

**The Numeral System and Measurement System**

**of**

**Chuuk**

**A**

**Term Paper**

**submitted to:**

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**and**

**Project: MACIMISE**

**by**

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## **Introduction**

In any culture, the counting system as well as the measurement system is most often the first cultural activity that is passed from generation to generation. “Counting numbers are often the first association we make with mathematics” (Ascher 1998, p. 5). The first mathematics lesson that children receive from their parents is counting and measurements. For this reason, counting and measurement maybe the most intact cultural activity passed from generation to generation. It becomes common knowledge not only to the older folks of the community but to the youth as well. The school system contributes to the preservation of this part of the culture by including the basic counting system in the Chuuk State Curriculum Framework.

This paper aims to present a very basic and general description of the counting system and the measurement system employed by the people of the state of Chuuk, Federated States of Micronesia, and attempts to provide examples of its application to different cultural activities.

Chuuk was discovered in 1565 by Arellano (Krämer 1932, p. 40) but M. T. Dumont d'Urville was the principal opener of Truk; he arrived on December 22, 1838 (Krämer 1932, p. 53). In spite of that voyage little was known about Truk until 1927 when “the work of the Capuchin Father Laurentius Bollig appeared” (Krämer 1932, p. 53). Augustin Krämer himself was in Truk from 1906 to 1907 and explored Truk exhaustively (Krämer 1932, p. 53).

Krämer's exhaustive work in exploring Truk provides a lot of evidence that a numeral system and measurement system in Chuuk existed before European contact. Numeral classifiers were also described within the language as early as the time when Bollig and Krämer explored Chuuk. Krämer claimed that Bollig listed the number system in Bollig's book *Palau*, II, on page 331, while Krämer himself wrote the numbers and

classifiers he heard from the people of Truk during his exploration (1932, pp. 98-99). Early uses of the numeral classifiers are also listed in Krämer's book. He also listed the measurement system used (page 340).

Interestingly, most of the numeral names and numeral classifiers listed in Krämer's book are still used in the present times with variations in spelling and pronunciation. The result of the interview we had with selected people in Chuuk at the present times yielded information consistent with the list provided by Krämer and Bollig in their books.

It is important to mention that differences in spelling and pronunciation of the basic counting system and measurement system depend on whether one is from the Lagoon, Northwest, or Mortlocks region. Other regions in Chuuk resemble the variations found in one of these three regions. The words and spelling used in this paper depends on where the source of the information is from. This paper makes no attempt to use only one region to present the counting system or the measurement system of Chuuk.

## **I. Chuukese Counting System**

"The capacity to count is a human universal related to human language" (Ascher 1998, p. 6). It is safe to assume that each culture has their own numeral system. Although each culture may find different uses for their numeral system, they have created the system for their specific needs. This use, whatever it is, is one underlying factor for that culture to maintain the system. It is evident that the numeral system of Chuuk is still used because a lot of young people still know the numerals. The system herein presented is the result of interviews with Chuukese old and young alike. It is interesting to note that the Chuukese numeral system as presented by Krämer is very consistent with the information from my interviews, with variations in the spelling and pronunciation.

## A. Basic Numeral System

The numeral system of Chuuk is very fascinating. The system starts like the English standard counting system where terms are used to indicate numbers: “one” *ew*, “two” *ru*, “three” *enungat*, “four” *ruanu*, “five” *nimou*, “six” *onou*, “seven” *fisu*, “eight” *wanu*, “nine” *tiwou*, “ten” *engon*.

Then the counting system proceeds with terms for values of tens where new words are introduced: “twenty” *rue*, “thirty” *erik*, “forty” *faik*, “fifty” *nime*, “sixty” *one*, “seventy” *fiik*, “eighty” *wanik*, “ninety” *tiwe*.

In the hundreds value, the term “-puku” is used to indicate a hundred. “The hundreds value is formed by using either the ones value or tens value as a prefix to the term ‘hundred’ with some variations to the terms used for some of the tens and ones value” (Aserina Kanto: Interview). Table 1 shows how the hundred numerals are formed using the numerals for ones and tens.

