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Understanding transmission of skill as influencing continuity or change through locally manufactured utilitarian ware at Greco Roman Karanis

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Understanding transmission of skill as influencing continuity or change through locally manufactured utilitarian ware at Greco Roman Karanis

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Archaeology

by

Sonali Gupta-agarwal

2015

ABSTRACT OF THE DISSERTATION

Understanding transmission of skill as influencing

continuity or change through locally manufactured utilitarian ware at

Greco Roman Karanis

by

Sonali Gupta-agarwal

Doctor of Philosophy in Archaeology

University of California, Los Angeles, 2015

Professor Willeke Wendrich, Chair

Archaeological ceramics are mostly used in dating archaeological layers, but this presupposes that they should be able to tell us *how* and *why* cultural continuity or change occurs. For my research, I focus on the standardization and variability of pottery because these concepts indicate causes for change, continuity and an understanding of learning patterns and mechanisms. I concretize the role of pottery workshops in continuity and change in an archaeological context and approach transmission through Bourdieu's '*habitus*', focusing on the interactions between the

individual and the group. The group represents a community of practice (e.g. a pottery workshop) transmitting a certain tradition through teaching and learning. Apprenticeship in these workshops conveys these traditions within a broader process of enculturation. The workshop and the individual potters within it have a recognizable signature, which can be traced metrically. Using an anthropological approach, I concentrate on modern-day pottery workshops in Egypt and India with long traditions in pottery manufacturing for four main reasons: Firstly, interacting with present day living and working potters allows me to to ask questions to understand the role of learning by potters, the identification of a producer's work and the influence of consumers on learning and processes of continuity and change. Secondly, it allows me to observe actions and processes within main stages of pottery manufacture relating to similar vessels. This in turn enables me to trace subtle micro-variables in the actions of present day production processes (such as body movements and specific gestures) using video footage as well as the traces these actions leave on vessels. Lastly, I conduct experiments to demonstrate that transfer of knowledge/skill/learning can be detected through archaeological ceramics by comparing measurable characteristics in ancient and modern pottery. For implementing reason, the variations in movements and gestures from the video recordings were color coded using Anvil (qualitative data analysis and research software) in order to discern the patterning associated with each stage in pottery production of similar vessels. Once coded, the data is subjected to quantitative analysis. The method outlined above allows me to demonstrate that individuals from one workshop follow similar actions and leave similar traces on vessels when compared to individuals from another workshop. It also enables me to differentiate between workshops manufacturing similar vessels by body movements and usage of space. There are a total of eight supplementary files relating to video annotation from workshops located in both Egypt and India (provided with the thesis).

I then transpose the method and understanding gained from the study of modern potters to the archaeological context. The essential component is that in both the present day and ancient conext, the study focuses on similar vessels. This is necessary to discern actions and processes that are a part of the *chaîne opératoire* through different approaches such as visual and chemical analysis, measurement of dimensions such as rim thickness, rim diameter and neck/wall thickness of vessels. This enables the definition of similarities and differences within and between pottery workshops to aid in understanding knowledge and transmission at ancient Karanis.

My research suggests that by adopting a research design tested in the present and applied to archaeological ceramics in the past, one can trace ancient communities of practice and interpret continuity or change in material culture as part of an ongoing learning tradition.

The dissertation of Sonali Gupta-agarwal is approved.

Dwight Read

Jason Throop

Hans Barnard

Willeke Wendrich, Committee Chair

University of California, Los Angeles

2015

Dedicated to my parents, Dr. JDM Gupta and Raka Gupta

and my Guru, Dr. S.P Gupta, who inspired me to be an archaeologist

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Gupta-Agarwal, Sonali "The final curtain call: the abandonment of Karanis in light of Late Roman Amphorae". *Coptica, Journal of Coptic Studies* (2010), *Los Angeles, USA*

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Garge, Tejas; Geetali, Anuja; Gupta, S.P.; Gupta, Sonali; "Antiquities from Kamrej Excavations-2003": *Journal of Indian Ocean Archaeology No.1, pp. 67-77* (2004).

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Chapter 1

Background

In this chapter, I give an introduction of the thesis along with the research questions. The site of Kom Aushim in northwest Egypt is presented in its geographical and temporal context followed by a section on publication of pottery and the debate regarding abandonment. The chapter includes sections on research methods and material and the ceramic corpus retrieved to date along with a list of fabric types under fabric nomenclature. A summary of dissertation chapters is provided at the very end.

1.1. Introduction and research questions

For over two centuries archaeologists have used ceramics as chronological markers (Petrie 1899). This indicates that change occurs over time, but there has not been a thorough analysis of *how* and *why* change (that enables pottery to be used as chronological marker) occurs. Change can be both abrupt and gradual, which is the very basis for dating both stratigraphic layers and sites through analysis of ceramic finds. Continuity has in it the seeds of gradual change. The dynamics behind change and continuity is something that can be recognized and analyzed.

The two major mechanisms for change and continuity are knowledge transfer and the role of customers who may demand continuity or change. An independent mechanism may be the slow evolution of forms, in which potters make subtle changes to their vessels, either deliberate and unconsciously. If the potters have a deep understanding of the forms of the vessels, allowing them to identify their own work from that of others, vessels that will be purchased more readily by customers may be imitated in the next generation of vessels. Over time this will result in shapes that slowly and steadily become different from older vessels due to gradual change. This interplay between tradition and innovation, among both producers and consumers is another important element of my investigations.

The second point of interest in this dissertation is to understand transmission of skill in crafts such as pottery manufacturing. Transfer of knowledge and steering of/adaptation to customer demands happens in bounded groups. I seek to understand this transfer of knowledge by identifying different communities of potters within a larger group of potters making similar vessels in ancient Karanis, Egypt. I investigate how subtle differences in production techniques of similar vessels can result in slight variations in the final vessels produced. In my work, I demonstrate that potters usually are able to identify their own work from that of other potters. If it is possible to quantify the differences that this identification is based upon, this method can be used by archaeologists to identify ancient pottery workshops using ceramic sherds alone. In order to do find communities of practice in the past, I start with such communities in the present. I carried out my research among a total of 22 modern pottery workshops in Kom Aushim, Nazla, Fustat, Sheikh Ali, Dar-es-salaam and Ballas (Egypt), Amer, Jagatpura, Chattrikhera, Chedamangalam, Tatthapilly and Korumuloor (India).[1] The reason for doing research in Egypt and India are manifold, 1) both countries have long traditions of pottery manufacturing 2) cross cultural comparisons allow one to assess how much a specific culture contributes to microscale processes that affect long term changes, and 3) my knowledge of both Arabic and Hindi came in handy for conducting fieldwork in these two countries. In each of these workshops I observed the potters at work, conducted structured interviews, and captured video footage to be analyzed

[1] See maps of Egypt and India with workshop locations in appendix A

in detail. I furthermore measured select dimensions of the pottery produced in an effort to identify similarities and differences between potters and workshops. The hypothesis that it is possible to identify the maker of a vessel based on such measurements was successfully tested repeatedly (*see chapter 6*). Archaeological samples were collected from Kom Aushim (ancient Karanis), a large settlement in the Fayum region in northwest Egypt, active in Graeco-Roman times, approximately from the third century BCE until the sixth century CE. Potsherds were collected from the surface in areas where pottery kilns, and most likely also pottery workshops, were active in ancient times and areas.

Teaching and learning strategies are socially and culturally constituted. Learning crafts such as pottery is transmitted within groups of potters using both discursive and non-discursive knowledge specific to each group. Communities of potters ensure continuance of skills through the transference of this knowledge and in the process maintain group cohesion and distinctiveness. The skills so transmitted within a group of potters are reflected in the produced vessels. The identification of specific communities of potters is done through the identification of similar microvariables (the material reflection of particular gestures and postures) transmitted through the teaching-learning tradition. The research addresses how deep seated the roles of enculturation; daily practice and *habitus* are in transmission (Bourdieu 1977). Finally the research provides insight as to how these transmission trajectories affect continuity or change. Apprenticeship and the learning associated with it in specific communities of potters can allow the understanding of the dynamics behind change and continuity. In the archaeological context, subtle variations between sherds of similar vessels can help in identifying specific communities of potters. The sherds then can be utilized in explaining the effects on the long-term processes of continuity and change of transmission of knowledge (both discursive and non discursive) in specific groups.

In an attempt to answer these research questions, I go back and forth between theory and method to understand learning and its transmission in an ethnoarchaeological context and then transpose the method to archaeological ceramics. The effort is not to make the pots 'passive markers of cultural change' (Last 2006:124) but through them understand the broad social and economic context. The present research through a combination of qualitative and quantitative approaches offers a new perspective on the topic of transmission studies, social dynamics, continuity and change. The identification of ancient communities of potters opens new avenues for further research.

1.2. Karanis in context: The site and its history

The temporal framework for this dissertation covers the Late Roman period, which in Karanis spans from the late fourth to the sixth century CE (Pollard 1998)[2]. The Fayum provided a major part of Egypt's agricultural yield in the Graeco-Roman period**.** The remains of the Graeco-Roman city of Karanis lie on the northern edge of Egypt's Fayum Oasis (Figure 1-1). Karanis was a town established in the Arsinoe nome under Ptolemy II Philadelphus (285-247 BC). The purpose was to settle Greek veterans in this region and to exploit the fertile Fayum oasis.

[2] This view is supported by recent ceramic analysis at Karanis from 2006 to 2012 available in the unpublished ceramic reports of the UCLA/RUG project, which confirms the dating given by Pollard. Also see the discussion on date of abandonment in *section 1.5* of the current chapter.

Figure 1-1
Satellite image showing the location of Karanis (Kom Aushim) on the northeastern edge of the Fayum Oasis (Google Earth Images: 2014)

Earlier, during the time of Amenemhat III (c. 1860-1814 BC), a ruler of the Twelfth Dynasty, a series of canals had been constructed in the region. Lake Moeris or modern day Birket Qarun was fed by a branch of the Nile, which flowed through the Oasis. During the time of the Ptolemies, the water level was lowered by restricting the influx of water, allowing a major quantity of land being reclaimed along the northern shore i.e. where Karanis was founded. The Ptolemies restored some of the earlier canals constructed by Amenemhat III and constructed a network of new canals (Cook 2011). This irrigation system and its maintenance by the regime were crucial, for it dictated the productivity of the land. Proper maintenance of canals in times of a thriving economy led to prosperity while periods of uncertainty led to a domino effect where improper maintenance led to silting up of the canals affecting agricultural productivity.

In the Greco-Roman period, there was an influx of Greek veterans. The new settlers well understood the importance of the fertile Fayum area and sought to restore productivity by cleaning the canals (Bagnall and Rathbone 2004). By the Late Roman Period, the mixed population got thoroughly integrated, although we know that there were Roman citizens alongside non-Roman inhabitants. Karanis was part of the agricultural infrastructure that supported the economy of Rome. As subjects of the Roman Empire, the people of Karanis were obliged to pay taxes in money (for business and occupations) and in kind (for agricultural produce) (Gazda 2004). By the third quarter of the first century CE, grain from Egypt became the most important source for food for the city of Rome for at least four out of the twelve months of the year. There were periods of prosperity followed by recession. An hypothesis regarding the economic decline of Karanis in the fourth century CE and abandonment in the fifth century CE was first proposed by Boak and Peterson (1931). This view was based upon the apparent scarcity and absence of certain classes of dated evidence, mainly coins and papyri from the fifth century. However, based on the ceramic types, it is evident that the site continued to be occupied well into the sixth century (Pollard: 1998) [3]. The settlement has a wealth of pottery with a diverse range of vessel types. For the purposes of this dissertation, I focus on domestic utilitarian ware from Karanis.

[3] See *section 1.5* for details on discussion on date of abandonment

1.3. Excavation background

In 1895, the site of Karanis (Kom Aushim) was first excavated by Grenfell, Hunt and Hogarth (1900), representing the Egyptian Exploration Fund in search of papyri. Excavations commenced in 1900 for a brief period and shortly after, the site saw large-scale damage and destruction by the *sebbakhin* or seekers of organic fertilizer who took the *sebakh* or fertile soil resulting from decaying mudbrick and organic remains. The organized (and officially condoned) work of the *sebbakhin* left Karanis with a gaping hole in the center of the town.

Figure 1-2
Satellite image showing the site of Karanis
(Google Earth Images: 2014)

In 1924, Francis Kelsey of the University of Michigan, renewed interest in Karanis and excavations began after a gap of thirty years (Gazda 2004). The excavators started a controlled, stratigraphic excavation. They were interested in papyri, but also in all other archaeological remains. The excavated finds were divided between the University of Michigan, the Egyptian, Agricultural and the Graeco-Roman Museums in Egypt (Harden 1936). After a long hiatus, The Egyptian/French excavations took place in the 1970's to excavate the northwestern part of Karanis (Nassery 1975). Publication of these excavations is extremely limited and concentrates mostly on the small Roman bathhouse (Nassery et al. 1976). Finally, the University of California, Los Angeles (UCLA) and the Rijkuniversiteit Groningen (RUG) under Dr. Willeke Wendrich and Dr. René Cappers respectively, started excavations at Karanis in 2005. It is with the UCLA/RUG project that I have been studying the ceramic repertoire and transmission of knowledge and skill at Karanis. Later, the University of Auckland, New Zealand, joined the project with a specific focus on the Epipaleolithic and Neolithic remains in the area.

1.4. Publication of pottery from Karanis

The monograph on pottery at Karanis was completed by Barbara Johnson in 1981 under the aegis of the Kelsey museum. However, the pottery finds kept in the Kelsey Museum are mostly complete vessels. Johnson's publication did not represent the entire excavated corpus; diagnostic and body sherds of local material were not included in her study. The neglect of an entire corpus of pottery left numerous gaps in our understanding of the site. There were also known dating problems due to lack of correlation in the forms studied by John Hayes in his work on Late Roman Pottery (Hayes 1972) and the forms found in context at Karanis by the University of Michigan. The problems relating to dating were stated by Johnson but were never resolved

(Johnson: 1981). Karanis was occupied until the Late Roman Period and abandoned in the sixth century CE.[4] The UCLA/RUG excavations from 2005 to 2012 have excavated ceramic material that firmly establishes the period of occupation for the site.[5] For my research I rely on only Late Roman cooking vessels produced locally at Karanis so as to keep chronological control for understanding transmission. In view of this, it is important to have a discussion regarding the dating of the ceramic corpus and the period of abandonment in the next section.

1.5. Abandonment debate

As mentioned earlier, the hypothesis regarding the decline and abandonment of Karanis was first proposed by Boak and Peterson (1931) of the University of Michigan, who suggested that the continuous occupation of Karanis ended during the reign of Emperor Marcian in 457 CE. It has been pointed out that an ill-assorted heterogeneous coin hoard that belonged to a Roman lady of the time is evidence of the chaos and recession and represents monetary anarchy (Gazio 2007: 22). In his paper on the chronology and economic condition of Late Roman Karanis, Nigel Pollard (1998) suggested that the abandonment hypothesis was formed on the scarcity and absence of certain classes of dated evidence such as coins, papyri and ostraca from the topmost layer due to exposure. However, the pottery excavated at the site indicates that the Roman Period in Karanis continued into the sixth century CE when it was finally abandoned. Roman rule in Egypt heralded a period during which potters borrowed many vessel types originating outside of Egypt, such as the African Red Slips and reworked the borrowed shapes. At Karanis there are seven examples of African Red Slip forms or ARS in the Michigan publication (Pollard 1998)

[4] There is no evidence of Islamic pottery after the Late Roman Period in Karanis.

