payment to make the *sou-auchamw* happy and willing to provide services. Their discussion includes the general specifications of the house, such as its length, and the *sou-auchamw* explains appropriate Auchamw units of a house with that length. The *sou-auchamw* further details certain kinds of cultural mathematics to be used in constructing the house:

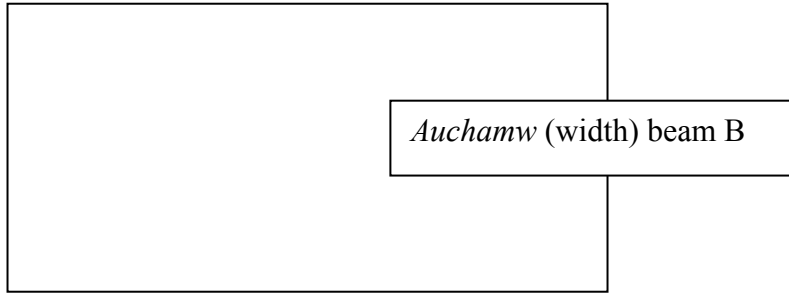
- a. Five *engaf*, stretching arm's lengths of cord from middle-finger tip (left hand) to middle-finger tip (right hand) are measured. The cord will then be folded eight times, by combining both ends of the cord, then, he held both ends with his right stretching arm while his left arm held up and pulled the opposite bottom of the folded loop, straight for a second fold, and did the third and the last fold, by combining the bottom of the folded loop to those ends, again. He counted the number of string pieces within the whole folded pile as 8th pieces. He then used *tileupw*, a different scale of an arm-length, from finger tip to the sternum plate. He took the whole folded pile and held the ends parts with fingers of a stretching arm and straightening them with a little pulling to lengthen the whole folded pile inward, toward his sternum plate. This measurement

is known as *onoupwuu kisikiis*. A space range unit, in English will be from 12 to 15 *ngaf* out of the given length 24 *sinou* (length).

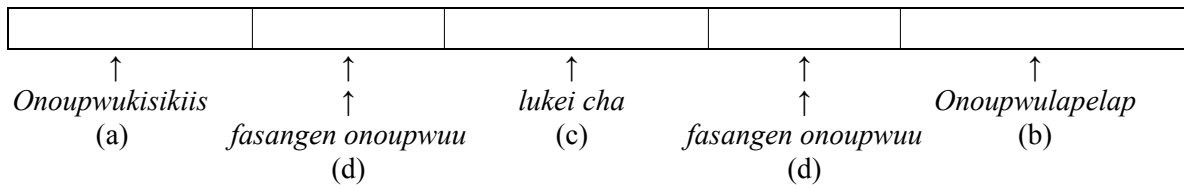
- b. Three full arm's lengths of the same cord from finger tip to finger tip is taken and folded four times. He went through the same process, as he did the 5 *ngaf*. He again, used *tileupw*, a different scale of stretched arm's length, from finger tip to the sternum plate. This is called *onoupwuu lapelap*. In English will be a space range unit from 16 to 18 *ngaf*, out of the 24 *ngaf* in *sinou* (length).
- c. A middle length, however, is not usually recommended for a family home. It is known as *lukeicha* (from 11 to 13 *ngaf*), similar to a curse that often leads to abandonment of the house-building or to trouble during the family's occupation of the house.
- d. From the middle length to an arm's length – from finger tip to sternum plate on both sides from the actual middle mark – there is often a favorable width of the house, and that is known locally as *fasangen onoupwuu*. The lower in English will be 9, 10, and 11 and the upper will be from 13 to 15 *ngaf*.