**Table 1: Chuuk Counting System in Ones, Tens, Hundreds**

Ones	Chuukese	Tens	Chuukese	Hundreds	Chuukese
1	<i>ew</i>	10	<i>engon</i>	100	<i>epuku</i>
2	<i>ru</i>	20	<i>rue</i>	200	<i>rupuku</i>
3	<i>enungat</i>	30	<i>enik</i>	300	<i>unupuku</i>
4	<i>ruanu</i>	40	<i>faik</i>	400	<i>fepuku</i>
5	<i>nimou</i>	50	<i>nime</i>	500	<i>nimepuku</i>
6	<i>onuo</i>	60	<i>one</i>	600	<i>onepuku</i>
7	<i>fisu</i>	70	<i>fiik</i>	700	<i>fupuku</i>
8	<i>wanu</i>	80	<i>wanik</i>	800	<i>wanupuku</i>
9	<i>tiwou</i>	90	<i>tiwe</i>	900	<i>tiwepuku</i>

The word for one hundred is “*epuku*”, which combines *e-* meaning ‘one’ and *-puku* meaning ‘hundred’. *Rupuku* is ‘two hundred’, which combines *ru-* ‘two’ and *puku* ‘hundred’. Some variations in the words used can be seen with ‘three hundred’ where the counter prefix *unu-* for ‘three’ is used and ‘four hundred’ where the prefix *fe-* is used to indicate ‘four’ thus ‘four hundred’ is *fepuku*. It should be observed that all the hundreds use a combination of the ones numeral combined with *-puku*, the word for ‘hundred’. ‘Five hundred’, ‘six hundred’, and ‘nine hundred’ seem to combine the tens numerals with *-puku*. “The word for ‘five hundred’ which is *nimepuku* is not a combination of the word *nime* for ‘fifty’ and *-puku* for ‘hundred’. It is a combination of the word *nim* from the ‘five’ which is *nimou* and *epuku* for ‘one hundred’ (Joshua Emwalu: Interview)

For the thousands value, the word *ngeruo* is used for ‘thousand’. The thousands value is formed almost the same way that the hundreds value are formed but strictly “using all the ones value as prefix to the thousand word *ngerou*” (Aserina Kanto: Interview). It combines the ones value as a prefix with the thousands word *ngerou* as indicated in Table 2.

**Table 2 : Chuuk Counting System in Ones and Thousands**

Ones	Chuukese	Thousands	Chuukese
1	<i>ew</i>	1000	<i>engerou</i>
2	<i>ru</i>	2000	<i>ruangerou</i>
3	<i>enungat</i>	3000	<i>wunungerou</i>
4	<i>ruanu</i>	4000	<i>ruanungerou</i>
5	<i>nimou</i>	5000	<i>nimengerou</i>
6	<i>onuo</i>	6000	<i>onuongerou</i>
7	<i>fisu</i>	7000	<i>fuungerou</i>
8	<i>wanu</i>	8000	<i>wanungerou</i>
9	<i>tiwou</i>	9000	<i>tiwoungerou</i>

The terms used for the ten thousands value combines the tens value terms as a prefix with the thousand term *ngerou* as shown in Table 3.

**Table 3 : Chuuk Counting System in Tens and Ten Thousands**

Tens	Chuukese	Ten Thousands	Chuukese
10	<i>engon</i>	10,000	<i>engonngerou</i>
20	<i>rue</i>	20,000	<i>ruengerou</i>
30	<i>enik</i>	30,000	<i>enikngerou</i>
40	<i>faik</i>	40,000	<i>faikngerou</i>
50	<i>nime</i>	50,000	<i>nimengerou</i>
60	<i>one</i>	60,000	<i>onengerou</i>
70	<i>fiik</i>	70,000	<i>fiikngerou</i>
80	<i>wanik</i>	80,000	<i>wanikngerou</i>
90	<i>tiwe</i>	90,000	<i>tiwengerou</i>

Hundred thousands value combines the hundreds value terms as prefix to the thousand term **ngerou**. See table 4.

**Table 4 : Chuuk Counting System in Tens and Ten Thousands**

Hundreds	Chuukese	Hundred Thousands	Chuukese
100	<i>epuku</i>	100,000	<i>epukungerou</i>
200	<i>rupuku</i>	200,000	<i>rupukungerou</i>
300	<i>unupuku</i>	300,000	<i>unupukungerou</i>
400	<i>fepuku</i>	400,000	<i>fepukungerou</i>
500	<i>nimepuku</i>	500,000	<i>nimepukungerou</i>
600	<i>onepuku</i>	600,000	<i>onepukungerou</i>
700	<i>fupuku</i>	700,000	<i>fupukungerou</i>
800	<i>wanupuku</i>	800,000	<i>wanupukungerou</i>
900	<i>tiwepuku</i>	900,000	<i>tiwepukungerou</i>

It is noticeable that the number system from 'hundred' onward follows exactly the standard English counting system. They are almost the exact translation of the English numbers. For example the English number 'twenty thousand' is a combination of 'tens' value twenty and the word 'thousand'. This may imply that those parts of the counting system may have been added to the original counting system when formal education reached the island of Chuuk.