[5] Information from unpublished ceramic reports of the UCLA/RUG projects from excavation seasons 2006 to 2012.

and four examples from the UCLA excavations that date to the sixth century.[6] The seven examples of ARS forms from the University of Michigan corpus have been branded as finds associated with squatter occupation. Copies of these forms have been made in the local Egyptian Red Slipped forms, which are further indicators for the latest phase of occupation at the site, dating to the sixth century CE. Pollard infact concluded that the evidence is indicative of relative prosperity and not squatter occupation of a decaying settlement (Pollard 1998). The fact that four other examples come from different locations at Karanis is indicative of a more permanent type of settlement.

To further substantiate continuance of Karanis well into the sixth century CE, the presence of certain amphorae lends credence to the fact that Karanis was very much in the trading loop during the time that it was interpreted as already being abandoned. The first of these is the common Late Roman 1 Amphora 1 (LR1), produced in the Roman provinces of Cilicia and Cyprus. It was one of the most important transport amphorae from the late fourth to the first half of the seventh centuries CE and it became particularly frequent in the later fifth and early sixth century CE. The form evolved considerably from the fourth to the seventh centuries (Reynolds 2005). At Karanis, there is evidence of the later more commonly found developed form with an ovoid body, a rounded base and a broad neck with thickened rim. At Karanis, there is also surface evidence of the LR1 amphora (type YA II) similar to the one found in the Yassi Ada shipwreck dating to the 7th century CE (Van Alfen 1996: 193). That the production and importation of the LR1 amphora carried on into the seventh century CE is confirmed by this shipwreck dated after 625 AD (Van Alfen 1996).

[6] Information from unpublished ceramic reports of the UCLA/RUG projects from excavation seasons 2006 to 2012.

At Karanis, some LR1 amphora contain pitch lining, which is normally associated with wine to prevent seepage through the walls of the vessel. Other LR1 amphora do not contain pitch lining, which suggests that the olive oil would form its own non- porous coating on the inner wall of the vessel. If olive oil was indeed transported in LR 1 amphora, the question remains, why these would be found in the Karanis during the Late Roman Period. Egypt after all, was and still is an olive producing area and logic would suggest that during tough times, the trend would be to rely on production at home. The evidence suggests that oil was being imported due to its high quality during this period. It may be that until the conquest of Egypt by the Arabs, oil of a higher quality was being imported for the benefit of the local elite rather than relying on the local product. The only change in this period was the trade with the countries around the Mediterranean Basin had shifted from west (Italy and Gaul) to east (Cyprus and Cilicia).

Another common amphora type in Karanis is the Late Roman 2 amphora or LR2. The concentration of this type in the Aegean region with production attested on Cnidos, Chios and Argolid (Peacock and Williams1986). It was produced from the fourth to the seventh centuries CE with evidence that it was used to transport both wine and olive oil.

Another type, Almagro 54, or Late Roman 4 amphora, or LR4, has its origin in the coastal southern Palestine, Gaza and Ashqelon and dates from the fourth to the end of the sixth centuries CE, production probably ending with the Arab conquests. It is likely that these vessels contained white wine of Gaza and Ashqelon, which was famous (Riley 1979). Its distribution and popularity may perhaps be connected with the use of Palestinian wine for the Christian rite. Similarly, the Late Roman 5 amphora, or LR5, has its origins in Palestine and Egypt. It is said to have been produced in northern Egypt from the late fifth century CE to the beginning of the seventh century CE (Peacock and Williams 1986).

I have been a ceramicist for the excavations at Karanis from 2006 to 2012. The excavations have revealed the presence of all the above-mentioned imported Late Roman amphorae, including the Egyptian Late Roman 7 amphora or LR7 in a broad area of the site especially Karanis East.[7] The evidence of Late Roman amphora in Karanis East is also in line with the argument regarding the dam breach of a large irrigation reservoir in the southwest of the Fayum in the Late Roman Period (Römer 2013: 169-179). This may have led to rapid expansion of Karanis towards its eastern section (personal communication: Barnard).

The presence of mostly eastern Mediterranean amphora demonstrates that there was a significant shift in trade from the fourth century onwards, but this did not lead to a stop in trade or abandonment of the settlement. Pollard (1998: 148-149) states that outside sources tend to suggest that Karanis probably remained prosperous throughout the fifth century CE. It is known that there was a decline in trade with the western provinces in the fifth century and a rise in trade with the eastern provinces, specifically wine from Cilicia (Martin 2010) and Gaza. In a kiln area, which has yielded various imported amphorae, LR1 from the eastern Mediterranean is the common type found here.[8] The LR1 sherds found in kilns at Karanis were used by the potters as fillers for the kiln wall owing to the sturdiness of the imported fabric. There is evidence of LR1 sherds stuck to vitrified material from the kiln walls. Ethnoarchaeological observations also attest the use of sturdy sherd fragments for insulation, wedging and fillers in construction of kilns, which due to the processes of extreme heat melt with the vitrified wall lining. The LR1 1 rim sherds from Cilicia and the LR4 sherds from Gaza dating from the fifth to the sixth century were apparently reused by the potters of Karanis in the kilns. This shows that the kilns were still

[7] Information from unpublished ceramic reports of the UCLA/RUG project excavation seasons 2006 to 2012

active in Karanis during the Late Roman Period.

These kilns produced ceramic utilitarian ware dating to the Late Roman Period. These local ceramics have been found stuck to vitrified material and as wasters suggesting clear use of kilns in the Late Roman Period. The locally manufactured ceramic types can therefore be used in studying transmission of knowledge and skill.

Papyri

From the papyri we get impression of the problems faced by the local people at Karanis. One of these documents, describing a water right dispute at Thanesamen in the Arsinoe Nome addresses the villagers of Karanis:

> *They have no right to the water of Thanesamen or to nearby fields. If anyone from Karanis tries to draw water at Thanesamen and gets beaten up, or crushed, in the attempt, it shall be with impunity. Shepherds who have been grazing their flocks nearby are to be unmolested.* (P. Haun. III 58; Rea 1993; Bagnall 2007)

Various Karanis and Columbia papyri describe violent resistance to tax collection (Bagnall 1993). According to Bagnall (1993), the problems documented in the papyri from Karanis are largely the results of economic hardships owing to taxation demands on agriculture. Keenan (1989; 1981) is of the opinion that these documentary papyri are concerned with life's disruptions. He suggests that the Egyptian symbiosis of agriculture and pastoralism and the integration of village and city life were often to the disadvantage of the villages.

Questioning the oracle was a way by which the people would cope with their trouble ridden daily lives. The South Temple in Karanis dating to the first century CE has a large altar with a small room inside it. Here, the priest would act as an oracle consulting Sobek-Pnepheros, the local crocodile god. The priest was a mediator between the populace and the god, thereby making him accessible to the larger population. Next to the expected questions of love and everyday life, in troubled years, the queries posed to the oracle seemed more urgent:

> *Will I be sold into slavery? Will my property be confiscated? Must I become a fugitive?* (Gazio 2007: 27).

These fifth-century papyri indicate that Karanis was facing difficult times, especially in regard to water issues. Perhaps the irrigation system was silting up, greatly diminishing the resources to irrigate the land and leading to enormous economical and social pressure. At the beginning of the Byzantine era around 390 CE, there was widespread rural depopulation because of crushing taxation on agriculture and the bubonic plague. The shift in trade from the western to the eastern Mediterranean brought about changes in economy. The economy of Karanis may not be doing as well as before but it was definitely in circulation. The dam breach theory (Römer 2013) discussed earlier, leading to the lake level rise and the consequent expansion of Karanis towards the east (personal communication: Barnard) where the presence of Late Roman amphorae from the fifth and sixth centuries CE have been found, appears to be the most tenable evidence to suggest that the site was abandoned in the sixth century CE. The conclusion regarding the abandonment in the sixth century CE is on the basis of ceramic sherds found in excavations from 2006 to 2012, and in agreement with Pollard's view.

1.6. Research method and material

To understand transmission of skill and knowledge, and its effect on continuity and change, I focused on locally manufactured pottery. For this, a number of probable kiln areas were surveyed in the south and southeastern part of Karanis *(see figure 1-2)*. The vestiges of kilns in some of these surveyed areas indicate that pottery production areas were active in the Roman period (*see details in chapter 6*). According to Gazda (1983:16) the tax rolls dating to 173-175 A.D mention four people paying tax as potters. By the Late Roman Period, the community of potters may have grown with the expansion of Karanis. I focus on locally produced Late Roman utilitarian ware, a type of ceramics that is generally characterized by a considerable standardization in shapes and sizes, to gain an understanding of learning pathways within specific communities of potters producing similar vessels. In spite of standardization, such pots show small, but consistent differences between the work of different potters. The method focuses on variables involved in pottery making processes that have the potential to affect the processes of continuity and change. The production sequence, or *chaîne opératoire*, has been used as a research strategy and framework to record and discuss the choices and ordering of the makers of ceramic vessels (Leroi-Gourhan 1943). There are two conceptual systems in the production of artifacts 1) concepts and ideas shared by the cultural system and 2) concepts and ideas specific to the potter (Read 2007: 91). According to Read, these concepts and ideas concretize via variables: one set of variables represents the individual concepts of the artisan expressed on the artifact or artisan specific concepts (here, the potter); and the other set of variables represent the concepts of the culture as a whole.

Ethnoarchaeological investigations into the processes that leave such various micro traces become the point of reference for archaeological investigations. I investigate these choices in the ethnoarchaeological context by doing fieldwork in various pottery workshops in Egypt and India (introduced in *chapter 4*), through space usage analysis, gesture and posture analysis and in both ethnoarchaeological and archaeological contexts in the actions and processes of pottery manufacture, and finally, measurements of vessel dimensions.

If one takes an exhaustive set of measurements, the question regarding the dimensions through which types are defined will continue to elude us. Thus, a theory that identifies the relevant dimensions should precede taking the measurements (Read 2007: 148-149). The subject of these relevant measurements has been discerned from my ethnoarchaeological fieldwork. I have proceeded with a taxonomic classification that is based on a method where potters of modern pottery workshops point out the important attributes (*potter interviews in chapter 4*). This is an example of what Goodwin (1994: 606-633) would call 'professional vision' (discussed in *chapter 3*). The method is non-biased as it is not based on the choice of the researcher but it is one based on the choice of the potters. Nearly all the potters point to the rim as the part of the vessels that allows them to discern their work from that of others. Thus, to identify the work of different workshops, I use the rim of vessels to build a typology based on function of the vessels. The rim typology then is real, based on a criteria determined from modern potters.

Over the years (from 2007 onwards), I developed a rim typology catalogue for ceramic vessels at Karanis. All excavated rim sherds were numbered in accordance with this catalogue revealing the most common types occurring in various excavated areas. By this method, the occurrence of the common ceramic cooking vessel types in all the kiln areas became the basis for my investigation regarding similarities and differences between kiln/workshop areas in order to understand transmission of skill and knowledge (*details in chapter 6*).

The morphological standardization of the cooking pot is shared by the larger community of potters at Karanis, while the variability of the rim within the standardized cooking pot is potter specific. The range of variability (of individual potters) within standardization is workshop specific. The cooking pots at Karanis have two kinds of variability represented by a 'range of variability', these are, 1) range of variability within a group of potters of the same workshop 2) range of variability between workshops.

The 'internal homogeneity' of cooking vessel forms and 'external isolation' (Read 2007:154) represented by the range of variability in rim thickness measurements of these vessel forms could potentially show differences between communities of potters at Karanis using similar vessels.

Through my method and analysis, I have made an effort to make the emic distinctions of the Karanis potters visible by forming taxonomies based on processes that are subtle and embedded in the produced vessels. The nature of these processes manifests itself in vessels by differences in rim thickness and distinctions caused by processes in pottery manufacture such as use of temper. The underlying reason for these distinctions is due to specific enculturation, daily practice and the *habitus* in workshops (*discussed in chapter 3*). While relying on ethnoarchaeological and archaeological data, I validate my findings by using qualitative, scientific and quantitative analysis to reinforce each other.

1.7. Ceramic corpus from Karanis

There are primarily two types of clays in Egypt, Nile clay from the Nile valley and marl clays originating from 1) shales and limestone found along the Nile river between Esna and Cairo and 2) secondary deposits from Wadi Qena (Bourriau et al 2000: 121). The common term in use by archaeologists and ceramicists for Nile clay is Nile silt or 'silt clay'. This sounds contradictory but refers to clay rich in silica and iron deposited by the Nile River. The term Nile silt ware means ceramics made from Nile river clay (in the dissertation, I shall use the term Nile silt clay). The production of local vessels is dependent on quality, abundance and distance to clay sources. The potters then set up their workshops, keeping in mind the above-mentioned factors. Therefore, before providing the fabric nomenclature applicable to Karanis, it is important to discuss the factors of availability of clay (quality, abundance and distance to clay sources) to firmly situate the production of local vessels.

Quality

The ceramic assemblage and clay sources at a site allow us to examine the range of quality (see below). Firing reforms the clays' mineral structure, rendering them unidentifiable. Therefore, defining the quality of clay based on mineral or chemical evaluations is not entirely possible. Hence, in the following paragraphs and in *table 1-1* below, using ethnographic sources and other scientifically known characteristics of clay behavior, I have listed some of the components that aid in explicating the subjective quality of clay in Egypt in objective terms. This process sheds light on the reasons behind choices made by potters, which remain valid in modern as well as ancient times. The choices enable us to assess the influences behind local production.

Objectifying Quality:

1= low score/ 2= high score

Note: Please see under each category for explanation of score

Clay type	*Silt*	***Score***	*Marl*	***Score***
Workability	Requires temper (Bourriau *et al*: 2000) -attempt to enhance working properties, temper usually located near clay source, so more economical	*1*	Does not require temper (Bourriau *et al:* 2000), -no attempt to enhance working properties, good as it is	2
Procurement	*Easy:* from banks of canal and lake, within reach-no specialized know-how needed	*1*	*Difficult:* specialized mining (*Bourriau et al:* 2000) and mines located as far as Qena	2
Firing temp	*Lower than 1000 degrees:* ceramics fired at low temperatures are less strong than those fired at temperatures higher than 1000 degrees Celsius (Sinopoli: 1991)	*1*	*Higher than 1000 degrees:* takes longer to reach higher temperature. It scores more as the result is no bloating or blistering on walls and vessel is stronger (Bourriau *et al*: 2000)	2
Distance to clay	Near (<20 km) Local irrigation canal (Karanis), Lake Moeris (Fayum)	*1*	Far (in relation to Karanis) (>20km) Qena (Upper Egypt)	2
Finished product	*Application of fugitive slip if cracked:* can be repaired but the finished product has flaws, hence scores low in overall robustness	*1*	*No slip* possible if cracked: to be discarded, finished product should not have flaws, therefore scores high in robustness	2
Usage	*Daily:* scores low as easy breakage, use life limited, more economical *Type:* heavy, coarse and fragile	*1*	*Sporadic:* scores high as hard, use life longer, high cost therefore more value attached *Type:* light, fine and not fragile	2
Total score		*6*		*12*

Table 1-1
Objectifying quality: Marl versus Nile clay

As show in *table 1-1* above, I have attempted to determine/reconstruct choices of potters to understand local ceramic production. When we score the properties of marl clay in relation to Nile silt clays then we can conclude that it probably was considered to be of high quality when compared to the silts. I objectify quality by allotting an overall high or low score by evaluating silts and marls under several categories: workability, procurement, firing temperature, distance to clay source and usage type (the basis for allotting scores are based on known ethnographic sources and personal observations in Egypt) (Bourriau et al 2000; Nicholson: 2002).