After the local expert builder has shown the owner his recommended width (*auchamw*), then the owner can have his carpenter and the *sou-auchamw* start working on the house-building project, along with obligatory house-building rites. In effect, the *sou-auchamw* has identified four units of length: *onoupwuu kisikiis* (the smallest length limit), *onoupwuu lapelap* (the longest length limit), *lukei cha* (the unwanted middle unit), and *fasangen onoupwuu* (the favorable middle unit). Now, to illustrate these measurements, the following diagram is presented:

Sinou (length) beam A



Here is another diagram, not drawn to scale, only to show all four units of length:



- a. *Onoupwuu Lapelap* = $\frac{3}{4}$ of any preferred length (3 arm's lengths of cord or string from finger tip to finger tip, 3 *engaf* units, that are folded 4 times using *tileupw* units). This simply implies that OL = $\frac{3}{4}$ (given length). It can only be used for a house of a *samol* (chief).
- b. *Onoupwuu Kisikiis* = $\frac{5}{8}$ of the same preferred length as in A above (5 arm's lengths of string from finger tip to finger tip, 5 *engaf* units, that are folded 8 times using *tielupw* units). *Sou Auchamw* measured, by holding both ends together, then take the bottom folded loop and do another fold by combining the held ends with the bottom fold, and repeat the same process once again, then held the whole folded pile, with an arm stretched and lengthened the whole folded pile toward his sternum plate. He accounted to read as how many times, he did this and how much of the remaining parts. The numbers of string pieces in the whole folded pile indicated how many times the cord was been folded. He put away the 5 *engaf* (arm stretched length) piece, to do the same

thing with the 3 arms strengths lengths, in the same process and same way of reading.

If however, most readings are favorable, then the actual length for the *auchamw* would be between 15 to 16 *ngaf*. This simply implies that $OK = 5/8$ (given length). This is also called *iofas*. Usually it is used for a loner or a stingy person.

- c. *Lukei Cha* = $\frac{1}{2}$ from end to end of the string, with which A and B were measured, and will take one arm's length from the mid-length, that is *engaf* to be folded twice. This could also mean that $LC = (OL + OK)/2$. It is usually used for fish traps, animals, and cookhouses, since the word *cha* implies killing or drawing blood.
- d. *Fasangen Onoupwuu* = the remaining space unit between A and C and between B and C, accounted from the *lukei cha*. As for the FO, this implies a continuous finding of two middle-range spaces that could be $FO = (LC)/2$. This is also called *iochaow*, which means to gather lots of people and, in the Mortlockese culture, to bring forth blessings for the whole household.

Let us give an arbitrary figure to map out the above space range, say 24, just to demonstrate a concrete example. The following example was provided by the *Sou-Auchamw* Istaro Aritos, 64 years old, a retired teacher from Satowan and Ta Islands in the Mortlocks:

- (1) $OL = \frac{3}{4}$ of 24 = 18: the highest mark that could be used
- (2) $OK = \frac{5}{8}$ of 24 = 15: the lowest mark possible
- (3) $LC = (18 + 15)/2 = 16.5$: the middle range unit possible
- (4) $FO = (15 + 16.5)/2$ and $(16.5 + 18)/2$: the smallest range unit possible.

(5) The selection of what right *Auchamw* is to be used is a match folding between the $\frac{5}{8}$ and the $\frac{3}{4}$. The chart below will show the folding process as it might be, before a decision is made.