Another reason for this assumption is the word "*kit*" for 'ten thousand'. The people interviewed are aware of the word "*kit*" but do not know exactly its English equivalent. Among those interviewed no one mentioned the word "*faunopi*". The word "*kit*" for 'ten thousand' and the word "*faunopi*" for "one hundred thousand" mentioned by Krämer in Truk are not used in the present numeral system.

## **B. The Numeral System In Counting**

When the numeral system is used in counting, the numbers from one to ten are used basically as we do the English counting. The counting just goes *ew, ru, unungat, ruanu, nimou, onou, fisu, wanu, tiwou, and engon*. When counting goes beyond ten, the counting system becomes a little different from the English counting. Eleven in Chuuk counting is *engon me ew*. The word indicates putting together *engon* and *ew*. The word *me* is the Chuukese word for 'and'. This system is used for counting as it goes on to ninety-nine which is *tiwe me tiwou* and only used to put together the "tens" value terms and the "ones" value terms.

Counting that uses the hundreds and the ones does not use the word *me*. It combines the hundreds term and the ones term like *epuku engon* for 'one hundred ten'. It is true with combinations of any of the numbers that does not combine the tens value and the ones value. When counting includes the use of the tens value with the ones value, the word *me* is used to connect only the tens value and the ones value. Three

hundred eighty-five is *unupuku wanik me nimuo* with the *me* only found between the ‘eighty’ and the ‘five’.

### C. Counting Objects in Chuukese

“Another aspect of language intimately connected with number words is numeral classifiers” (Ascher 1998, page 10). The Chuukese counting system is dependent upon the objects being counted. When the basic counting system is used to count objects, the number name becomes a prefix to the name of the object they are counting which is basically a description of the object. The description of the object becomes its numeral classifier. Listed in Table 5 are the numeral classifiers that are commonly used even at the present times.

**Table 5 : Common Numeral Classifiers in Chuukese Counting**

Numeral Classifiers	Object Description
<i>-foch</i>	long objects
<i>-fou</i>	rounded objects
<i>-chche</i>	flat objects
<i>-chchi</i>	drops of liquid
<i>-ssat</i>	a slice of an object
<i>-mmet</i>	strips
<i>-mmen</i>	persons and animals

“*-foch*” is used in counting long objects like fish, sticks, soda straws, pencils, and pens among others. “*-fou*” is for round objects like taro, coconuts, breadfruit, balls, bowls, and betel nuts. “*-chche*” is used commonly to flat object like pandanus and coconut leaves, paper or plates. “*-chchi*” is used to count drops of liquid while *-ssat* is used to count sliced objects like fruits and meat. “*-mmet*” is for strips like hair and also used to count leaves when cut into strips for weaving and rope-making. “*-mmen*” is for counting persons and animals.

In the Chuukese counting system, the number word is used as a prefix to the object classifiers. When counting coconut leaves, “-*chche*” is the object classifier that is used. Thus one leaf is *echche*; two is *ruechche*; three is *unuchche*. Two long objects is *rufoch*. The same principle is used in the other object classifiers. It is interesting that the same object of a different shape uses different counting system. An example is the pandanus leaf. When counting a pandanus leaf, *echche* is used because they are considered flat objects. When weavers cut the leaf into strips preparing them for weaving the counting of the pandanus leaf in strip form becomes *emmet* because they are now cut into strips.

Table 5 is consistent with the list provided by Krämer (1932, pp. 97-98) with some variations in spelling. Krämer also provided more than the list in Table 5. Obviously the list in Table 2 is very incomplete as there should be more numeral classifiers that are not commonly used in the present times. Even Krämer’s list cannot be considered exhaustive. In fact, Elbert claims that “more than sixty counting classifiers occur in Trukese” (quoted in Alkire 1970, p. 10) while “Goodenough's dictionary supplementary volume lists over 100 numeral classifiers” ( Don Rubinstein, personal communication) . If that be true, most of them are not commonly used in the present, but then our informants are basically from Weno and we have not gone to the outer islands.