Mineral composition, chemical composition and particle size are some of the characteristics that influence the clay's workability, shrinkage, strength, thermal shock resistance, and color development (Rice 1987). These characteristics are significant to potters as they judge whether the clays can be easily formed, dried, and fired into durable containers (Rice 2007). However, potters understand these characteristics not by our scientific jargon but by their touch, word-of-mouth, tradition, luck, and trial-and-error, amongst other means. At El Nazla, Fustat and Ballas, Egypt, potters touch and feel the clay to determine its workability. In present day Egypt, pottery vessels made from marl clays are considered better than Nile silt clays by potters (Nicholson 2002).

The products from marl and Nile silt clays in the New Kingdom (c. 1550-1070 BCE) also indicate a similar trend in choice of raw material as in modern times; marls were reserved for specialized output, in a limited range of forms while Nile silt clays were used in manufacturing a generalized or utilitarian range of wares (Nicholson 2002). At Tell el-Amarna, at its zenith in 1350 BC, workshops made a range of low quality silt ware vessels and the best quality vessels were being imported from further south and included elaborate marl vases and jugs (Nicholson 2002). Silts are fired at temperatures ranging from 900-1000 degrees Celsius, while marls are fired at even higher temperatures (Bourriau *et al* 2000). Mined marl clay is therefore considered to be of highest quality owing to high costs involved in production giving it more value (as shown in *table 1-1*) both in the past and in present times as well (Bourriau *et al* 2000).

Most vessels found at Karanis were either made from marls or Nile silt clays (*details in chapter 6)*. As a general rule, at Karanis, finer ware fabrics tend to be marls and coarser fabrics in local clays. Nile silt clays and local mixed clays were good for producing a whole range of cheap utilitarian wares. For the mass market, potters try to minimize the time spent on making each individual vessel as it is quantity that produces economic returns, not quality (Choksi 1998: 114). Potters do not search for high quality clay either; they only appropriate clay of sufficient purity to ensure limited loss during firing (Choksi 1998). During my interactions with potters, I was told that even if low quality clay causes breakage during firing, the clay is worth procuring; the potters choose quantity over quality most of the time. If the pottery is both more available and of lower quality, more is likely to be used, broken and finally discarded (Schofield 2000: 110). The regular demand of pottery ensures that the potters can stay in business.

Abundance and distance

Abundance is defined as availability of a surplus quantity of clay. For the site of Karanis, Nile silt clays mixed with local mixed clays are abundant. The mining areas for the marl clays on the other hand are far distant, and hence unavailable in close proximity to Karanis (see *figure 1-2* below*)*.[9] The areas highlighted in red are Qena where marl is quarried and Aswan where the iron rich pinkish Aswan clay originates. In *table 1-1* it is indicated that marl was probably valued more. Transporting good quality marl clay from Qena (middle Egypt) to Karanis (lower Egypt) would surely add value to the finished product, but would end up being an expensive enterprise (*Figure 1-3*). Procurement of clay is linked to costs involved in travelling to the clay sources, time spent in excavating the deposits, and transport costs involved in bringing the clay to

[9] In potter communities worldwide, seven kilometers is the maximum threshold distance a potter will travel to procure clay (Arnold 2003 :68).

production areas. Costs linked to procurement could increase prestige or value of the vessel giving higher returns to the potter. If the sources were situated far from production areas, it would make sense to procure high qualitative clay by importing it and working out the cost differential in terms of vessel sale. The potter could even have the option of importing finished vessels made from such clays from the distant production area and selling the finished products. In Karanis, there is no evidence of imported fabrics occurring in production areas with wasters or vitrified material but there is evidence of finished vessels made from Qena and Aswan clays. Thus, cost and accessibility of raw materials, required quantity and transport costs and the consequent distribution of finished vessels together determine the sources that will ultimately be exploited by potters (Sinopoli 1991: 16).

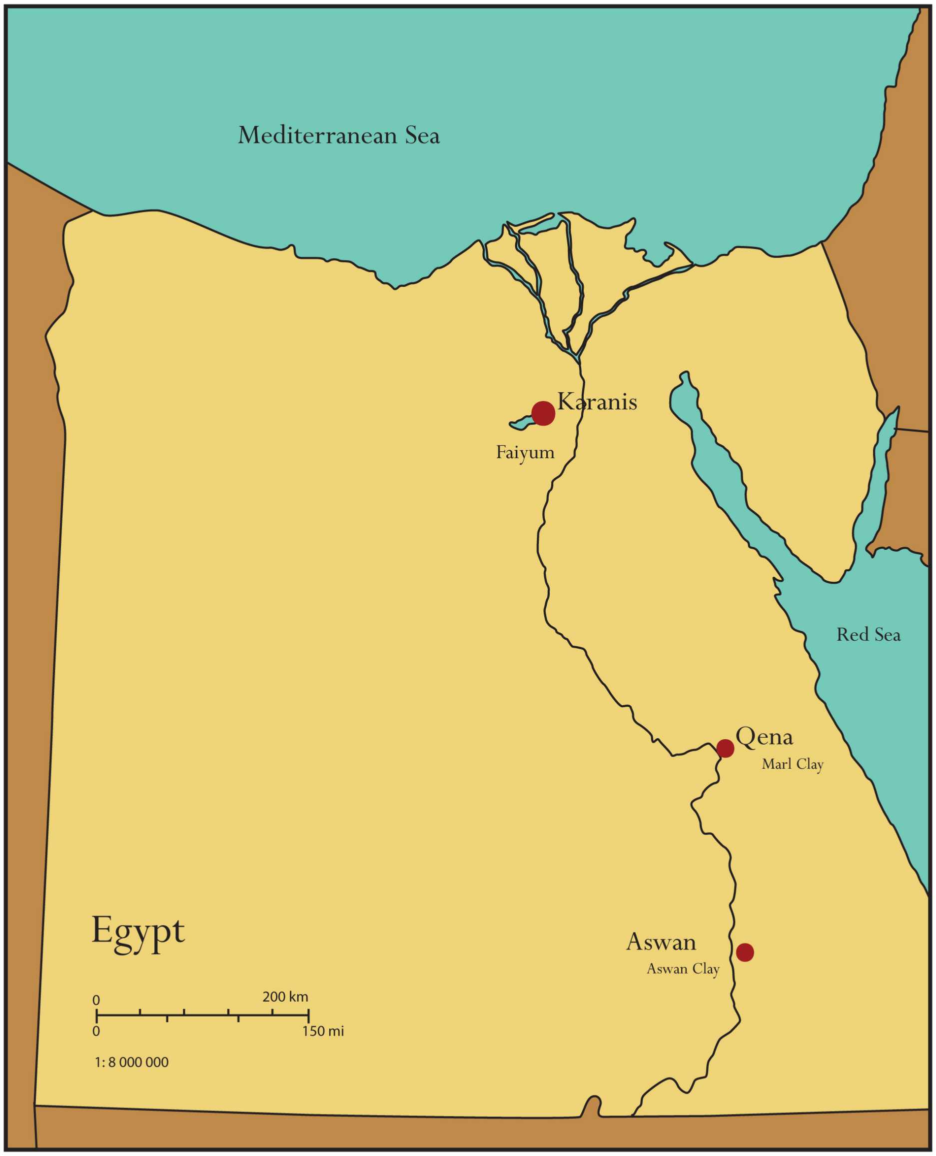

Figure 1-3

Map showing the location of Qena and Aswan and their distance to Karanis (Adapted from: Baines and Malek 2000: 21)

When there is availability of high quality clays, potters will set up pottery production areas in proximity and exploit such resources for manufacturing vessels. For example, in Ballas, Egypt, specialized miners quarry the marl clays from the nearby mountains and the potters collect it using donkeys or pick up trucks. The potters utilize the mined clay to make *ballas* jars and other utilitarian ware. Ethnographic studies indicate that generally, potters will readily select lower-quality clays if they are closer to their production area (within a seven kilometer radius) rather than higher quality clays from sources situated farther away (Arnold 1991: 23). The low quality sources for clay may be from reservoir or canal beds. The vessels made from such sources can be made in bulk and have a good market. This phenomenon of using clay from canal beds is noticed at El Nazla where potters use clays from the banks of the stream passing through the valley where the pottery workshops and kilns are situated. The proximity of the potters to clay sources and easy access to a water source, lowers production costs. The choice relating to production of pottery factors in the location of raw materials keeping in mind both quality and quantity.

The choice of raw materials and processes relating to production can be studied as expressions of cultural concepts. Potters in ancient Egypt understood the particular qualities of their raw materials and used them accordingly (Nicholson 2002). The potters at Karanis were also exercising a choice between different clay types (see list in *table 1-3*) and chose the local plain and local organic types to manufacture utilitarian ceramics over others (*see chapter 6*). They were using Nile silt clays mixed with local sediments, chaff and carbonates for local manufacture (*see chapter 5*) rather than marl clays.

Fabric nomenclature

The fabric type used for utilitarian ware at Karanis was made of Nile silt clays, local sediments and carbonates such as limestone (*see chapter 5 and 6 for details)*. The local utilitarian pottery studied for the purposes of the present dissertation relates to the Late Roman Period.[10]

Pottery classification in Egypt usually more or less follows the Vienna System (Nordström and Bourriau 1993: 168-182). In modern times as well as in antiquity, a multitude of settlement-specific variations of mixed clays leading to diverse fabric groups are noticed. This fact is also attested by Bourriau and colleagues (2000: 122). The Vienna System allows for an array of Egyptian fabric types to be represented and brings in uniformity in classification of Egyptian pottery. However, it is essentially a non-site specific classification scheme (Bourriau et al 2000: 122). To discern communities of potters and transmission of knowledge using locally produced ceramics at Karanis, it was crucial to use a site-specific classification. Therefore, while classifying only 'locally produced pottery' at Karanis, I have avoided the Vienna System nomenclature. The study by the University of Berkley (Redmount and Morgenstein: 1996 741) on modern Egyptian pottery also proves that some of the clays from the Fayum (naturally mixed or other sediments not associated with the groupings given under the Vienna System) form a type not present in the Vienna System.[11] This was probably true in antiquity too as indicated by the published Oxyrhynchus pottery leases, which show that Nile silt clays and desert marls with

[10] The ceramics have been dated on the basis of Late Roman amphorae and other fine ware found in the archaeological strata dating to the Late Roman period.

[11] The university of Berkley (Redmount and Morgenstein: 1996: 741) identified the following fabric types in Egypt: these were pottery manufactured from: (1) Nile alluvial sediments containing mica; (2) marl clays rich in calcium carbonate obtained from desert marl; (3) purposely mixed clays (nile silts with primary or secondary marl clays); (4) mixtures of Nile silts with purposely added carbonate materials; (5) kaolin clays obtained from Aswan with a distinct pink appearance; (6) Pliocene clays and (7) naturally mixed or other sediments not associated with the above groups. These groupings are well established and in use by most archaeologists (*e.g*. Tomber: 2006; Nordström and Bourriau 1993).

carbonates such as limestone were mixed during the Roman period (Cockle 198). There is also ethnographic evidence supporting the mixing of clays. At El Nazla, Fayum, the potters state that they mix Nile silt clays with marls or powdered shell for certain vessels. Thus, instead of classifying the local Karanis fabric types in a general classificatory table applicable for Egypt as a whole, I thought it best for the local types to have their own site-specific classification. The classification was made on the basis of presence of carbonate and organic temper using visual and spot chemical tests (*see chapter 5*).

At Karanis, I label the local fabrics as local plain and local organic clays. The local plain types are Nile silt clays mixed with desert marls and other local sediments found at Karanis. The fabrics have natural occurring carbonates, deliberately added carbonates or fillers and fabrics with a complete absence of carbonates. [12] The local organic fabrics at Karanis are Nile silt clays mixed with desert marls, local sediments (not determined in the Vienna system) and heavily tempered with chaff and chopped straw, visible both on intact surfaces and in fresh breaks. Chaff and straw temper are still employed in the Fayum for the production of vessels such as the *Zir* (a water pot) and the *Bokla* (bulbous water pot). The addition of such coarse material into the clay allows relatively slight vitrification; water is able to permeate the fabric and evaporate from its surface, and keeps the water cool and fresh. Further, with the addition of coarse temper during the process of manufacturing, water is able to escape as steam without damaging the vessel. Such a fabric is also desirable for cooking because it is able to withstand thermal shock due to differential expansion (Bourriau et al 2000: 124).

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[12] Fillers are determined by number, angularity or size- if larger than clay/silt size fraction (*see chapter 5 for details)*

The identification, classification (based on fabric, form, function and origin) and analysis of all other fabric types (*see table 1-2 below*) except the two local types from Karanis follow the Vienna System and were identified along with Roberta Tomber.[13]

Ceramic types attested in Karanis[14]		
Name	***Description***	***Provenance***
Local plain ware	Pottery made of local silt with carbonate temper	Karanis (evidence of wasters and with vitrified material)
Local organic ware	Pottery made of local silt with organic temper (threshing remains)	Karanis (evidence of wasters and with vitrified material)
Nile silt ware	Pottery made from silt from along the banks of the Nile river	Not produced at Karanis, but made all over Egypt
Marl ware (from the shale and limestone along the Nile valley)	Pottery made from the marl deposits along the Nile valley	Not produced at Karanis, but in Middle Egypt (present day Ballas)
Aswan ware	Pottery made of pink and orange firing clay	Not produced at Karanis, but in Aswan
Egyptian Red Slip (ERS)-A	Red-slipped pottery	Not produced at Karanis, presumably in Aswan
Egyptian Red Slip (ERS)-B	Red-slipped pottery	Not produced in Karanis, but from production centers along the Nile valley
Dressel 2-4 Egyptian Amphora	Occurs in a variety of fabrics identical to the	Not produced at Karanis, but attested at

[13] Ceramic specialist and Research Fellow at the British Museum.

[14] The fabric names listed in the table are commonly used by ceramicists in Egypt and the Mediterranean and comprise a mix of classification categories.

	Campanian and Catalan fabrics	production centers in the Nile valley
Égyptienne Amphora 1-3	Reddish brown	Not produced at Karanis, but attested at production centers around Lake Mareotis
Egloff 172	Dull brown	Not produced at Karanis, but attested at production centers in the the Nile valley
African Red Slip	Orange-slipped pottery	Not produced at Karanis, but imported from Tunisia
Tripolitania amphora	Brick red in color with occasional black surface	Not produced at Karanis, but imported from Tripolitania
North African Amphora	White surfaced with brick red core	Not produced at Karanis, but imported from Tunisia
Late Roman 1 amphora	Pinkish cream to reddish yellow	Not produced at Karanis, but imported from the eastern Mediterranean especially Cyprus
Late Roman 2 amphora	Light buff to light red in color	Not produced at Karanis, but imported from the Aegean and Black Sea region
Late Roman 3 amphora	Deep reddish-brown	Not produced at Karanis, but imported from Asia minor
Late Roman 4 amphora or Almagro 54	Brown	Not produced at Karanis, but imported from Palestine/Gaza region

Late Roman 5/6 amphora	Pale yellow-orange	Not produced at Karanis, but presumably produced in Palestine and northern Egypt.
Late Roman 7 Egyptian amphora	Dull brown	Not produced at Karanis, but produced in workshops in Alexandria and also Carthage and Benghazi

Table 1-2
Ceramic types attested in Karanis

1.8. Chapter layout

Chapter 2 gives a brief literature review and an overview of approaches in the study of cultural transmission. This is followed by a discussion of concepts relevant in understanding cultural continuity and change from archaeological artifacts. I argue that cultural transmission needs to be addressed from a dynamic standpoint where the social and historical contexts are to be taken into consideration. In crafts such as pottery making, transmission can take place when the body is engaged with its social and material environment. The process should begin at a young age. I discuss the role of consumer behavior in impacting ceramic changes and shaping the learning processes in workshops. The degree of standardization in pottery production is explored as a possible means of understanding continuity and change. I conclude that cultural transmission center on family, society and daily practice.