| $\frac{5}{8}$ <i>Onoupwu kisikiis</i> | No.folds | No string in folds | Remaining pieces | $\frac{3}{4}$ <i>Onoupwu lapelap</i> | No.folds | No.string in folds | Remaining pieces |
|--|----------|--------------------|---------------------------|---|----------|--------------------|-----------------------------|
| <i>5 ngaf</i> | 0 | 1 | 0 | <i>3 ngaf</i> | 0 | 1 | 0 |
| $\frac{1}{2}$ | 1 | 2 | <i>2 ngaf + 1 tileupw</i> | $\frac{1}{2}$ | 1 | 2 | <i>1 ngaf + 1 tileupw</i> |
| $\frac{1}{4}$ | 2 | 4 | <i>1 ngaf + 1 emwalu</i> | $\frac{1}{4}$ | 2 | 4 | <i>1 tileupw + 1 emwalu</i> |
| $\frac{1}{8}$ | 3 | 8 | <i>1 tileupw + 1 eang</i> | <i>Tileupw</i> is not an accepted reading, but <i>emwalu</i> and <i>eang</i> are better, if this continue on, <i>afiti</i> will be next and is also a better range for <i>Auchamw</i> . | | | |
| <p>This is a reading for only the width length for the <i>Auchamw</i> not the <i>Sinou</i>, which is the length of the whole house building. Folding is first, joining both ends together, that's correlates with <i>lukei cha</i>, then, join the bottom of folded pile to the held ends, which is correlates to <i>Onoupwu lapelap</i>, and another fold of the whole , is correlates to <i>onoupwu kisikiis</i>. Reading on the other hand, is based on the following remaining pieces: <i>opei</i>, <i>eang</i>, <i>afiti</i>, and <i>emwalu</i>, by measuring them from finger tip of one arm to wherever its ends on the same arm. They are the accepted remaining pieces that ensure the mark for the <i>onoupwu lapelap Auchamw</i>. This of course will make a difference with variations of human's heights.</p> | | | | | | | |

Judging and making decision for the right *auchamw* is based on the remaining pieces of string that cannot make a whole fold. The accepted remaining pieces are *tileupw* (from finger tip to sternum plate) and *opei* (from finger tip to center palm of a hand). The folding

process is, as follows: straightening of the string that represents the preferred length, #1 piece of string, joining both ends of the string, #2 string pieces inside, joining both ends, #4 string pieces inside, joining both ends together again, #8 pieces of string inside, then using *engaf*, a full arm's stretch unit to find what would the remain piece be. By doing all these computations, it completes the whole finding process of the accepted area units that a width of a home can use.

This is not the only measurement used by the *sou-auchamw*. A *sou-auchamw* from another clan or island may have his own measurement tools that are workable and different from those of Mr. Istaro. So, let us see other kinds of measurements from Néma Island and Namoluk Island. In particular, *Sou-Auchamw* Fichino Boone said, “You only need to know the length, then everything will be easily configured.” He uses only three kinds of *auchamw* widths. He described his own system, as follows:

Onoupwuu lapelap, which is a width for a *samol* (chief), or someone whose house is occupied by many persons, is, as follow, taking 24 as a sample of a preferred length:

- 24 = given length of a *sinou* (length of the tie-beam)
- 12 = his *lukei cha* (the unwanted unit).
- 6 = *fasangen onoupwuu* which he interprets as a branching out of *lukei cha*: the literal meaning of *fasangen* is branches.
- 18 = *onoupwuu lapelap*, the width for a *samol*, which is simply 6+12. *Sou Achamw* Mr. Boone uses the same method and deals with the exact marks instead of space range units. He folds the string in a same way, as indicated by his numerating numbers. However, to configure *onoupwuu lapelap*, he needs to halve the *lukei cha* length, and take the reading mark and added to *lukei cha* to have his *onopwu lapelap*.

Sometimes, it so happens that two sisters live together with their husbands and children. They use this *auchamw* to accommodate all of them especially if the parents join them in their shared household under one roof.

Kauten Rhaym (51-year-old *sou-auchamw* from Moch Island) has a similar kind of *auchamw* configuration, but he uses different names and numbers for the width measurements. Let us compare Rhaym's words, using the same 24:

- 24 = given a preferred *sinou* length beam
- 18 = *iochow* (for only the chief) and a blessing for a local cliché, “*Aramas chok angang, angang chok aramas*”, which means that people are defined by their work and work is made possible by people.
- 12 = *Makki chow* which means to welcome people at first, and then to chase them away. Another way to define *makki chow* is to invite them into your home but to get rid of them soon enough. If the home has a plentiful supply of food, visitors may stay long. However, when food supplies are small, visitors are going to stay for only a short while.
- 6 = *iofas* comes from the word *fas*, to nest like a nesting hen, and refers to an initial stage of family occupation that is fraught with penury. Later, in good times, its population increases, and the changing family circumstances may be upgraded to *makki chow* and *onoupwuu lapelap*.