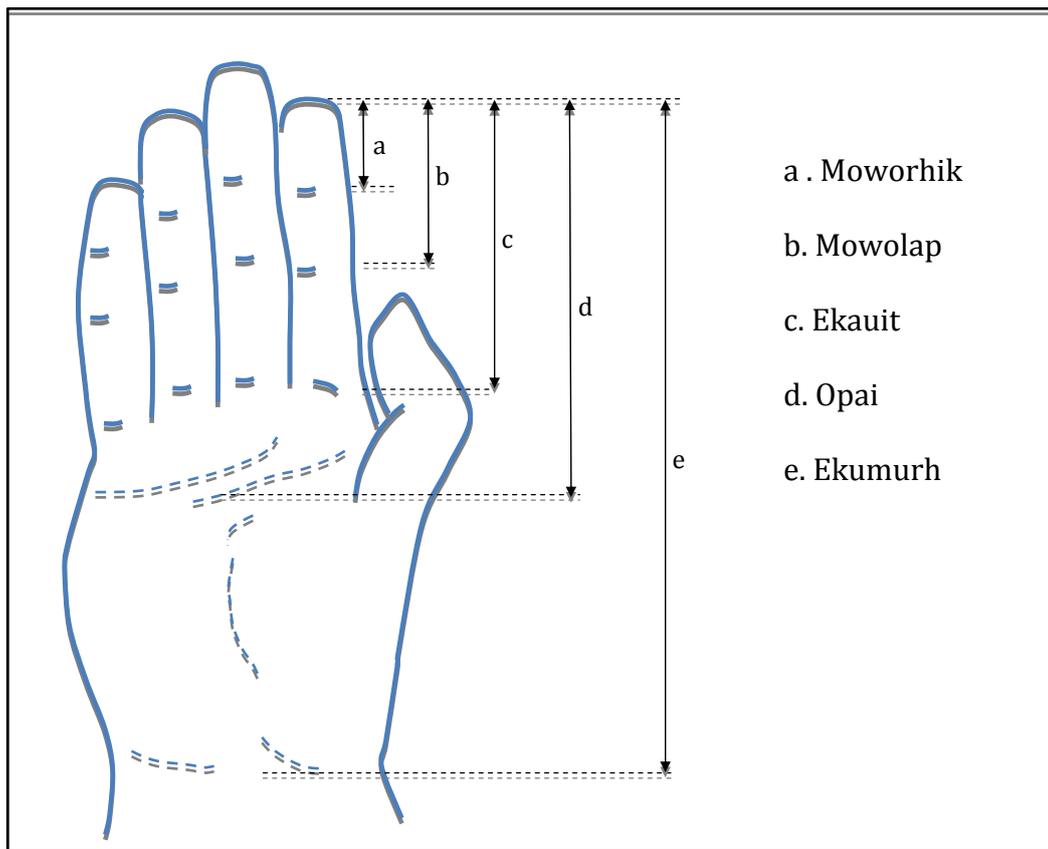
## II. The Chuukese Measurement System

### A. Length and Distance

Chuukese measurement uses parts of the body mainly the hands and shoulders.

Figure 1 shows the measurements using the hands.

**Figure 1: Hand Measurement**



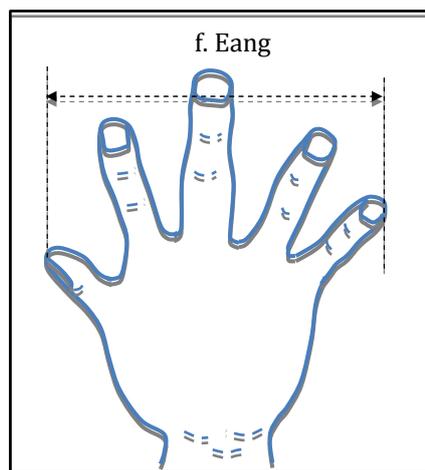
*Moworhik* starts from the tip of a finger to the first knuckle of the finger, approximately one inch. *Mowolap* is from the tip of the finger to the second knuckle of the finger, approximately two inches. Both these words are combination of two words. “*Mowo* is the joint of the finger and *rhik* means small” (Benedict Saipwarek: Interview). This indicates that *moworhik* is the tip of the finger or the first joint of the finger. On the other hand, *lap* means bigger, which indicate that *mowolap* is a bigger joint of the finger, in this case the second joint of the finger. *Ekaiut* is one whole finger measurement,

approximately three inches. These are used as liquid measurements and to measure length of small solid objects. When used in liquids it should basically be for measuring heights of liquid in a container.

*Opai* is from the tip of the finger to the middle of the palm. *Opai* is not only used to indicate length but also to indicate that the distance of an object from a person is within grab” (Benedict Saipwarek: Interview ). When somebody asks how far is an object and the object is exactly within reach of the person being asked, the person may used the word “*opai*” indicating that the person can grasp the object from where he is.