Chapter 3 provides the history, background and relevance of core concepts such as theory of practice, communities of practice, *chaîne opératoire* and ethnoarchaeology, which form an essential framework for the present thesis. Each of the concepts is followed by a discussion on discerning 'practice'. The social perspective along with the concept of *habitus* aids in appreciating the importance of contexts such as a specific pottery workshop, which allows the shaping of knowledge and skill that is to be transmitted. Communities of practice allow an understanding of learning and its transmission within the workshops and the relation between the individual potters and the group. The concept of *Chaîne opératoire* aids in the conceptual understanding of the potters regarding pottery-manufacturing processes. Finally, ethnoarchaeology allows for an approach where the knowledge from modern communities of potters contributes to an understanding of ancient communities of potters at Karanis. The fieldwork method, which forms the basis for investigations in *chapter 4, 5 and 6,* is discussed in detail. The concepts of *habitus*, enculturation, daily practice, learnt from theory and observed in these modern workshops form the basis for discerning communities of potters in ancient Karanis. To discern communities of potters, a theoretical framework for classification and metric analysis is first provided. Modern communities of potters (along with insights into ancient ones) are discerned through interviews in *chapter 4*, through an analysis of the *chaîne opératoire* in *chapters 5* and through metric analysis in *chapter 6*.

Chapter 4 outlines the interview method to discern communities of potters. The highlights of this chapter are various interviews with potters in Egypt and India, as a basis to analyze nuances of learning, the ability to identify one's work and the role of customers in the processes of continuity and change. This is followed by a section discussing insights derived from the interviews and analysis of modern pots, which can be used to help discern ancient communities of potters from potsherds found in archaeological contexts. The chapter highlights the role of customers, enculturation, daily practice and allegiance to a particular workshop as being instrumental in learning from a potter's perspective. The common perspective of various potters is used as an inspiration for devising methods to understand archaeological ceramics. One of the important viewpoints is how the potters profess their ability to identify their work from others, pointing to the rim as the main identifier. The rim thickness is ultimately used as the main criteria for discerning communities of potters in *chapter 6*.

Chapter 5 presents data derived from both ethnoarchaeological and archaeological fieldwork, which are used to discern communities of potters by analyzing aspects organized through the *chaîne opératoire*. These aspects include space usage in pottery manufacturing areas, body posture, gestures, transitions and observations of actions and processes of pottery manufacture. I was to an extent able to differentiate between potters who worked closely together in one workshop from those who worked in other workshops. The insights further helped me in finding metric variations left on ceramics, which are a result of operational sequences specific to each workshop and are useful in discerning communities of potters. Using visual analysis and spot chemical tests of archaeological sherd cross-sections from different kiln areas at Karanis, I was able to discern differences in carbonate composition. These differences can be related to the processes of pottery manufacture where each workshop tradition uses its own recipe for tempering the clay paste. Through this method, I was able to differentiate sherds of similar archaeological vessels suggesting differences between different communities of potters at Karanis. By observing group patterns relating to space usage, gesture and body posture, and the observation of actions and processes for pottery manufacture, it becomes possible to understand that repeated practices performed in a structured group get deeply engrained and are difficult to alter. These practices reflect culturally and socially specific ideas of how certain actions relating to pottery manufacturing are to be carried out. The *chaîne opératoire,* which includes gesture and body postures relating to each stage and action of pottery manufacture, leads to the production of vessels that preserve embedded signatures of each workshop tradition.

C*hapter 6* starts with a discussion on the concepts of standardization, variability and variation followed by a section on the method to analyze variability within standardization (the theoretical framework for metric analysis is provided in *chapter 3*). I conducted experiments to show similarities and differences within and between workshops by measuring variables such as rim thickness and rim diameter and subjecting them to the tests for coefficient of variation. I conclude that there is rim thickness variability in similar vessels and that each workshop follows a 'range of variability' within morphologically standardized vessels. I also conducted experiments to verify the statements of potters that they can identify their work from other potters by the rim of the vessel (all vessels being of the same type). The results prove that the potters are indeed able to identify their own work and discern it from others on the basis of the rims. The ability to identify the work of potters through rims highlights the role of enculturation, daily practice and *habitus* in pottery workshops. The rims are therefore instrumental in discerning communities of potters.

In the kiln areas at Karanis, I undertake frequency counts of body sherd types to evaluate the clay fabric relating to local production (supported by evidence of wasters).[15] The local utilitarian

[15] See chapter 6 for discussion of kilns being indicators of workshop areas (Eleni Hasaki 2002 PhD dissertation)

ceramics turn out to be the most ubiquitous types produced at Karanis. Gaining insights from the method employed in the ethoarchaeological context, I use rims as the identifying feature to discern communities of potters at Karanis by grouping similar rim sherds from the surface areas of known kiln areas and conduct frequency counts. I then choose the frequently occurring rim types common to all kilns areas. In order to understand transmission of skill and discern communities of potters, the rim type selected from the ceramic corpus at Karanis had to 1) represent locally produced vessels having similar forms and 2) be common to all kiln areas. Rims of jars, bowls, cooking pot and casseroles were the most common types found in the kiln areas. Out of these, I chose the cooking and casserole rim types, as notions of value or exclusivity affect these types the least. For example, in a modern home, we do not display kitchen utensils or show them off to people but display dinner ware, which is valued and meant for special occasions. These common types were subjected to the coefficient of variation tests. When potters work together, their individual 'range of variability' will be closer to each other than the individual 'range of variability' of potters working in other workshops. By observing the distance of values of variability within standardization for similar vessel types in specific workshop/kiln areas, it becomes possible to evaluate transmission of skill at Karanis. In *chapter 6, section 6.2,* it becomes clear that there is differentiation between workshops making morphologically similar vessels. The 'range of measurements or variability' of similar types sometimes overlap, leading to the blur effect (discussed in *chapter 6*), therefore, the values for the coefficient of variation for certain variables, which appears to be specific to each workshop, are better indicators for finding communities of practice at Karanis. The morphology of the cooking and casserole rim types in all kiln areas and the related main stages of the *chaîne opératoire* appear to be common and culturally salient (shared by the community of potters) but the visual, chemical and metric analysis of these rim types on the basis of rim diameter, rim thickness and wall/neck thickness (*see chapter 5 and 6*) indicate differences due to influences of enculturation, daily practice and *habitus* specific to each workshop.

In *chapters 4 to 7*, I set out to discern different communities of potters at Karanis, utilizing insights from my research in modern pottery workshops in Egypt and India. I conclude by stating that understanding transmission of skill and the influence on continuity or change using domestic utilitarian ware at Karanis is demonstratively possible.

Chapter 2

Cultural Transmission, Continuity and Change

This chapter gives an overview of approaches in the study of cultural transmission followed by a discussion of concepts relevant in understanding cultural continuity and change from archaeological artifacts.

Archaeologists employ seriation of ceramic variation and style as a relative dating method. However, instead of just using ceramics for chronologies, it would perhaps be worthwhile to ask questions as to why and how regular change in ceramic types actually occurs and what this reveals about ancient society. The transmission of culture from one individual, group or generation to another takes place in every human society. Transmission is a necessary process to maintain culture (Schonplfug 2009: 9) and the mechanism of transmission is the subject of several disciplines, such as anthropology, psychology, evolutionary biology and education to name a few. We learn culture as a routine that is shared and passed on from generation to generation (Lancy 1996) and a family, society, and daily practice play an important role in determining how culture is transmitted and maintained.

2.1. What is culture?

Edward Taylor (1874:2) defined culture as a complex whole that includes knowledge, belief, art, law, morals, custom, and any other capabilities and habits acquired by man as a member of society. Culture has also been defined as "man's extra-somatic means of adaptation" (Renfrew 1994: 1). Culture is not merely nature expressed in another form but has been characterized as the opposite: where culture gets embodied as meaning (Sahlins 1976: 209). William McGrew

(2004) attempts to establish criteria for culture and mechanisms for the study of culture exhibited by both humans and primates. According to McGrew (2004: 21) the definition of culture should have the following essentials: that it is socially learned, normative and collective. An important component of human culture is social learning: learning influenced by the observation of, or interaction with, another individual or an individual's product (Derex et al. 2012: 1). "Culture is information capable of affecting individuals' behavior that they acquire from other members of their species (humans and primates) through teaching, imitation, and other forms of social transmission" (Richerson and Boyd 2005: 5). Schonpflug (2009: 2) labels traits as "cultural" if they are acquired by processes of non-genetic transmission such as imprinting, conditioning, observation, imitation, or direct teaching. Thus, as Lancy (1996) suggests, culture is indeed a routine that is shared and not genetically embedded. Cultural transmission is the process through which cultural elements reflected in attitudes, values, beliefs, and behavior, are transmitted and taught to individuals and groups (Taylor and Thoth 2011). Primates are seen to have a culture too but what makes our human culture unique is the *ratchet effect*, which is characterized by a generational modification of behavioral traditions, characterized by increase in complexity and utility (Tomasello et al 1993; Kensayers and Lovejoy 2008: 98). Culture allows us to describe differences in human behavior throughout the world. We are defined by our culture, yet when it comes to pinpointing cultural roots and explaining cultural preservation or demise, we are often unable to do so because cultural assumptions and associated practices are largely taken for granted and left unexamined. The study of cultural transmission focuses on concrete answers to continuity and change. In the next few chapters I have attempted to view cultural transmission on a microscale, subsequently linking it to macroscale processes of continuity and change, using the ceramic corpus from Karanis, Egypt.

2.2. History and background

Cultural transmission studies have had three main theoretical approaches. The first was developed in the late 19^{th} and early 20^{th} century when Lamarckian philosophical thinking dominated. The philosopher Lamarck, and authors in the same school of thought mention the concept of inheritance of traits and their consequent evolution. However, these concepts were explained in the context of understanding evolution in a biological sense.

Malinowski (1922) viewed culture as functioning to meet the needs of individuals rather than society. Foucault (2001: 173) described culture as "a hierarchical organization of values, accessible to everybody, but at the same time the occasion of a mechanism of selection and exclusion". According to Jerry Moore (2009), Boas rejected these evolutionary approaches and took the idea of culture as a historical process based on interaction and ideas of diffusion. His views on cultural transmission lacked an emphasis on causation in history, the role of individual and agency (Verdon 2007:447).

The second approach was developed from the 1950's onward and considered transmission studies from a social psychological perspective. The Francophone tradition of Leroi Gourhan and Marcel Mauss focused on how the techniques of production are learned and transmitted. Mauss (1934) along with focusing on body techniques was also interested in the concepts of the person and contributed to a historical analysis of cultural transmission. Lemonnier (1986; 1992; 1993) and Sigaut (1987; 1993) further expanded their work on the techniques approach where technology is explained as an integral part of culture and society that brings about physical interaction leading to transformation of matter. The theories of the materiality of identity and agency explained in terms of culture and society (Dobres and Hoffman 1994) are examples of this approach.

The third approach features contributions from biology and population genetic models. Several schools of thought apply evolutionary methods to the examination of culture. Selectionists compare artifacts to human phenotypes, explaining artifact variation through natural selection and drift (Dunnel 1989; Lyman and O'Brien 1998; Stark et al. 2008). The most popular theory, based on more than thirty years of research, is the gene-culture or dual-inheritance theory advocated by Cavalli-Sforza and Feldman (1981) and Boyd and Richerson (2005). The dual inheritance theorists use both anthropological and evolutionary theories. According to them cultural evolution includes certain processes that selectionists leave out in their focus on biological evolution and consider cultural transmission to be driven by individuals' decisions to imitate the behaviors of other individuals based on imperfect knowledge of a trait's usefulness and other possible biases (Stark *et al* 2008: 6). Within the framework of gene-culture or dual inheritance theory (Cavalli- Sforza and Feldman 1981), vertical transmission is said to operate between parents and offspring; horizontal transmission allows transfer within a generation or peer group; oblique transmission allows transfer from an individual to a member of a different generation who is not a direct descendant. Thus, according to Cavalli- Sforza and Feldman (1981) three vectors of transmission enable transfer of knowledge. Even though scholars such as Cavalli-Sforza, Feldman, Boyd and Richerson (1985) note that social orientations[16], skills, and knowledge are similar in successive generations and not entirely tied to genes but they continue to focus on only genetically related generations.

[16] Here, social orientations mean habits that we inculcate by virtue of being in a particular culture.

The usage of the term dual inheritance for both genetic and culture transmission is misleading as both follow very different trajectories. Stark is of the opinion that other theorists employing evolutionary methods which include the human behavioral ecology school, focus on the relationship between behavioral strategies and ecological circumstances, but they do not take into account drift or mechanisms by which differences can arise (Stark et al. 2008: 19). Social theorists and evolutionary theorists differ in the explanations they offer for cultural similarities and differences. The former see similarities and differences as being meaningfully constituted i.e. conforming to the behavior of people in their own groups and differing from others as studied strategies for negotiation and social identity (Stark et al. 2008; 9). The latter see these differences and similarities arising due to innovation, random change, and imitation. Social norms are considered unintentional byproducts (Stark et al. 2008: 9; Richerson and Boyd 2005).

2.3. Cultural transmission: a dynamic view

In my opinion, assigning processes of cultural transmission to limited categories, as vertical, horizontal, or oblique pathways of transmission may not be the best approach. Also, multiple processes of transmission are not mutually exclusive; they operate simultaneously in a single context and/or may be crucial at different stages of an individual's lifetime (Stark et al 2008: 7). Factors such as economy, politics and geography also influence cultural traits of people (Boas 1974: 187). Cultural transmission, viewed from such a standpoint, is dynamic and influenced by the social and historical contexts in which it takes form. Hence, cultural transmission needs to be approached in a way that incorporates these other influences.

Boas in his work mapped historical links between cultures showing diffusion; but he did not explain why people borrowed these cultural traits. As stated earlier, his views on cultural transmission lacked an emphasis on causation in history, the role of individual and agency (Verdon 2007:447), elements that are crucial in understanding the pathways of transmission. Research on style and social boundaries has helped in understanding variability in the materialization of social identity and its relationship to the transmission of "ways of doing" (Stark et al 2008: 3; Hegmon 1992, 1998; Stark 1998, 2003). Ceramic stylistic patterns have been explained through learning frameworks and intergenerational transmission especially in the North American Southwest (Stark et al. 2008:3). Studies of situated learning (Lave and Wenger 1991; Minar and Crown 2001; Wallaert-Pêtre 2001; Rogoff 2011), craft skill learning (Shennan and Steele 1999), learning and apprenticeship in an ethnoarchaeological setting (David and Kramer 2001:311-21) and particularly the "processual plus archaeology" (Stark et al 2008: 3; Hegmon 2003) incorporating the use of *habitus* and practical knowledge (Bourdieu 1977) are examples of approaches that are rooted in the social sciences and humanities. Practice theory in particular emphasizes the relationship between practice and social reproduction (Lurhmann 1991; Stark et al 2008: 4).