ETYMOLOGY AND. HISTORY

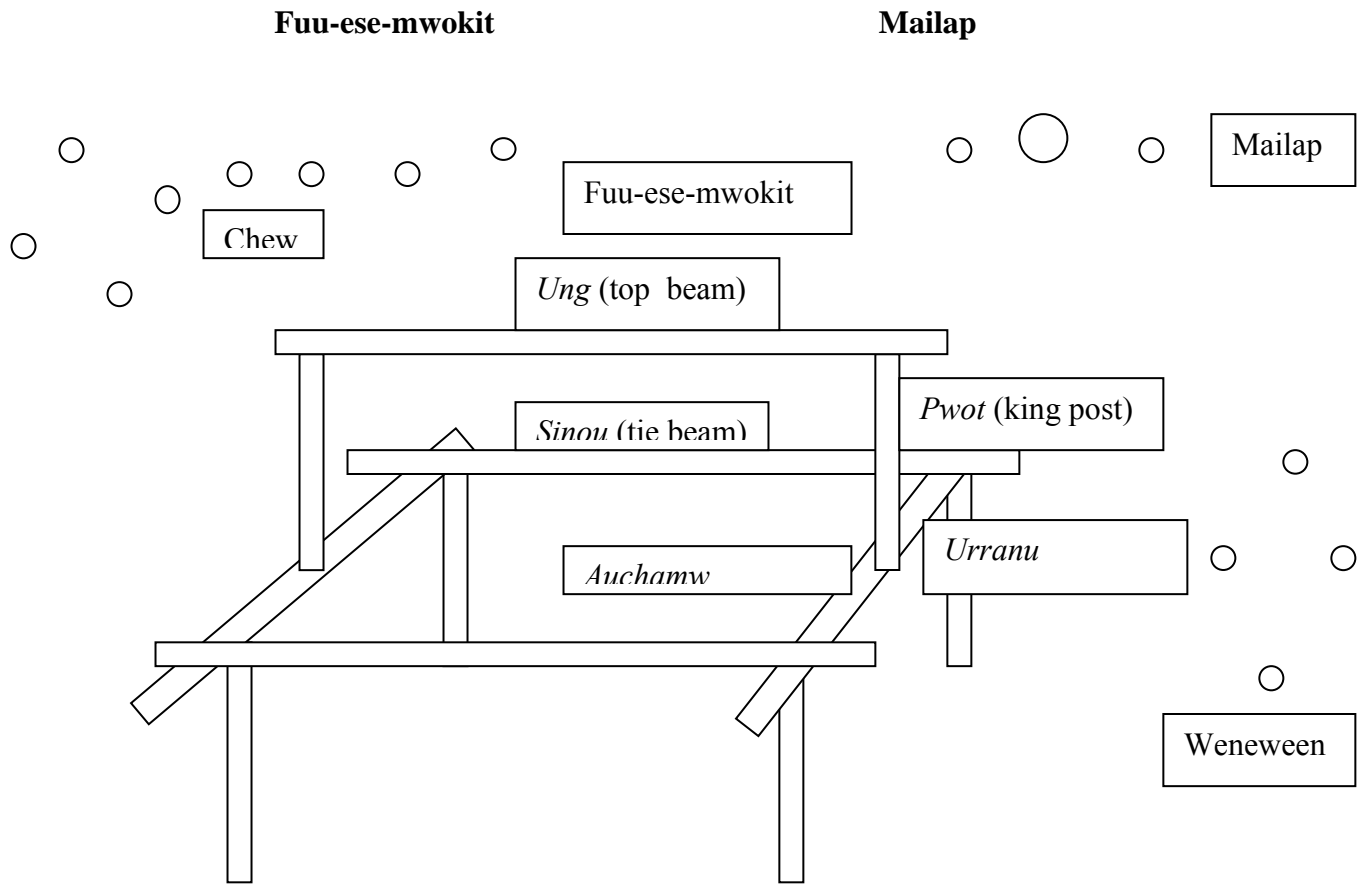
The *sou-auchamw* believes in animism – that every creation including the celestial body has a spiritual soul.. Some configurations used in expressing *sou-auchamw*'s thought are astral. It is a belief that the whole earth, including situational activities, is controlled by celestial bodies like the stars.