*Ekumurh* is from the tip of the finger to the wrist area of the hand. It is approximately six inches in length. This is another measurement that does not only measure length but is also a measurement that means a handful. It is usually used to measure materials for weaving and for making *mwaramar*. When one is asked to get materials for making *mwaramar*, *ekumurh* indicates that the material they got is a handful. If you take a handful of rice, the amount of rice is called *ekumurh*.

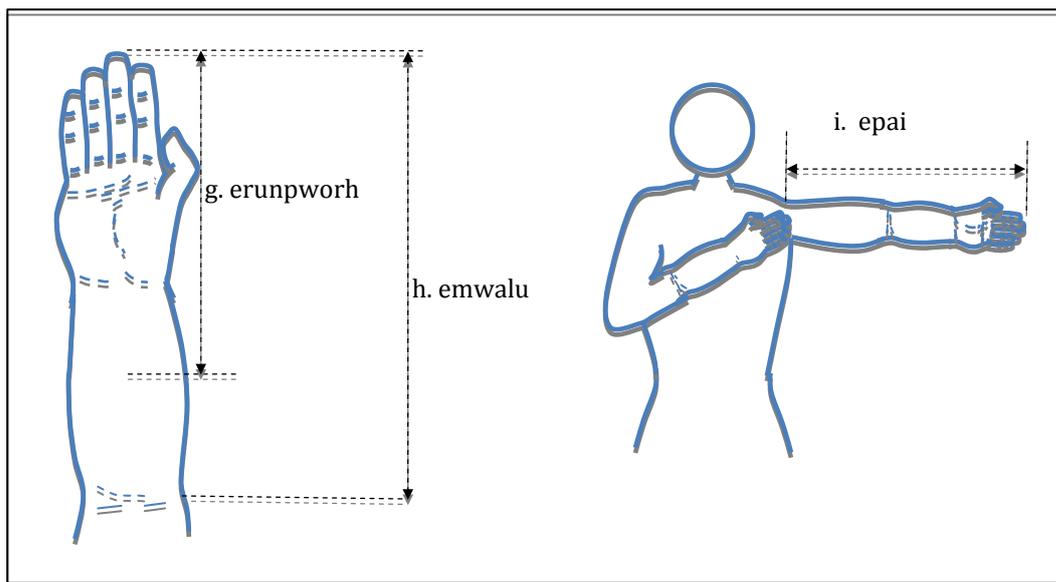
**Figure 2 : Eang**



*Eang* is one hand span. It is defined as the span between the thumb and forefinger. “In common practice however, *eang* is often measured from the tip of the thumb to the tip of the small finger with the hands are spread open wide or hands

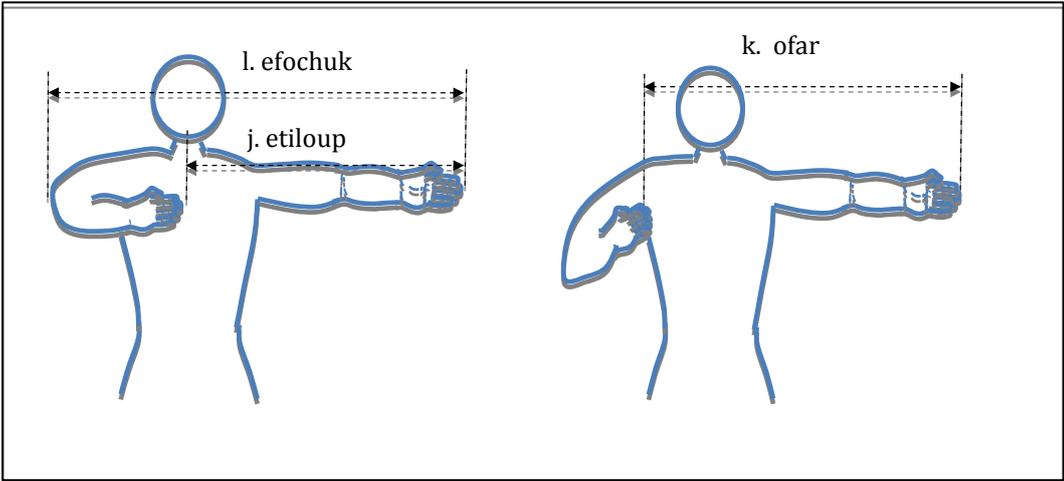
extended” (Benedict Saipwarek: Interview). Together with *ekumurh*, *eang* is commonly known as “the women’s measurement”. It is used to measure diameters of round objects. Women use this measurement to measure the diameter of *mwaramar* to make sure that it fits the head. Women also use this measurement in weaving baskets.