2.4. Transmission of skill and knowledge

According to Sigaut (1993:3-5) the term knowledge means explicit knowledge while implicit knowledge is termed skill. He parallels the concept of knowledge to that of information where one mentally acquires information, stores it in the memory and retrieves it when needed. Sigaut defines skill as having the ability to identify and getting rid of irrelevant information quickly and effortlessly. However, when we deal with knowledge of a craftsperson, it involves a "high level of abstraction"(Sorenson and Salisbury 2012:4). The craftsperson visualizes the end product, which requires knowledge about the properties of tools and materials as also the manual skill to put the visualization into practice. Skill is knowledge that is part of the body, draws on cognitive and motor activities, improves with practice and involves bodily engagement (Bleed 2008:157, Mauss 1973, Olausson 2008: 36; Sennett 2009: 10, Kuijpers 2012: 138).

For example, among the Balinese dancers, instruction of learning is visual rather than verbal; it proceeds with the master moving the arms and the body of the students so that they come to embody the proper gestures and movements (Bateson and Mead 1942: 84). Similarly, the craftsperson situates his/her body into materiality thereby embodying knowledge. The engagement of the body with its social and material environment in a specific community of practice aids in the transmission of knowledge (Kohring 2012: 11). Thus, tacit or embodied knowledge passed on by action satisfies the understanding of transmission of knowledge and skill in the context of a craftsperson.

2.5. Change and continuity

My research started from the premise that there is a connection between transmission of culture and the ways in which knowledge and skill are transmitted as well as with the level of change and continuity in the knowledge that is transmitted. While culture is dynamic and active, changes do not progress in a linear fashion, but are rather built and adapted based on what is provided by previous generations, in light of new ideas and circumstances. Thus, some practices ''spiral around'' or "get recycled" in a new form (Rogoff 2011: 211).

To explain change and continuity in the past, it is apt to first illustrate this with everyday objects such as clothes. Clothing, a feature of nearly all-human societies is not only intended as protection from the weather but it performs a large range of other functions, for instance showcasing gender, religion, social status, group belonging and perhaps the most important function of covering our nakedness. The realization that clothing trends fade in and out of fashion in each society can shed light on continuity, change and also the reason for choices.

Sir Flinders Petrie (1899) made use of varying pottery styles in his relative dating of artifacts by way of seriation or artifact sequencing to delineate periods in chronological order. Petrie's artifact sequencing could add light to the changing trends in clothing, explained in terms of continuity and change. Subsequently, we can ask questions relating to why a particular style in the history of clothing continues or changes; what are the influences; how are these influences transmitted; why is there continuity or why is change taking place at all? According to Bentley (2010), change is the very essence of the creative process; hence, change has to happen. In Braudel's (1979) view, change is fundamental and occurs at different rates. But then how can we measure change? In industries, the process of transmission is one of copying, in which creativity contributes new behaviors that eventually replace the old ones (Bentley 2010). We all witness continuity and change in our societies- an example is of the continuity of attire from the 18th century still worn by the Amish people in the 21st century; the change of attire by the women of Egypt from the 1970's when they did not use head coverings to a time when most women cover their head due to social reasons; the use of the bulky telephone instrument for a decade and the change to a cordless digital version in the next decade. Similarly, pottery exhibits continuity in forms, shapes and function, but also witnesses gradual change and development. The feedback prompting continuity or change emanates from our society, therefore, continuity of a tradition and change are social phenomena. Buchanan (2007) suggests that to understand social phenomena one needs to consider patterns of interaction. In my view, a careful examination of patterns in vessel dimensions gives clues to what exactly causes change and continuity. I will deal with these patterns in detail in *Chapters 5 and 6*.

Social interaction and the processes of learning have an effect on "conservation of" and "change in" material cultural traditions (Minar and Crown 2001). It is important to define the sources of cultural variation to understand continuity and change. According to Stark et al. (2008) we should consider human error in copying, cognition, and social processes as some of the sources. Other sources of variation include contact with other cultures, innovation, gradual changes in craftsman production and changing requirements of consumers. Artifacts are created and interpreted by people and embody classificatory and organizational principles (Miller 1985).
Differences in *habitus* (Bourdieu 1977) reflect boundaries and arise from unconscious structures that are less susceptible to conscious manipulations (In *chapter 3,* I discuss the concept of *habitus* in detail under the theory of practice). I have learnt from my fieldwork that when potters in a community manufacture the same type of vessel, the form and size of the vessel's rim can allow the observer to delineate different workshops. To elaborate further, forming the rim is a phase in the production sequence of the pot where individual potters are consistent and are controlled by the *habitus* of the specific workshop where they work. Thus, there is variation between potters and workshops. Metric variation of the rims that fall within a specific range of measurements can be related to a specific workshop and the products of the artisans are characterized by those measurements. Learning takes place within the group through social tools such as enculturation, interaction and daily practice. Thus, investigations into the *habitus*

centered or social learning boundaries can potentially help in understanding continuity and change in ceramics.

Understanding the nature of interactions within these *habitus* centered differences is crucial for my study. As I previously showed (Gupta-Agarwal n.d), we often can identify cultural traits (such as subtle actions, behaviors at the micro level) for the pace of change in a community. Here I use ethnographic work from the *Dii, Duupa, Doayo* and *Fali* people of Cameroon (Wallaert-Pêtre 2001) to illustrate this.

1. Among the Dii, Duupa, and Doayo, apprentices in pot making are essentially taught over a period of seven years in a segmented fashion. This is a stage- by-stage instruction of the production process. Learning is by observation and imitation with no room for the independent questioning mind to express itself (Wallaert-Pêtre 2001).
2. The Fali people teach the entire pot-making process at once. Students take two years to fulfill the apprenticeship period. Teachers encourage learning through observation and imitation, coupled with questioning and experimentation (Wallaert-Pêtre 2001).

Wallaert-Pêtre (2001) contends that where transmission of learning involves careful guidance by a skilled teacher emphasizing replication, the finished products of the apprentices reveal little variation or difference from ceramic products manufactured by the previous generation. This is ceramic evidence of 'continuity' in tradition. The consumers prefer continuity, and this preference impacts the rigid teaching/learning process. Teachers permit no questioning, and learners concentrate on perfect, error-free replication. Where transmission of learning involves less direction and more experimentation, we see greater innovation and hence increased variation in the end products. In the ceramic style of the Fali people, rapid changes are prompted by this kind of an instructional framework. Here, the consumers also prefer change and do not value old traditions thus impacting the teaching/learning process allowing for change. Likewise, other ethnographic contexts also prove that when the apprentice is under the strict tutelage of the instructor, the finished products appear very similar or standardized (Roe 1995:51). My postulate, therefore, is that teaching and learning can be rigid (tightly controlled) or flexible (yielding). Skilled potters give students varying "degrees of freedom." The degree of freedom has a long-term effect on the development of ceramic styles. The behavior of the consumers also influences the reasons behind a particular choice made by the teachers coupled with a subtle interplay of consumer demand and production culture that stimulates innovation and change.

According to Derex and colleagues (2012:1), there are two types of social learning namely product-copying and process-copying. The product-copying individuals are learners who find the means to achieve the outcome on their own; the process-copying individuals are those who learn the means to achieve the outcome (Derex et al. 2012). In their findings conducted in a laboratory environment at Montpellier, individuals from process-copying groups were seen to outperform individuals from the product-copying groups or individual learners. In an ethnographic context, such a divide is not feasible. It is my experience that seasoned potters are both adept at process-copying (stages of pottery making) and product-copying. Potters and other persons in traditional crafts are taught the entire process of a craft over the years; they are also taught how to make a particular artifact. Thus, they employ a convergence of both process and product-copying rather than a divide. The difference between learners lies in the subtle variations, a trademark of the specific workshop where they learnt their skill. Belonging to a specific community of practice is the key to understanding performance mechanisms. Hence, an approach using the concept of *habitus* is at the basis of my thesis.

2.6. Consumer behavior

Consumers expect a specific product and only buy from the producer what matches this expectation. Consumers not only impact ceramic changes, but they also potentially shape the learning process for a "specific ceramic functional type." To illustrate, a "functional type" can be a cooking pot, encompassing many types of different cooking pots, while a "specific functional type" can be a cooking pot with a specific rim shape. If the consumer is looking for a specific type of pottery and demands standardization, then the producer (master potter) will create a standardized output. This consumer demand prompts rigidity in production and a high production rate of the 'specific functional type', saving time and effort.

Standardized production implies that the craft is carried out by a group of individuals utilizing a limited range of materials and somewhat formalized or routinized techniques that result in identical procedures focused on replication such as mass production (Rice 1987: 202). As a result, standardized and thus, specialized ceramics reflect little heterogeneity in composition and appearance (Rice 1987: 202). According to Rice (1987: 202), there is reduced variability in specialized pottery production. The degree of standardization may be assessed through an analysis of individual pottery workshops, raw material recipes, manufacturing techniques, form, metric dimensions, and surface decoration. Does standardization, therefore, lead to long- term continuity? The answer in most cases is affirmative: the production of amphorae in the Mediterranean, for instance, is a good example of continuity of a particular form that stays virtually identical in both shape and size for long periods (Peacock and Williams 1986).

Part of consumer behavior are driven by consumption demands that need to be understood as part of analysis of the type and scale of production (Costin 1991: 3). Further, the availability of a certain type of clay demanded by consumers to be used in manufacturing, the proximity of this clay source to the producers' workshop, and the distribution of vessels may help in inferring the catchment area of transmission. The pattern of distribution gives insight into social constraints (Hodder 1979) and sheds light on the political and economic influences. Thus, production of vessels does not occur in isolation but is embedded in political, social and/or economic systems (Costin 1991).

Ceramic forms and styles undergo change due to several variables including technological developments, changes in function, fashion and personal taste. Another variable of consumer behavior that plays a crucial role in transmission is performance. According to Schiffer (2005), performance can be defined as the functionality of an artifact. Here, I use performance as the functionality of a manufactured vessel. If the vessel does not fulfill the required function, for example, a cooking pot shatters each time when placed on the hearth, the consumer would reject this particular pot and look for one which does not shatter. Thus, when performance differs, the consumers' choice or selection also varies (Schiffer 2005). This selection has a boomerang effect wherein the producer of the artifact has to consider the choice of the consumer and make appropriate changes. When performance generates negative feedback, the craftsperson generates variants. From these newly generated variants, the consumer selects the one that performs better and mitigates the negative feedback. It is reasonable to assume that the craftsperson would choose to replicate only those artifacts that are successful in living up to the expectations of the consumers and are sold, after all a full-time craftsperson has to make a living. This process of artifact production whereby new variants are created in answer to performance problems and negative feedback leads to new types in the archaeological record. An object that received negative feedback prompts the craftsperson to rethink and assess his/her strategy. Thus, the craftsperson can impart knowledge based on new influences triggered by the feedback, thereby affecting the teaching/learning process. It needs to be tested whether through the influence of these performance issues one can assess how feedback affects continuity or change. I will illustrate through fieldwork interviews in *Chapter 4* that positive feedback or acceptance of a product is one of the factors that allows for the continuity of craft and very slow change, while a negative one or rejection of a product leads to rapid change and both influence cultural transmission.

So far I have discussed mainstream approaches in cultural transmission studies, introducing debates on the effect of transmission, effects on continuity or change and related concepts. My own views on cultural transmission center on family, society, and daily practice and are very much in agreement with John Roberts (1964) take on culture.

Roberts (1964: 438-437) considers culture as information and any single culture as an "information economy" in which information is received or created, stored, retrieved, transmitted, utilized, and even lost. The greater the informational store, the more complex and efficient the retrieval mechanisms are likely to be. The acquisition and use of socially acquired information is assumed to be profitable to individuals as it allows them to avoid the costs, in terms of the effort and risk, of trial-and-error-learning (Derex et al 2012: 1). Roberts (1964: 438-447) adds that children are viewed as "storage units [that] must be added to the system…as older members of the society disappear". This points to the importance of information or knowledge and skill that need to be transmitted from a young age especially true in the context of craftpersons.

In order to understand the workings of socially acquired information, one needs to gauge *how* transmission of a craft such as pottery happens and *where* it is staged. This brings us to a discussion of, theory of practice, communities of practice, *chaîne operatoire*, and ethnoarchaeology addressed in the next chapter.

Chapter 3

Practice theory, *chaîne opératoire* and ethnoarchaeology

The chapter starts with a brief definition, history and background of several core concepts followed by a section detailing their application in my research.

3.1. Theory of practice

In everyday life, people influence and in turn are influenced by their social structures. In my thesis, I am trying to understand what are the daily social circumstances that influence a potter in a workshop (implicit and explicit), how these affect the knowledge/skill that is transferred, and how do these influences and processes help in understanding continuity and change in archaeological ceramics. The theory of practice espoused by Bourdieu (1977) is a social perspective that allows analysis of people within an established structure. Meaning, knowledge and the ontological perspective of that social structure are shaped by contextualized embodied experiences and the creation of habitual practices (Kohring 2013: 106). Other scholars like Luhrmann (1991: 321) have explained ideas about the world becoming persuasive as a by-product of practice through the concept of interpretive drift.

The key term in Bourdieu's theory of practice is the concept of *habitus*, inspired by Marcel Mauss' (1934) notion of body technique and dispositions. Bourdieu poses that permanent dispositions are "'schemes of perception and thought', extremely general in their application….and also, at a deeper level, of the form of bodily postures and stances, ways of standing, sitting, looking, speaking, or walking". (Bourdieu 1977: 15)

The importance of stances such as gesture and speech can be illustrated with two personal examples,

1) Gesture: while looking through a family photo album I noticed that in certain pictures, female members of my maternal side of the family have a habit of covering their mouths with the hand while seated (see *figure 3-1*). The gesture is a reflection of sadness. However, my paternal side of the family does not exhibit this trait.

Figure 3-1
Maternal grandmother is seen with her hand covering the mouth
Photo taken in 1984 by a relative

2) Speech: both my sister and I say the word “saafai” (Hindi for cleaning). The correct diction for the word is ‘safai’ (single a). However, my entire maternal side pronounces the word with a double a, “saafai”. These two habits (gesture and speech) are

considerable parts of my growing up when I spent years with my maternal relations and not my paternal ones. According to Mauss (1934), body knowledge and techniques are highly developed actions of a given culture and are learnt. The body is the main medium for learning about how to think, do, and practice (Sorenson and Salisbury 2013: 2). When practices become embodied knowledge, they come to inhabit and affect the body as motor skills and practiced way of doing things (Sofaer 2006; Sorenson and Salisbury 2013).

In contrast to body knowledge, conceptual knowledge is abstract in nature, and reflects the cumulative insights and experiences of various individuals (Brown et al. 1989: 33). Bodily and conceptual knowledge are integral to crafts such as pottery making and cannot be separated because both are embedded in and reflective of the culture where they take form. In order to learn how to use both body and conceptual knowledge, one has to become a part of a structured group. Thus, both tangible and intangible knowledge get transmitted between individuals within a framework that defines the group, and which allows its members to view the world in a specific way.

Habitus in subjectivism and objectivism

Bourdieu developed the concept of *habitus* to unite social phenomenology (subjectivism- based on mental experience) and structuralism (objectivism- based on social structures) rather than to view them in isolation. Once the two spheres (subjectivism and objectivism) are united, one can think about influences in relation to each other (Grenfell 2008).

In a social setting, like that of a pottery workshop, knowledge, skill and culture are transmitted in daily practice. It is the basis for social differentiation where both personal and cultural dispositions come together (Wendrich 2012: 3). Studying such a setting allows the analysis of knowledge transmission and the relationship between teaching/learning and continuity or change.