- For instance, the star *Mailap* (Altair) is the soul of the *samol* (chief) which divides the earth into two spheres – *Efóng* (northern sphere) and *Eor* (southern sphere). He is constantly stretching out his arms to hold *Chew* (Big Dipper) in his right hand and *Weneween* (the upper-right star in the Southern Cross) in his left hand. From *Chew* and *Weneween* the two spheres are further divided in half: *Weotiw* (east) and *Lotou* (west). The four parts of the celestial sphere are tied together by *Fuu-ese-mwokit* (Polaris, which means the “star-doesn’t-move” and is the handle of *Chew*) to ensure safety of human beings.
- Also, the mythological Péluelap (the Great Navigator) had two sons Rongochik and Rongolap and a daughter Inofas. The father bestowed upon his children great knowledge and skills. All four were not just mythical or legendary characters but also models of human activities, such as house-building.

The *sou-auchamw*’s mathematical knowledge of house-building is derived from his knowledge of these characters. For instance, *Sou-auchamw* Istaro’s 5/8 is an indicator that all the major parts of a thatched-roof home should point toward all wings of time, given as direction for all human beings. Below are charted the five major parts of a house and the sliced parts of the spheres:

| | | | |
|-----|--|--|----------------|
| (1) | <i>Efóng</i> | (north) | <i>Ung</i> |
| (2) | <i>Eor</i> | (south) | <i>Pwot</i> |
| (3) | <i>Weotiw</i> | (east) | <i>Sinou</i> |
| (4) | <i>Lotou</i> | (west) | <i>Auchamw</i> |
| (5) | <i>Weotiw Afféng</i> <i>Weotiw Eor</i> <i>Lotou Afféng</i> <i>Lotou Eor</i> | (northwest) (southwest) (northeast) (southeast) | <i>Ur</i> |

Most of the *sou-auchamw* from the Mortlocks, except Moch Island, builds homes facing Mailap. The Moch *sou-auchamw*, especially from the Sor clan, builds homes facing *Weneween* because he believes that Moch Island is like a man who turns his back on people and faces away from them as he talks. Also, Moch experiences big surfs that come from the direction of *Weneween*. The $\frac{3}{4}$ figure, in Istaro's Auchamw on the other hand, is a blessing from all four spliced spheres to be given to Mother, Father, and their Children – under the watchful care of Mailap. In effect, Mailap always watches over the four corners of the house by standing at *Urranu* (the main post of the house that is to be oriented under Mailap and always on the right front side). Below are listed the five major building parts toward Mailap.



Measurement Units for Building the House

- a. *Ur* (post): *Ofar* (from the ground your stepping on, to on your shoulder), *Onimong* (from the ground your stepping on to on your head), and *Attapeta* (from the ground your stepping on to an over reach above your head) also known as *Uresu* (a cultural belief that a building uses that *attapeta*, it implies constant out for traveling).
- b. *Auchamw* and the house material: *Engaf* (Double arm-stretched), *Tileupw* (single arm-Length).