**Figure 3 : Arm Measurements**



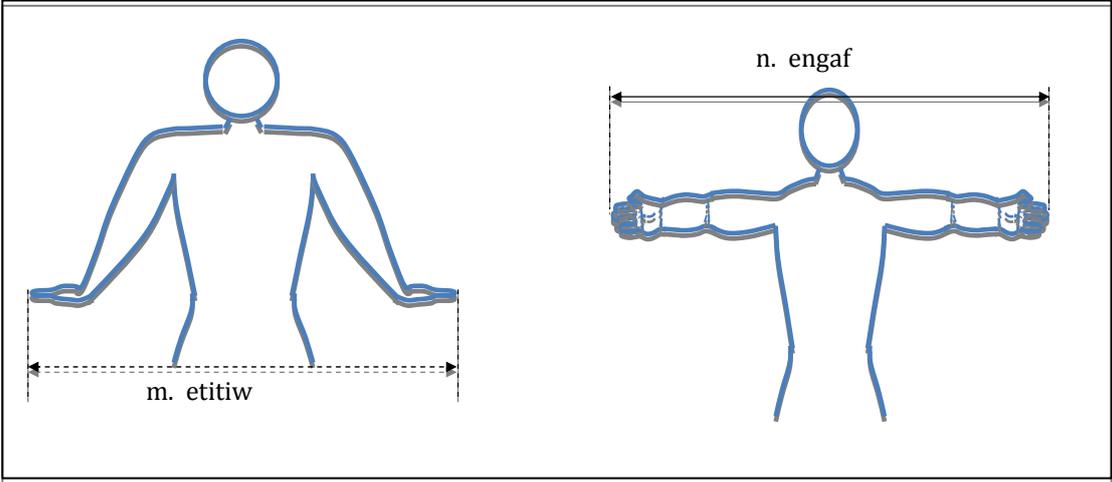
*Erunpworh*, *emwalu*, and *epai* are the measurements in the system that use the arm. *Erunpworh* is from the end of the finger to the mid-part of the elbow and the wrist while *emwalu* extends from the tip of the finger to the elbow, that is, a forearm length. *Epai* is from the tip of the finger of the right hand to the right shoulder when using the right arm to measure. These measurements are commonly used in measuring fish and long objects. They are also used to measure the length of *mwaramar* for the neck. The common notion today is that *emwalu* is the Chuukese measurement equivalent to one foot.

**Figure 4 : Body and Arms Measurements**



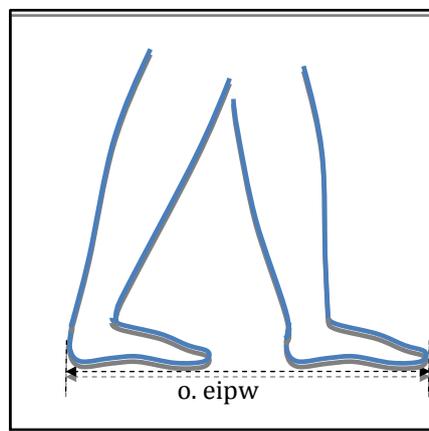
Some of the measurements that use the body with the arms are shown in Figures 4 and 5. These measurements are generally used to measure fish, ropes, cloths, and weaving materials among others. *Etiloup* is a measurement from the tip of the finger to the middle of the chest. *Tiloup* means to “part in half” (Curtis Hayseck: Group Discussion). When using the right hand to measure, *efochuk* is from the tip of the finger to the tip of the elbow. Fochuk is a Chuukese word meaning “to elbow” somebody. When measuring with *efochuk*, the left elbow should be in a position as if you are to elbow somebody. *Ofar* is from the tip of the finger to the left shoulder.

**Figure 5 : Body and Both Arms Measurements**



*Etitiw* is a measurement from the tip of the finger of the right hand to the tip of the finger of the left hand with arms spread out at waist level while *engaf* is from the tip of the finger of the right hand to the tip of the finger of the left hand with arms spread out at shoulder level. Both measurements are used to measure longer lengths. The common use for these two measurements is measuring the materials for rope-making. When the desired length of the rope is about 50 feet, *etitiw* is used while *engaf* is used when the desired length is 100 feet.

**Figure 6 : Foot Measurement**



Among the common anatomical measurements discussed herein, *eipw* is the only foot measurement included. *Eipw* is equivalent to one normal step. This measurement is used to measure distance.