Habitus in the regulation of behavior

Bourdieu (1994: 65) states "all of my thinking started from: how can behavior be regulated without being the product of obedience to rules". *Habitus* contains in it, a "structured and structuring structure" (Bourdieu 1994: 170). It is "structured" by ones past and present circumstances. It is "structuring" as it helps to shape practices in a cohesive way. It is a "structure" in that it is not random but has an order. According to Throop and Murphy (2002: 198), Bourdieu's take on subjective experience within this structure leaves social agents at the whim of the structure, where the treatment of the social actor becomes difficult to comprehend. To address social action, they recommend "ground anthropological research in systematic phenomenological investigations of those structures of consciousness that contribute to the pattering of the experience, the attribution of meaning, and the cultural constitution of the life-world" (201). In the Cameroon example illustrated in *chapter 2,* teaching pottery making in the long term allows the students to be predisposed to certain patterns of behavior; this behavior gets transmitted when the students inculcated in that behavioral tradition become teachers themselves resulting in replication of regulated behavior through practice. Furthermore, the context allows transmission, as it too is a part of the *habitus*. This structure has within it a system of dispositions that generate perceptions, appreciations, and practices (Grenfell 2008). Thus, *habitus* is created through a social process, rather than an individual one, and leads to patterns that are enduring (Navarro 2006: 16).

Each of these structures is different even though they have overarching similarities being from the same culture. To illustrate with an example: Roberts (1951), studied the Navajo as one culture and expected similarities in their knowledge, skills and material culture. However, what he found was overlap and variation and he could not understand the reason for considerable variation in one culture. Lancy (1996: 28) reexamined the research and came to the conclusion that the even though the Navajo was one culture, there was variation because Navajo culture meant something slightly different in each of the households. The information regarding Navajo society was distributed over many individuals; therefore, each household had a specific way of doing things within the larger Navajo cultural context (Lancy 1996: 28). Similarly, in Karanis in antiquity, smaller groups of potters would have had their own specific way of enacting and understanding body and conceptual knowledge, which would have been transmitted within the larger common cultural context of the community of potters.

3.1.1 Discerning practice

Habitus includes the collective set of practices and habits in which an individual and the group he/she belongs to participate on an everyday basis. It embraces factors such as knowledge, aspects of time, space, and socio-cultural fellowships (Høgseth 2012: 69). According to Høgseth (2012: 70) the cultural fellowship, which includes "language, social belonging, familiar conditions, and individual similarities and differences, makes the *habitus* of every person unique." Bourdieu (1998) describes the individual having the 'feel for the game' in the space where unwritten rules of the game are enacted. This enables individuals to improvise in response to the circumstances of the moment. *Habitus* is communicated through *hexis* or disposition (Mauss 1934) (discussed earlier), which enables communication through subtle body language, involuntary movements and imperceptible nonverbal communication. Therefore, transfer of knowledge “encompasses the entirety of operational sequences, mental models, appropriate behavior and involuntary gestures, within a social context” (Wendrich 2012: 4).

Thus, the theory of practice along with *habitus* provide a structural framework that can potentially help in discerning communities of practice relating to knowledge transmission of pottery manufacture. A specific practice may be assessed by gauging permanent dispositions transmitted within the group in the form of bodily postures and gestures (of the potters), perception and thought (the potters’ views) and the vessels produced (material markers), all parts of the larger *habitus*.

3.2. Communities of practice

In the context of craft production, the concept of communities of practice is an approach that enables us to understand the relations between the individual and the group, which reflects and is reflected by the production process (Wendrich 2012: 5). The concept of daily practice highlights the social and negotiated character of the explicit and the tacit; what is said and what is left unsaid; what is represented and what is assumed (Wenger 1998: 47).

The concept of communities of practice is relevant in understanding how learning, knowledge and skill are transmitted. Jean Lave and Etienne Wenger (1991) put forth their model of situated learning where learning involved a process of engagement in a community of practice. Lave and Chaiklin (1993: 5) argued that 'learning is ubiquitous in ongoing activity, though often unrecognized as such.' The interrelationship between social structures, situated experience, practice and identity all intersect at learning and therefore the social and individual are inseparable (Wenger 1998). To take an example of a potters' community: practices come into existence over time through sustained interaction and involve much more than technical knowledge or skill in pottery manufacturing. The community has particular ways of doing things (Wenger 1998: 45). Learning involves participation in a community of practice, in which participation 'refers not just to local events of engagement in certain activities with certain people, but to a more encompassing process of being active participants in the practices of social communities and constructing identities in relation to these communities' (Wenger 1999: 4).

In learning crafts, participation is an integral part of daily practice especially for new initiates because it allows them to observe how others conduct themselves. It gives a sense of how craft expertise is manifested in conversation and daily activities (Brown *et al*. 1989). Such participation motivates the learner to hone his/her skills creating a sense of identity with the group, which often consists of a hierarchy of crafts persons within the workshop. Observing others in the group making crafts is one form of learning but hands on experience coupled with regular practice in craft making is essential for an individual to truly 'learn through feeling' (Ingold 2000: 21-22). Transmission of knowledge also takes place through the process of imitation (Hill 1982). Repeated practice through play or imitation allows internalization. Another form of participatory learning is 'Legitimate peripheral participation', defined as a process that involves going from peripheral involvement to being a master in the craft (Lave and Wenger

1991). During my fieldwork at Nazla, a present day community of potters in Fayum, Egypt, the involvement of individuals with peripheral tasks commences at a very young age. Chores include getting water and clay from the levigation tank, kneading clay, placing vessels to dry in the sun, loading and unloading the kiln, and applying slip to the vessels. Rogoff (2011) suggests that children who are steeped in daily routines of community life learn to attend to the actions of others when compared to children who are segregated from adult activities.

In *Figure 3-2* below, A is carrying the small flowerpots (*khashbooha*) made by his father, S to be placed outdoors in the sun for drying. In *Figure 3-3* above, A is kneading clay for S. While A engages in peripheral activities, it saves time for S because he can concentrate on shaping pots at the wheel and reach his production goals. Peripheral activities such as placing pots, kneading clay require least adult involvement but hold importance in mastering the stages of pottery manufacturing. The child starts engaging with both bodily and conceptual knowledge. For example, the physical activity of kneading clay is crucial for the conceptual understanding of recipes and their properties (mixing of water & temper with clay).

(Figure 3-2)
Performing peripheral tasks (carrying vessels for drying)

(Figure 3-3)
Performing peripheral tasks (kneading clay)

Slowly and steadily after getting a grip on these routine activities, the child gets inducted in the process of vessel forming which requires more adult supervision. At this stage, the child has had considerable visual and auditory exposure to the processes of pottery production and has since implicitly learned these activities. The transition from peripheral involvement to core tasks is a learning curve that ultimately brings about mastery in a specific craft such as pottery. Thus, peripheral participation is also an initial form of membership and the interaction with a skilled individual makes the learning legitimate. The learning process in all includes not only the skills required to master the craft learning but also an enculturation in the group to understand the social cultural make up of the community in which the workshop tradition thrives.

Communities of practice have three core characteristics: mutual engagement, joint enterprise and shared repertoire. The first refers to sustained relations organized around an activity in which members of a group co-participate; the second is a negotiated regime of mutual accountability; the shared repertoire is defined as resources for practice that reflect a history of mutual engagement; this would include laws, tools, procedures, and stories (Wenger 1998: 73-84). Therefore, to understand learning in context, one has to investigate communities of practice with their teaching and learning mechanisms.

3.2.1 Discerning practice

The communities of practice have within them a shared notion of learning and disseminating the ways and means of knowing and doing things. The techniques and their bases are reinforced and routinized through the process of continued interaction. Wenger (1990) refers to the concept of sequestration or boundaries, which limits access to the activities shared within a community of practice. The sequestering process generates differences in practice between people on either side of the boundary.

The specific *habitus*, embodied knowledge, social context and practices enable a community of practice to develop its specific signature. This signature is passed down from potters working together to new initiates who join the group as apprentices. By analyzing the material expression of the signature, it is possible to discern specific communities of potters through archaeological ceramics.

3.3 Chaîne opératoire

As archaeologists, our task is to understand past societies through material culture. Leroi-Gourhan (1964) in his effort to design a better method to analyze technical phenomena developed the concept of *chaîne opératoire* or operational sequence, which focused on production processes, rather than the end product. The method "provides a useful framework for outlining agency by enabling a method to determine the choices made by producers at every stage of the production process and thus the variation that occurs" (Wendrich 2012: 257). The study of technical sequences allows an understanding of the society in which the technique originated, and also the social context, actions and cognition involved in the production of an object (Soressi and Geneste 2011). According to Lemonnier (1991: 16), *chaîne opératoire* cannot operate independently of the society that produces it and, therefore, every sequence is unique in its own way. The aim of *chaîne opératoire* is to understand the conceptual framework, technology and mental processes required in the manufacture of an artifact. Leroi-Gourhan (1964) realized that archaeologists could investigate the choices of the craftspersons and shed light on their cognitive perspectives.

The first phase of the *chaîne opératoire* is the conceptual transformation of raw material through selection and categorization; the final stage is the discard of the artifact (Read, 2007: 189). The *chaîne opératoire* of pottery manufacture as seen in modern day pottery workshops is illustrated in *table 3-1* below:

Phase	***Description***	***Example***
Procurement	The activity of pottery production is based on first obtaining raw materials, which includes a close source for water, fuel, clay and temper.	At Sheikh Ali, Egypt, water is available from a nearby canal; clay is procured from the banks of the canal; temper in the form of ash comes from the kiln while chaff is collected from the fields. Grain stalks from the fields provide fuel.
Preparatory	the aim is to make a paste that enables shaping of the vessel.	In Ballas, Egypt, buffaloes trample lumps of clay mined from the nearby mountain. This process allows occasional mixing of buffalo excreta allowing the clay to get more workable. After which, the clay is left in water tanks for levigation. In Fustat, Egypt, impurities are eliminated through levigation only, which allows large clay particles to sink to the bottom of the tank. In Amer, Rajasthan, impurities are extracted by sieving through a fine muslin cloth. The clay is then left to dry after which it is, usually, trampled to make it consistent. The clay is next mixed with temper such as ash, straw, chaff or cow dung (dependent on the function of the vessel) to aid in the manufacture. The clay is further kneaded to release all the air pockets.
Shaping	Shaping of the vessel takes place on the wheel or by coiling, pinching or molding techniques. At this stage too adding of temper takes place to keep a good ratio of water, clay and temper. Sometimes, half the vessel is shaped on the wheel and one-half is shaped by hand	In Nazla, the pot is made in two stages, the lower part is made by hand using the hammer and anvil technique while the upper part (the neck, mouth and rim) is made on the slow wheel. In Chedamangalam, Tathapilly and Korumullor, shaping takes place entirely by hand.
Drying (leather hard)	The vessel is placed in the sun and allowed to get dry until leather hard. The drying process may take a few days to a week.	In Tathapilly, the vessels are continually shifted during the course of a few days as too much exposure to sun or shade can ruin the vessels.
Secondary	If required, appendages such as	In Ballas, the potters add the handles after the

treatment	handles or spouts are added to the vessels.	leather hard stage.
Drying (bone dry)	The vessel is placed in the sun again to get rid of any remaining moisture	In Ballas, the water jars are placed outdoors in the sun.
Surface treatment	Surface treatments such as burnishing, incised decoration and applying slips take place before firing,	At a workshop in Dar-es-salaam, Qena, the potter burnished and applies a red slip
Firing	Vessels are fired in open fire pits or kilns (usually updraft kilns) using fuel that ranges from stalks of grain and dry branches in Egypt to coconut fiber in Kerala, India. The color of the vessels depends on the oxidized or reduced environments while being fired. The vessels are carefully placed in the kiln for optimum firing.	In Sheikh Ali, dry branches and stalks of grain while, in Kerala, coconut fiber is used as fuel in workshops. In Ballas, a pottery kiln can hold approximately 300 water jars and the firing lasts for 1.5 to 2 days. Once fired, the vessels are ready to be sold to consumers directly or through middlemen.
Post firing treatment	when breaks occur after firing, a wash is applied to hide the faults.	In Dar-es-salaam, slip is applied to the vessels after firing to hide breaks.
Use	Vessels are used by the customers	*brahm* or the cooking casserole is used in Qena and Alexandria for cooking fish; the *maatam* of Kerala is used for tapping coconut water which is then fermented to make *toddy* or alcohol
Re-use	Many of the vessels break over a period and get repaired or are reused in different ways	broken *ballas* jars are used as architectural fillers on rooftops while sherds are used as hop scotches by children in villages in India
Discard	Once the vessels get past the reuse phase, they eventually get discarded and complete their life cycle, the expansion of Gourhan's *chaîne opératoire*.	In archaeological sites, large quantities of sherds are seen strewn across the site.

Table 3-1
Chaîne opératoire of pottery manufacture

3.3.1 Discerning practice

Pottery production sequences can be used to define communities of practice. They represent the production stages, and provide information on the selection and preparation of raw materials; choice of the form and techniques for shaping clay pastes; modes of surface treatment, decoration, application of appendages; drying; firing; use; re-use and discard. Within these stages each community of practice will have its own characteristics and thus the *chaîne opératoire* can also be used to trace a specific practice. Daniel Miller (1985) studied social relations in Central India, where the caste system is adhered to strongly, by looking at variability in pottery vessels including the processes in manufacturing from a small village in this region. By focusing on various aspects of the pottery vessels, he brought together aspects relating to technology, function, style, symbolism and ideology and was able to understand social positioning of castes and their differences. Distinctions in practice are also created by differential access to technical and social knowledge. What is taught and what is learnt is specific to each group, and this plays a role in decision making at each stage of the production process. Different production patterns are a reflection of such specific practices.

Leroi-Gourhan (1964) highlighted the importance of gestures, body position and tool use in production processes. In an ethnoarchaeological setting, a detailed analysis of the production sequence and its associated bodily movements, gestures and tool use that are socially learnt can help in dissecting varied production processes. In the archaeological record, finding markers left on pottery vessels by bodily gestures, postures, tool use and other actions and stages of the *chaîne opératoire* could enable the discerning of practice between and within communities of potters.

3.4 Ethnoarchaeology

Gould (1980) used the term living archaeology for fieldwork conducted by an archaeologist in living societies. Kent (1987: 33-43) defined ethnoarchaeology as:

> The formulation and testing of "archaeologically oriented and/or derived methods, hypothesis, models, and theories with ethnographic data. Ideally, one starts with

archaeological research interests, goes to ethnographic data for formulation and/or testing of hypothesis, models and/or theories about these interests, and then returns to the archaeological record to implement the understanding gained from the ethnographic data.