The *sou-auchamw* will foresee that the *uranu* (the key post of blessing for the home) should face Mailap. He follows procedural steps with obligatory cultural rites to honor and respect the spiritual beings of *uranu* as well as Mailap and other stars, such as Weneween in the case of Moch Island. The notion that stars are care-takers of humanity support how the *sou-auchamw* designs and develops the structure of a house. As Mailap stretches his arms, it forms the *ung* (the main top ridge) of the constructed home, while Weneween and Chew embrace each other, constructing the body of the home. Their heads are the *pwot* (king post), and their spreading legs are the *ur*, posts for the whole home structure.

Below are the procedural steps of building a house with the appropriate cultural rites for each step.

- a. Procedural Step: *Maleras* (clearing of the site, filling in puddles, leveling of the area, and erecting of the posts, such as *uranu*) takes place, and the *sou-auchamw* will give special measurements for the posts, as follows:
 1. *Onafar* (on the shoulder): *Onafar* is usually used for the *onoupwuu auchamw* with an *apinikot* or *faan apwuk* (over-hang) for the tied poles to be lengthened down at the belly button height. That is the actual meaning of *onoupwuu* at the navel.

2. *Wonumong* (over the head)

3. *Attapeta* (reaching over).

Cultural Rite: *Apokufich* (relatives from both parties of the husband and the wife) will bring coconut fruits in abundance.

- b. Procedural Step: *Kachimweta* takes place. After all the five major parts are erected, it is essential to start tying the roofing sheets. All persons doing this task must use the “opou” unit – that is, from the middle finger tip to the center palm to prevent leakage.

Cultural Rite: *Kachimweta* is like *apokufich* inasmuch as the relatives continue to bring coconut fruits and little food to eat.

- c. Procedural Step: *Afinu* (dedication of completion of the house-building project) will take place. The *sou-auchamw* will receive compensation for his work, to be given by the landowner, his family, and his relatives.

Cultural Rite: An open invitation exists for anyone who wants to attend the dedication ceremony. The *sou-auchamw* will judge how the blessing of the house is by the number of people in attendance. He will also be watchful of other *sou-auchamw* present who through performance of evil might interfere in the dedication.

Indeed, some *sou-auchamw* may be bad. They will try to compete with those good ones because of the social recognition and abundance of gifts given usually during the *afinu* dedication. They will use necromancy, or black magic power that can kill not only the *sou-auchamw* but also everyone else at the dedication ceremony, as well as all of the new household members. In the event that a bad *sou-auchamw* is seen anywhere near the new home site, a good *sou-auchamw* who built the house will give special medicine to counteract and nullify such spell and to vitiate interest for the neophyte *sou-auchamw*.

Nowadays, whenever a home will be built, a fence is required as part of the **apokufich** to be completed first before any further work actually starts. This happens not only in the Mortlocks but also throughout Chuuk.

COMMUNITY VIEWS OF THE KNOWN *SOU-AUCHAMW*

The *Sou-auchamw*, in house-building, as well as the *Sellap*, in canoe-building and the *Pélu*, in navigation, is regarded highly and considered by the community as virtuoso in his personal profession. The community also refers to all three as healers of personal illnesses. Their knowledge and skills are extensive and sacrosanct. They have charisma and are well respected by not only the home community but also wherever they go.

Nowadays, the number of *sou-auchamw* decreases every year, and their amazing knowledge and skills will become defunct. What they know about ethnomathematics, as did the legendary Rochochik, will no longer be viable; it too will pass into legend and inevitably disappear. It would be hoped, therefore, that the heirs of the *sou-auchamw* will have interest and willingness to inherit and apply the *sou-auchamw*'s knowledge and skills.