### **B. Counting and Measurement**

Like in English measurements, Chuukese measurements serve as units of measurement using the number system as prefixes. Most of the common measurements mentioned and explained above can be used as units of measurement. *Eang* is one hand-span measurement; the *e-* being the number prefix and *-ang* the unit of measurement. When the length being measured is two hand-spans, then its length is *rueang*.

Although it is not a common practice, some people use two different units of measurement to measure a desired length. When one does this, the result can be viewed as compound denominate numbers. Say one measures an object's length using *engaf* and finds that it is a little more than two of the measuring system used and that little is measured by *eang*. We can then say that the length of the object measured is *rungaf me eang*. This can be viewed as a compound denominate number in the Chuukese measurement system.

## **Conclusion/Recommendations**

**The system of** counting and measurement in Chuukese culture is very rich and almost inexhaustible. The examples presented herein are just a very basic and small part of the system that emerged from interviews.

It is recommended and planned that further research should be done on the following:

### **1. Application of counting and measurement in the different cultural activities:**

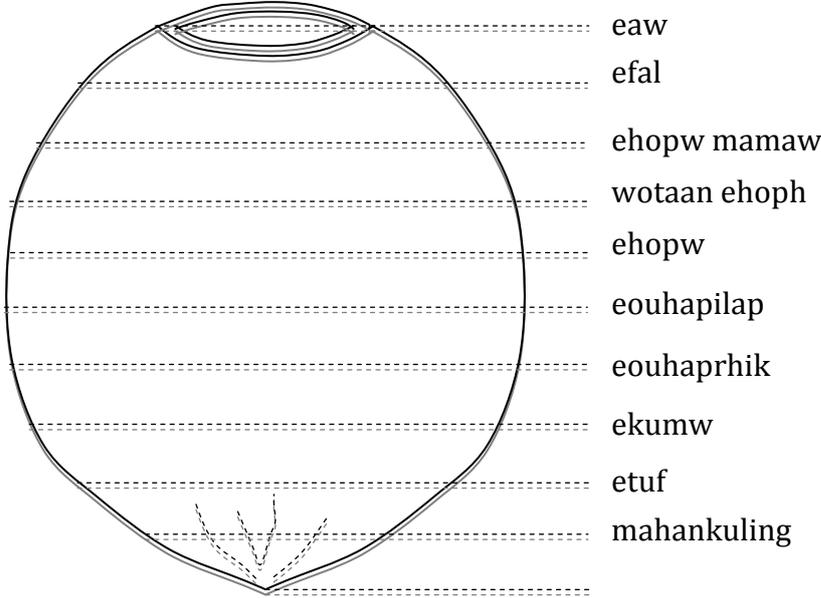
Investigating the application of counting and measurement in different cultural activities such as construction, dances, songs, and weaving may bring about other counting systems and measurement systems that are only used in such activity. In building the sides of the traditional fish trap the standard distance between each vertical pillar (*urulap*) is *emwalu*. When the vertical pillars are set, horizontal sticks are then tied to the pillars that serve as the wall of the fish trap. The distance between the horizontal sticks is measured as *rueud*, that is, a two-finger-width span. The measurement *eud* (one-finger-width span) however is not on the list of the basic anatomical measurement.

Alkire in his discussion of locating the seven secondary keel-water control points mentioned, “fixing the location of these control points introduces a new measuring technique which is used exclusively by canoe builders” (Alkire 1970, p. 29). To identify such measurements that are introduced and exclusively used in such traditional activities, there must be an exhaustive investigation into such activities.

### **2. Exploration of other counting and measurement in Chuuk.**

There are other counting and measurement systems in Chuuk. Current investigation on this topic reveals that there is a measurement system for liquid using coconut. “This measurement is used in measuring the amount of coconut wine produce” (Joshua Emwalu: Interview).

**Figure 7: Liquid Measurement Using Coconut**



Time length measurement using a torch has also been mentioned. “When asked how long we are going to fish, answer usually comes in the number of torches consumed” (Miuty Nokar: Group Discussion). And, “when asked when the face of the moon can be seen, they will answer, four torches” (Kind Kanto: Interview). Measuring time length using the torch could be one of the earliest time length measurement systems. Krämer mentioned that they when they came to Chuuk, women who were fishing with their torch met them.