David and Kramer (2001: 11) use the term to mean "ethnography for archaeology" where research includes an ethnographic component carried out with the analogical needs of the archaeologist. For them, ethnoarchaeology involves the study of production, typology, distribution, consumption, and discard of material things. They infer from patterns in material culture generated by environmental, material and socio-cultural variables. Ethnoarchaeology is also seen as the 'anthropology of techniques' advocating the significance of anthropological reflection on the social and cultural dimensions of material culture (Marciniak and Yalman 2013: 7). My own understanding of ethnoarchaeology is particularly influenced by the works of Leroi Gourhan (1965), William Longacre (1991; 1995), Kramer (1985; 1996) and Wendrich (1999). Leroi Gourhan (1965) recommended using anthropological data for understanding excavated material. William Longacre (1991:1; 1999:45) has worked extensively with the Kalinga potters in the Philippines and defines ethnoarchaeology as a study by archaeologists to investigate variability in material culture, its relation to human behavior and material culture, for use in archaeological interpretation. Carol Kramer (1985; 1996) studied modern potters in India and defines ethnoarchaeology as ethnographic fieldwork conducted for understanding the relationship between patterned human behavior and material culture by documenting sociocultural behavior that leave markers in the archaeological record. Wendrich (1999) studied basketry and recorded video footage of modern Egyptian basket makers to analyze actions, movements, working rhythm and workspace. Inspired by the work of the abovementioned authors, I have followed a similar course by deriving data from modern day pottery workshops to understand the behavior of the potters and the impact of this behavior on the vessels produced so as to more fully understand the production context of archaeological ceramics at ancient Karanis.

Analogy between archaeological remains and modern production, use or discard, is one of the central methods of ethnoarchaeological research. Analogy is defined as an inference that if two or more things agree with one another in some respects, they will *probably* agree in others (Webster English dictionary 2008). This *probability* can be utilized by ethnoarchaeologists to (re) construct the past as it provides a platform where interpretations can be formed and tested. By beginning with a known, one can figure out the unknown. Analogies aid in explaining the behavior, opinions and attitudes of people who are not present to explain these themselves. Therefore, analogy is a means to an end. It can provide a well-structured framework for interpretation of the archaeological record and how it came into being. Even though, analogy is an important tool, it does not provide any certainty (Gould 1980; Wobst 1978). Analogy is a form of inductive inference wherein all premises can be true, but the conclusions drawn from them may be false (David and Kramer 2001: 44). It is crucial that relevant questions, sources and subjects be chosen at the outset. For example, when one is trying to understand the working of an ancient kickwheel, an irrelevant source would be a modern electricity powered wheel. Sources aid in providing fragmented glimpses of the past; therefore, the relevance of time, the area being investigated and other aspects should be looked into critically before arriving at an interpretation of the research subject. In order to strengthen successive approximations of the past, it is important to establish the principles of connection, the considerations of relevance that inform the selection and evaluation of analogies (Wylie 1985).

Analogy in ethnoarchaeology

Ethnoarchaeology is considered a discipline, a method and a research strategy (David and Kramer 2001; Wendrich 2013: 191). According to Cameron (2006: 25) archaeological and ethnoarchaeological studies are interactive and reflexive. In addition to ethnoarchaeogical research, which is founded in archaeological questions, ethnographic analogies can also assist in the interpretation of archaeological data. According to Wendrich (2013: 205), to ensure a valid analogy, a sound ethnoarchaeological approach should include an evaluation of continuity and change explicitly and in their specific contexts. One of the goals of my dissertation research is to understand the processes of continuity and change. Even though the value of ethnoarchaeological analogs employed in the study of long-term processes is limited, ethnoarchaeology can still be used for developing models to be tested against the archaeological record (David and Kramer 2001: 53).

I use analogy by looking at relationships between known ethnographic behavior and observable material artifacts (pottery) to evaluate statements, models and assumptions, which are then applied to the archaeological record for testing.

The static archaeological record has embedded information that include techniques, motor and cognitive skills expressed through gesture and posture. In my dissertation, I go back and forth between the source (modern pottery workshops) and the subjects i.e., broken sherds found in modern workshops and in ancient Karanis, to understand the embedded production processes. Once these processes and their markers are understood, distinctions between communities where pottery manufacture is transmitted through practice may be found. There is a propensity for ethnoarchaeological analogies to lead to naïve conclusions but ethnoarchaeology allows us to understand the entire range of possibilities of particular phenomena that may appear similar to the archaeological record (Wendrich 2013:202).

As Wendrich (2013: 191) sums it up:

> Ethnoarchaeology is not a comparison between present and past, but between present (archaeological record) and present (current active society).

3.4.1 Discerning practice

According to Wendrich (2013: 195), it is crucial that we study facets of artifacts not in isolation but in the broader context of society. There are several examples of techniques and methods employed by scholars to do this. Longacre (1985) tagged Kalinga pots to assess their use lives; O'Connell and colleagues (1991) acquired data on activities noting down what people were doing; Valentine Roux (Roux and Corbetta 1989) used techniques of cognitive psychology to understand apprenticeship. Others have used films and videos to understand the *chaîne opératoire*. One example is a film made by our team researching the production processes of vessels made by women potters in the Pattanam region of Kerala, India (2012). According to Goodwin (1994: 606-633), every profession has an existing code or language that connects every individual within its specific community. Only those who have been professionally trained are entitled to speak this language. Thus, according to him, the code, highlighted events and the graphic representations are the 'professional vision'. Thus, a complex perceptual field can be understood in an analytical framework. I have followed a similar approach.

In the archaeological context, thousands of broken sherds are used for multiple interpretations such as chronology, site function, social status, or trade networks. Other research questions pertain to use-life of vessels by assessing breakage rates, effect of depositional and post-depositional processes. Often classifications and typologies are used for both intra and inter-site comparisons. When considering pottery sherds to trace communities of practice, the specific group that facilitated the transmission of knowledge and skill into manufacturing the artifact is brought into focus. My research enabled the definition of several groups or structures (pottery workshops) within the larger social space (Karanis and its community of potters) where each workshop had its own practice and which in turn also structured the constituents, i.e., the group. In other words, I have discerned the specific signature of some workshops at ancient Karanis. The purpose of this was to understand the role of transmission (teaching, learning) in each of these groups at Karanis which manufacture similar vessels; how the vessels produced reflect the specific workshops and finally, an understanding of the processes of continuity and change in archaeological ceramics through microvariables is brought into focus.

I have developed an approach, where traditional knowledge of living craftspersons in the present contributes to understanding craftspersons in the past. I, therefore, opted for starting with an ethnoarchaeology that links the concepts discussed earlier in the chapter (theory of practice, communities of practice and *chaîne opératoire*). Ethnoarchaeology provides a powerful strategy in discerning a specific community of practice by studying variability based on the selection, location and procurement of raw materials allowing archaeologists to investigate both the behaviors and the material results within a specific spatial and temporal framework (Kramer 1985; Stark et al 2000: 298).

I have studied modern potters and the results of their actions in the vessels produced within their respective workshops. My aim was to define the unseen distinctions between these workshops and to understand specific communities of potters. In my assessment, parts of the *habitus* can be made visible, and help in distinguishing workshops through metric analysis in the archaeological context *(see chapter 6 for details)*.

3.5. Ethnoarchaeological Fieldwork

Through my ethnoarchaeological fieldwork, I first contacted modern communities of potters and explained the purpose of my presence. I then attempted to discern the variables that define the core knowledge of the group (both explicit and tacit) through observation, video and statistical analysis. This knowledge enabled me to get more insight into sherds found at ancient Karanis *(see chapter 4 for details)*. For my fieldwork with modern potters, I decided to cover two countries on different continents: India and Egypt. Fayum in Egypt and Rajasthan in India, both have desert climates and share similarities in pottery manufacturing techniques (hammer and anvil method). This constraint in climate and technique enables to study learning processes, transfer of knowledge and skill in similar circumstances. Cross-cultural comparisons aid in developing theory and method provided the unique context is taken into account (Wendrich 2013).

During my first interaction with the modern community of potters I introduced myself and clearly explained my research in brief and the reason I was there. The fact that I was a person who had no other agenda except studying about their craft put the potters at ease, and they agreed to set up regular meetings. To gain further access into the modern community of potters, I had to approach them in a manner that was not too intrusive lest I upset the routine of the potters and consequently impact my fieldwork. I, therefore, entered the community in a manner adopted by anthropologists (Bernard 2006: 210-242), opting for silent observation at first.

3.5.1 Silent observation

Observing potters and their activities silently allows reflexivity. It was important for me to first position myself by being unobtrusively present. Positioning myself involved understanding how my identity was conceived in comparison with the local categories. My identity was not just determined by being a doctoral student researching potters, but it encompassed layers of identity, being a foreigner, a city dweller, a literate female from a certain ethnic group and living in a developed country. All these identities had to be negotiated while entering the community. Being unobtrusive was crucial in the beginning as it allowed me to observe things as they were as close to normal as possible. I placed myself where I would not obstruct the daily activities of the potters, but at the same time in a manner that allowed me to observe the activities. Potters do not open up easily if one is not from the community. When a week of silent observation passed, I went on to the next phase of becoming a guest of the community by participating.

3.5.2 Participant observation

Participant observation "involves getting close to people and making them feel comfortable enough with your presence so that you can observe and record information about their lives" (Bernard 2006: 342). On several occasions during my fieldwork, I helped the potters with tasks such as placing vessels outdoors to dry or loading the kiln and at times preparing tea. The potters and their assistants went about their business while I made notes of their activities, shot video footage and drank tea. Participant observation reduced the problem of 'reactivity'-of people changing their behavior when they are aware that they are being studied (Bernard 2006: 354). During my own fieldwork, I witnessed the change in the reactions of the potters where from being a subject of curiosity, I transformed to someone who had always been there walking around with a pencil, clipboard and calipers and someone who knew how to manufacture pots. The latter part was important to the potters as I was not merely studying the potters and treating them as subjects but was someone who was genuinely interested in the craft. Participant observation enables one to ask sensible questions at a later stage and gives the researcher confidence and intuitive understanding about the meaning of the data that has been collected (Bernard 2006: 355). It allowed me to have an involvement with the potter's social group and at times enabled me to see from their perspective.

3.5.3. Interactions

In the next stage of my fieldwork, I interacted freely with the potters in each workshop. The conversations enabled me in understanding observed behavior; points of view, and personal reflections. In order to not put undue pressure on the potters, I conversed with only those persons in the workshop who were willing and eager to communicate with ease. I do speak in rudimentary Arabic and while in Egypt, I had the benefit of two of my colleagues who made the conversations flow and later helped me in formally interviewing the potters while translating.[17] In translations, one has to be wary of introduced errors and misunderstandings introduced in translations. In my case, because both of the translators were archaeologists and understood the purpose of my interviews, there was trust and reliability when they translated for me. Without their help, crossing the language barrier would have been very difficult. I was not able to communicate well in all the workshops in Kerala, India because of the absence of an interlocutor

[17] Ashraf Sobhy Rezkallah and Mazher Ezzat of the Supreme Council of Antiquities were instrumental in translating my conversations with the potters and vice versa. Without their help, my study would have been unsuccessful.

for bridging the language problem [18]. However, I filmed and observed as much as possible to gather information. While in India, I had to be particularly aware of assumptions relating to social status. The potters would often ask me to which caste I belonged and whether my parents had given me permission to intermingle with them.

3.6. Discerning communities of potters: Methods

Based on my interactions in workshops through silent observations, participant observation and interactions with potters, I decided to discern distinctions between communities of potters making similar vessels through three approaches: a) interviews with potters b) action analysis within *chaîne opératoire* and c) metric analysis

3.6.1 Discerning communities of potters through interviews

Communities of practice are social networks where potters share a common tradition of learning, teaching and interacting. Archaeologically, I could not trace the importance of learning/teaching, or the influences of customers in transmission, but I could highlight the significance of these aspects by studying modern pottery workshops. In *chapter 4,* I discern modern communities of practice by interviewing the potters specifically focusing on the importance of learning, teaching, identification of the producer and the influence of consumers on transmission, continuity and change.

3.6.2 Discerning communities of potters through action analysis

The potter's *habitus* amongst other things also includes specific ways of doing things at a

[18] India is a diverse country with 29 official languages; the states toward the north and south speak in languages derived from the Indo-European and Dravidian group of languages respectively. The result is that the easiest mode of communication between the people from the north and south is English.

workshop (for example, usage of tools, kneading clay, clay recipes, forming rims). The artifact so produced reflects the signature of that particular workshop. A study of the *chaîne opératoire* of modern day pottery manufacture helps in identifying moments of choice and specific markers left on the vessels. The observations and results from modern day workshops can help in identifying markers in archaeological ceramics, which enable us to trace and better understand specific workshops of the past. In <u>*chapter 5*</u>, I use *chaîne opératoire* as an important tool in analyzing different aspects of its actions and processes to demarcate workshop differences and similarities in several modern community of potters manufacturing similar vessels.

3.6.2.1 Activity and space analysis

Communities of practice not only influence the way things are done, but also the workspace and work flow. The culturally determined use of space is ingrained in people, and they feel out of place when spatial patterns differ (Kent 1993). Various methods of observation have been employed to studies of human activity by anthropologists such as understanding distribution of activities across space (O'Connell 1991) and documenting total time humans allocate to a range of everyday activities (Gross 1984). In <u>*chapter 5 section 5.1*</u>, I have conducted scan sampling of activities and space usage to understand the pattern relating to pottery manufacture in workshops. To undertake observation in a systematic way, behavioral scientists use ethology as a technique in which one scans the group being studied at short intervals through scan sampling (Dawkins 2007). Scan sampling is a structured method that includes timed observation periods and behavioral coding. Scan sampling also known as tracking is well suited for research in which intra-and inter-group comparisons of activities, uses of objects, and uses of space are an analytic goal (Ochs et al. 2006: 391). Activities such as chatting or resting with occasional tea breaks (as

I have witnessed), may not be related to the production process, but 'provide effectiveness and sustainability of the work' (Wendrich 2013: 201). I believe that each of these activities also becomes a part of the specific *habitus* and therefore the scan sampling method is a good tool to gauge both space usage and activities of craftspersons. The relevance of scan sampling lies in its potential to reveal patterned behavior that can be compared with data from both within and between workshops to show similarities and differences in space usage patterns. Thus, scan sampling data along can reveal layers of that influence daily practice. This method helps us distinguish between the various signatures of the group.

3.6.2.2 Gesture and posture analysis

Gestures, body postures and experiences are all a part of the potter's *habitus*. These are integral components that facilitate pottery manufacturing. My suggestion is that potters from the same community of practice would have similar postures and gestures. In order to evaluate this, I have chosen video filming as a medium to analyze the similarities and differences of modern day potters by their gestures and body movements in activities relating to manufacturing of similar vessels.

Film and video capture complex social dynamics and natural contexts of technologies that are difficult to verbalize. Moving images provide a record of the nuances of the process, emotion, subtleties of behavior and communication that photographs can only suggest (Collier & Collier 1986). An ethnographic video is any footage that is used to represent ethnographic knowledge and therefore does not need to conform to specific film styles or conventions (Pink 2007). A video with raw uncut and long sequences of footage as in an ethnoarchaeological video then, contributes to recording elements relating to subtleties in action, which may be representative of or interpreted as cultural, social or symbolic. The actions in specific activities can allow keen analysis by pausing, rewinding and forwarding in order to gauge motion, time and working rhythm. Because it enables repeated viewings, as well as watching in slow motion, video capture of ethnoarchaeological observations may reveal interesting phenomena, which could go unnoticed in a one-time observation. Drawings and photographs cannot convey the working rhythm (Wendrich 1999), use of space, body, eye contact, interaction of the producer with the surroundings and people in a way that a video can. Repetitive watching of video footage helps in the detailed analyses of processes, coming as near to a laboratory environment as possible (*ibid*). During the pottery manufacturing processes at various workshops, I noticed that the potter would engage in casual talk with visiting villagers and bystanders. The interactions may not be of direct use in production but the ease with which the potters continue to make pots seems to be a part of social strategy of the potter (*ibid*). This also tells us something about the deeply ingrained and embodied aspects of the craft, which can go on while attention and interest is directed elsewhere. The filming of interaction between the potters and their families gives the study a dynamic realism lacking in other modes of research. Skill can best be captured through video where attention to the production process can be observed. While working with Egyptian basket makers, Wendrich (1999) measured the speed and regularity of working rhythm and related this to the level of skill.