In Chuukese culture, although he should select whoever among his heirs is willing to learn, he does not have to do so. The *sou-auchamw* has two culture-based options. They are *chenillam* (an in-return token gift for unforgotten kindness) and *rongen kaulipou* (a gift for an heir for being there for the father always). The *sou-auchamw* can bestow the inheritance of house-building knowledge and skills as a gift to whoever fulfills *chenillam* or *rongen kaulipou* best – relative or not. The decision by the *sou-auchamw* is a reminder in the community that a father's arm is like a pillow, not only as a place for a son or nephew or someone else to rest and receive comfort from a father but also a place for someone to wait and be called upon by the father to do his bidding (Reuney). In effect, the

sou-auchamw will designate a person who personifies the qualities of a Rongochik – attentive, respectful, and obedient to a father.

TODAY’S YOUTH GENERATION

It is quite apparent that the *sou-auchamw* and his house-building knowledge and skills represent customary tradition in the Mortlocks. It is equally apparent that few people in today’s youth generation are aware of such cultural factors as *chenillam* and *rongen kaulipou*. Present-day youth look with eager eyes at western ways and prefer to eat rice and corned beef, rather than breadfruit, taro, banana, and fish. They wear western fashion and think through their boom boxes. Many, in fact, have already migrated to Guam, Hawaii, and the U.S. mainland, with little hope and wish to return to Chuuk in order to live in traditional culture. Self-aggrandizement may be replacing social duties and obligations. What chance, therefore, might *chenillam* or *rongen kaulipou* have against the enticement of better education, better jobs, and better health care outside of Chuuk?

To be sure, others of today’s youth generation do remain in Chuuk. However, they lack motivation or interest in learning traditional culture and finding well-being therein. Rather, they fish to sell. They farm to sell. Their primary option is to receive monetary compensation for what they do, rather than to sacrifice themselves in service to others, such as a *sou-auchamw*. They simply cannot subsist in tradition and wait for any length of time and hope for an inheritance of house-building skills. Besides, most of today’s youth do not possess the heart and mind of Rongochik. That is old-fashioned, they would say. They are boorish toward our cultural knowledge and skills, the author would say.

SUMMARY:

The life of the *sou-auchamw* is not just a tale of cultural mathematics; it is a lifestyle beyond calculation and computation. To be sure, the research required to write this paper includes specific knowledge and skills involving numbers, and then more. It may be true that much time has been spent in discussing situations and circumstances that go beyond a blueprint for constructing a traditional house. All the same, it is even more so true that much time is necessary in order for us to explore the underpinnings of house-building beliefs and practices.

That is essentially the same for understanding the art and science of feng shui, a kind of art and science of time and space from China, much of which applies to house-positioning. People may wish to scoff at and mock the practice of feng shui, and people may wish to do the same with traditional house-building in the Mortlocks. That is their privilege.

The art and science of the *sou-auchamw* exists. Its justification to exist may be, in part, its practice of ethnomathematics, but there is so much more to house-building than the knowledge and skills of cultural mathematics. So, to put it more analogously, the *sou-auchamw* is just one filament or strand in the weaving of a pandanus mat, but its contribution to the finished product, like other contributions, make us appreciate our own culture. If we choose to dismiss how this contribution works, we live a lesser life through ignorance of what was in order to believe that we are enlightened by what is.

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paper about it. That is the give. The take is what the author gains by his participation in MACIMISE. It is attitude-building; it is humility-creating; it is self-empowering.

WORKS CITED

Alkire, William H. (1944). “System of Measurement on Woleai Atoll, Caroline Islands”.

Aritos, Istaro (Sou-Auchamw) (2010). Personal communication.

Asher, Marcia. “A multicultural View of Mathematical Ideas”. Page 5

Boone, Fichino (2010). Personal communication.

Nelson-Barber, Sharon. “Exploring Pacific Knowledge and Classroom Learning”.Page 3

North American Study Group on Ethnomathematics.

<<http://nasgem.rpi.edu/index.php?siteid=37&pageid=485>>

Reuney, Kokuu (2010). Personal communication.

[NOTE: Mr. Reuney, 51 years old, is a classroom teacher.]

Rhaym, Kauten (2010). Personal communication.

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Pacific Resources for Education and Learning