**4. Exploration of possible operations in Chuukese numeral system.**

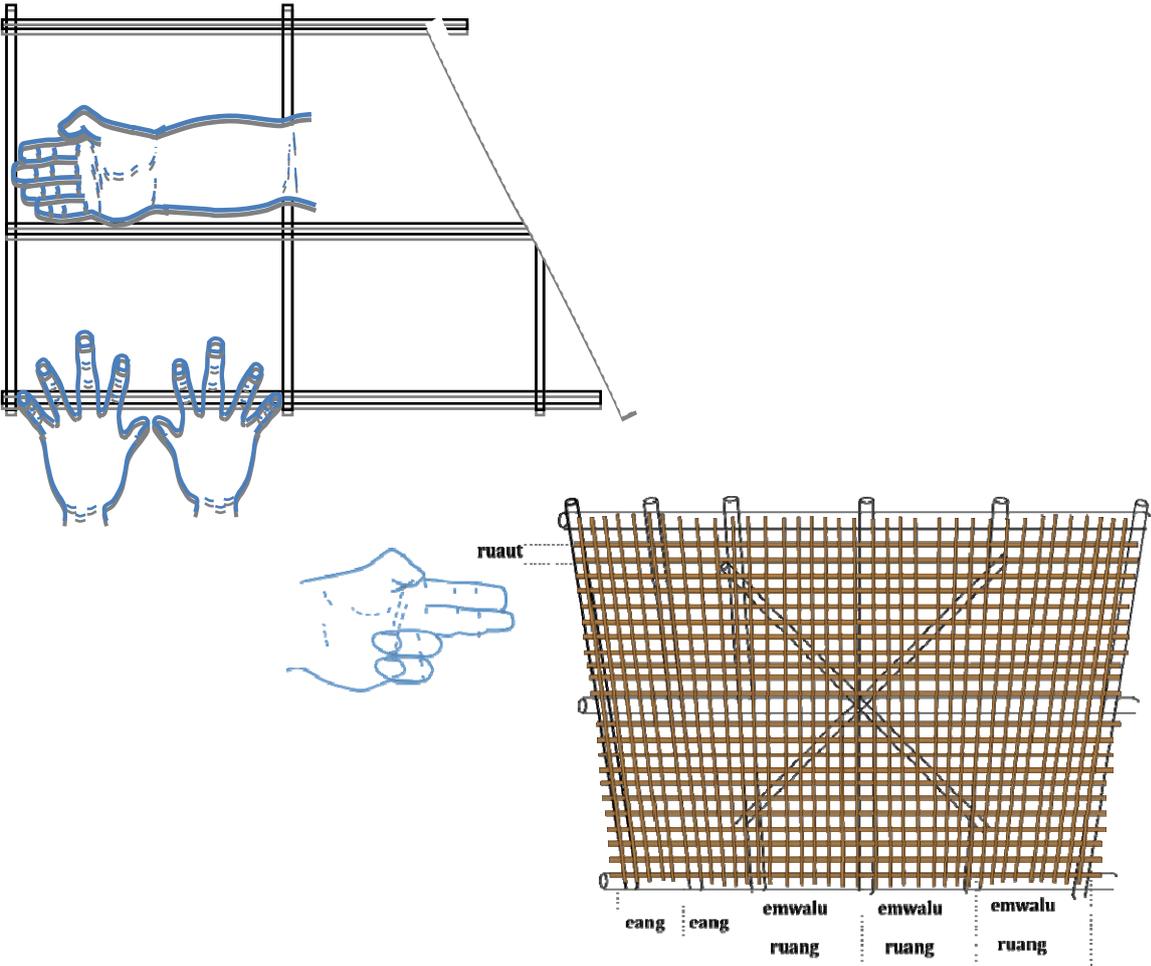
There should also be an extensive study on the possible operations in the Chuukese numeral system. “Basically the number concept is the recognition of a single entity combined with the understanding that another can be added into it, another then added to that aggregate, another to that, and so on” (Ascher 1998, p. 2). Krämer also provides evidence that addition exists in the Chuukese number system. He writes, “I

also heard the following words are used for number in pairs -  $1 + 2 = \text{evaru}$ ,  $3 + 4 = \text{alafal}$ ,  $5 + 6 = \text{limevon}$ ,  $7 + 8 = \text{fuseval}$ ,  $9 + 10 = \text{divengol}$ " (Krämer 1932, p. 99).

**5. Exploration of possible conversion system in Chuuk's system of measurement.**

Mentioned in item number one is the construction of the fish trap *uuw*. The distance between the pillars of the fish trap called "*urulap*" is *emwalu*. However, when our informant was showing the length measurement, he was using his right and left hand span that is considered *ruang*. This could be evidence that there is a conversion system for some of the measurements.

**Figure 8: Pillars and Wall of a Traditional Fish Trap**



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