Our dependence and bias towards written material to guide archaeological reasoning makes us distrustful towards visual observations (Collier & Collier 1986). However, with good theoretical framework, effective methodology and a powerful medium as video, visual ethnoarchaeology has allowed me to discern micro variables crucial for my research. In *chapter 5 section 5.2*, I coded body movements of potters from each workshop manufacturing similar vessels through video footage by using the *anvil* software for video analysis. I have then exported this qualitative data for quantitative analysis to show, similarities and differences in bodily postures and gestures associated with pottery manufacturing activities both within and between pottery workshops manufacturing similar vessels to discern possible communities of practice.

3.6.2.3 Variability analysis

The main stages of production processes relating to pottery manufacture of similar vessels may be the same, but the actions and processes of production will be different. In *chapter 5 section 5.3,* I discern similarities and differences by observing the actions and processes for the production of similar vessels manufactured by workshops situated adjacent to each other. Logically, the similarity and differences in the actions and processes would impact vessels produced and leave *s*pecific markers, which could allow the defining of distinctions between workshops.

3.6.2.4 Visual analysis

With insights from 3.7.2.1 to 3.7.2.3, I surmise that archaeologically ceramic sherds of such similar vessels should have embedded traces of actions and processes of pottery manufacture. Therefore, an analysis of such sherds should show those similarities and differences and help define specific communities of potters.

In chapter 5 under *section 5.2.2,* I use visual analysis to gauge similarities and differences within the matrix of common vessel types from specific kilns at Karanis to make an assessment about the nature of temper used in the clay pastes.

3.6.2.5 Chemical analysis

To corroborate the visual analysis above, in *chapter 5 under section 5.2.3,* I attempt to show these similarities and differences of embedded actions of pottery manufacture by subjecting the matrices of the vessels to spot chemical tests to test for inclusions relating to temper used in clay pastes.

3.7. Discerning communities of potters: summary

Interaction and exertion of control are important in a workshop setting as they allow for the transmission of skills and information. Skill acquired through time as a result of practice leads to the production of standardized products (Longacre 1999: 53). I aim to make an assessment about the similarities and differences that occur between morphologically standardized vessels to understand transmission of skill at Karanis through locally produced utilitarian ware. Standardized ceramics reflect little heterogeneity in composition and appearance within each category of pottery (Arnold and Nieves 1992: 93). The standardization of techniques and features reflect deeply seated ideas of appropriateness and aesthetics within the community; any change in these areas affect social and technological knowledge (Kohring 2013: 108). According to Arnold and Nieves (1992: 95) while assessing standardization one needs to compare the assemblage to another one, view standardization as a continuum rather than a single event and know that standardization can utilize varying characteristics of a ceramic assemblage such as shape, decorative techniques, degree of paste uniformity and dimensional variability. Variation in techniques and styles of production is due to the agency of individuals, communities, and objects that materialize history, the continuation of social relationships and the reproduction of shared knowledge with similar technical processes (Kohring 2013: 107) (*for detailed discussion see chapter 6*).

Learning involves manufacturing vessels shaped with appropriate measurements. Modern day potters, for example, reveal rim measurements only to potters who are a part of their own workshop. This kind of expertise is transferred through feel, a type of knowledge, which the Greeks refer to as '*techne*'. According to one of the potters at Fustat, the 'feel' is a special skill, which involves well developed touch and sensitivity that allows making a vessel that is appropriate and has to 'feel right'; this 'right feel' comes from years of experience and is expressed in the vessels they produce that cannot be replicated by those without this experience. Control of metric dimensions of a vessel makes sure that the transmission is taking place to the satisfaction of the teacher and the inherent tenets on which practice is based in accordance to specific workshop traditions.

To assess variability within standardization, it is first essential to classify the ceramic corpus in a way that allows such analysis. Here, I discuss the role of typology, modes and attributes to provide a framework for classification and metric analysis before describing in detail how the analysis was conducted. Ceramicists organize ceramic material utilizing typologies. The justification for identifying types and organizing these into a typology lies in whether our types and typology reflect the processes that produced the patterning so identified. Rouse (1960) thought of a type as one that must be based on distinctions that the makers and users shared collectively as part of their culture. He called these modes, which were distinct from attributes.

This distinction is important as it has implications for how I have measured and analyzed pottery. Some attributes may be modes, which are agreements in some respects. Modes are controlled, more spread out and similar (for example shape of a vessel) while attributes are craftperson specific wherein each potter has an individual notion of how things are done. Thus, for Rouse (1960), modes are reflected in the artifacts as attributes that conform to community standards; and which express its concepts or reveal the customary way of manufacturing or using artifacts (Rouse 1939). An analytic classification focuses on these attributes and through them attempts to get to the community standards, concepts and customs. According to this view, typology already has a structure and the goal is to recover the organization attained by makers/users in the past.

Read (class notes: May 2012) critiques Rouse's approach as being circular as it does not make clear whether mode comes first or classification. Thus, according to him, modes should be self-evident rather than leaving it to the researcher for interpretation. The groupings the researcher makes should possibly reflect the concepts and ideas of the makers/users (modes at the level of community including shared ideas and distinctions being at the artisan level), else the whole exercise of grouping becomes futile. My classification and analysis reflects Read's views.

Potters state that they can easily distinguish their own vessels from others on the basis of an identifiable marker, the rim. To corroborate the claims of potters with material evidence of rims in the ethnoarchaeolgical section of *chapter 6,* I conducted double blind experiments to explore whether potters manufacturing similar vessels can identify their own work from others. I took metric dimensions for similar vessels from different workshops to test whether subtle differences obvious to the potters can be expressed in measurements to trace the producers.

Pottery making is socially learned, embedded and transmitted. Forms may be similar, but metric attributes indicate different schools of practice. In *chapter 6* I show that it is possible to know the group signature of potters specializing in particular types by measuring metric attributes. I also record variability to help determine the range of measurements seen within one ceramic type made by potters of the same workshop versus similar vessels made by potters of other workshops.

Through insights from the ethnoarchaeolgical results, I try tracing groups of potters bound by practice through archaeological ceramics. The rim emerges as the most significant metric identifier and a dimension where the 'range of variability within standardization' can be assessed. This identifier stems from the makers and therefore reflects their concepts and not the researchers. If my suggestion is correct, then the measurement of the rim thickness taken on archaeological rim sherds should reveal specific community of potters.

In *chapter 6 section 6.4.4*, I build a typology of cooking pots and casseroles for the site of Karanis and discover the most common rim types occurring at the site. Through the test for coefficient of variation, box plots and density graphs, I assess the 'range of measurements' and variability in the two workshop/kiln areas. The idea behind discerning 'range' is that a close range of measurements of metric attributes in one group versus another will be based on learning influenced by a specific community of practice, enculturation and *habitus*. These influences are socially embedded, intrinsic and not learnt in a day. The cluster of the 'range', which pervades a specific workshop along with the values of coefficient of variation points to a particular group practice. The workshop tradition then bears a signature that cannot be replicated beyond this specific domain, unless one is a part of the specific enculturation or 'learning tree'. I seek to understand transmission at Karanis through the distinct workshops /kilns, which represent smaller communities of potters.

To reiterate, the stages of pottery manufacture may be similar, the forms may appear to be strikingly similar, but the differences are in the subtle details that stem from varied actions and processes of the *chaîne opératoire*, the subtle body postures and hand movements the potters employ, the order and way they use their tools and finally their perceptions and thoughts as specific groups. Archaeologically all these differences may be difficult to investigate but as suggested earlier, the identifiable markers left on the vessels may identify specific workshops. All we need to find is *which* of these specific markers hold the key to the specific *habitus*, practice and workshop. In my view, that marker is the rim and hopefully, it is the key to understanding transmission at Karanis.

While chapters 4-6 present the results based on the methods outlined above, chapter 7 lays out the final conclusions

Chapter 4

Discerning communities of potters through interviews

In the chapter, I outline the aims, reasons and methods of an ethnoarchaeological approach to discern communities of practice. Thereafter, I use interviews with potters as a basis to analyze workshops, nuances of learning, the ability to identify one's work and the role of customers in the processes of continuity and change. Finally, a section translating the results from my ethnoarchaeological research into a method that can be used to discerning communities of practice from potsherds found in an archaeological context form the basis of chapters 5 and 6.

4.1. Interview approach

Aim: to trace the continuity and change in ceramics by understanding and contextualizing the transfer of knowledge in communities of practice along with the influences of customer demand on this transfer.

How: Highlight similarities and differences within and between workshops that manufacture similar vessels in ethnoarchaeological and archaeological contexts. This will allow understanding of transmission of skill, continuity and change with reference to ceramics at Karanis.

Method: Interviews

In order to assure I could spend sufficient time in each workshop, I did this fieldwork over several years, revisiting some of the workshops. Over the years, my Arabic improved, and returning visits helped me to be accepted as a researcher in the community of potters. My time with each pottery workshop approximately lasted a month. Each week had a specific objective and was structured as shown in *table 4-1* below:

Week	Method	Objective
1	• Silent observation • Videography	understanding the production process and production time, by observation without disturbing the workflow.
2	• Participant observation	becoming a part of the community by helping at the workshop doing peripheral work. It allowed me to gain the confidence of potters allowing the interview sessions progressed with ease.
3	• Interview sessions: based on structured questions • Interview sessions: based on my observations • Videography	understanding how transmission of skill and learning takes place; how the potters identify the producer and their views on the role of the customer in the learning process.
4	• Experiments • Videography	testing various hypothesis to ethnoarchaeological data and then applying the method to archaeological data.

Table 4-1
Method & objective chart

The fieldwork was completed in the areas and workshops[19] shown in *table 4-2*:

Country	Region	Workshop location	Direction	Total workshops investigated= 22
Egypt	Fayum	Kom Aushim	North east Fayum	1
Egypt	Fayum	Nazla	South Fayum	1
Egypt	Cairo	Fustat	North Cairo	3
Egypt	Qena	Ballas	South Qena	2
Egypt	Qena	Sheikh Ali	South Qena	2
Egypt	Qena	Dar-es-salaam	North Qena	1
India	Rajasthan	Chattrikhera	West Rajasthan	3
India	Rajasthan	Amer	West Rajasthan	3
India	Rajasthan	Jagatpura	South west	1

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			Rajasthan	
India	Kerela	Chedamangalam	South west Kerela	1
India	Kerela	Tathapilly	South west Kerela	1
India	Kerela	Korumuloor	South west Kerela	3

Table 4-2
Workshops investigated for fieldwork

I investigated a total of twenty-two workshops[20] situated in five regions in two countries: Fayum, Fustat and Qena in Egypt, and Rajasthan and Kerela in India. My goal was to document the *chaîne opératoire* at different workshops and investigate the nuances of learning. I developed a standard questionnaire[21]; which allowed me to structure the interview process, but I was flexible and let the potter speak in-depth when he/she wished. The summarized responses are of only the interviewed potters as not all the potters were willing to answer all questions.[22] When posing questions, I had to be careful as to appropriateness-*who* could ask questions, the interlocutor or I? Also, *who* could be asked, the master potter, the assistant or the new apprentice? These issues were important so as not to offend the person in charge. This tells us something about the pathways of learning and the extent to which explicit questioning is allowed. Further, *how* I extracted information was important. I tried to be patient by not speaking when faced with long pauses and avoided suggesting answers to questions I raised. I avoided questions that invited yes

[20] Photographs of the workshops and potters interviewed can be found in Appendix B

[21] The questionnaire can be found in Appendix C

[22] As per IRB protocol of concealing identities of interviewees, the names of all the potters are coded.

or no responses and structured open-ended questions as the responses to these left scope for further conversations.

I had to be sensitive to the fact that the potters I worked with relied on making vessels for a living; my time interviewing them took them away from economic pursuits. Therefore, it became important to compensate them in kind or buying their products. On many occasions I encountered potters opening up their workshops and refusing any compensation; at other times (two instances), I encountered potters who did not want to speak till I compensated them for their time in cash.

Most questions during the interview related to learning, abilities of potters in identifying their own vessels from others, manufacturing processes and the influence of the customer in pottery manufacturing. The relevant details from the interviews were then summarized into sections below. The workshop descriptions are in a tabular format and provide information of the workshop area; total number of potters; male versus female potters; helpers; children; repertoire of vessels; availability of raw material, water, kilns and fuel. Thereafter, four sections summarize the background of the potter, the interview, his/her abilities to identify their work and that of others and finally the potter's view on the role of customer demand in deciding on what and how much to produce and the consequent effect on learning. The ability of potters in identifying their own vessel from similar vessels made by potters from their own and other workshops inform us potentially about the role of practice, enculturation and *habitus*. It also says something about the ability of practitioners to observe subtle differences that may elude a more casual observer. The role of the consumer is crucial as the preferences and demands on their part influence continuity, or change, thus affecting the workshop output as well as the teaching and learning process. I tried to summarize the workshop description under similar sections to keep a degree of standardization in order to give more clarity and bring out similarities and differences both within and between groups. I analyze the content of the interviews and with examples from my fieldwork firmly situate the role of apprenticeship, community of practice, identification of the producer and the role of customers in influencing learning transmission, continuity and change.

The responses by the potters helped me think through and develop a method to find material traits of specific communities of practice and use this information to devise methods to identify putative ancient communities of potters through traits of archaeological ceramics. I utilize all the information gathered from the interview protocols in developing a method for chapters 5 and 6 that relates to both ethnoarchaeological and archaeological contexts.

4.2. Workshop descriptions and interviews

4.2.1 Description of workshops in Fayum, Egypt

4.2.1.1. Kom Aushim: Workshop of E, M1, M2, W, MH and S	
Description of workshop area	Off the Fayum-Cairo desert road. Large airy workshop area next to a canal with both outdoor and indoor storage space.
Number of potters	5
Number of male potters	5

Number of female potters	0
Number of children in workshop	0
Number of male helpers	1
Repertoire of pots	Miscellaneous: *defayya (clay heater), zir (water jar), bokla (pot), sahfa (bowl), misa'a (receptacle for water or animal feeder), tabla (drum) 'asreyya (flowerpot), 'olla (pitcher with strainer), hanab (jar)* etc.
Origin of raw material	Clay: from canal and fields; other clays from upper Egypt transported in mini truck by supplier Temper: straw and chaff
Origin of water	City and canal supply
Kiln	3
Fuel	Wood shavings; husks from fields

<u>Background</u>

The group of potters at Kom aushim also belong to Nazla, but their main work area is Kom Aushim. E, M1, M2 & W are brothers. MH is E's son, and S is M2's son. M1 and S were not interviewed.

<u>Interview of M2</u>

M2 is 35 years of age and learnt pottery manufacturing using the hammer and anvil method when he was 12 years old. He started making pots professionally at 16 years of age. M2 has a son S, who is 18 years old. M2 learnt pottery making from his father and brother who taught him how to prepare clay, make simple pots followed by making more complicated pots. When he was 8 years old, he spent much time in his family's workshop, where he gradually picked up the skill. According to M2, the quality of the traditional vessels was better in the past as the clay was good but now it is not so. He asserts that like his ancestors he tries to focus more on quality and ends up making 20-30 *bokla* every day else he could make more if he just focused on quantity. He states that metric dimensions of a vessel in his workshop have a measurement range and if a potter goes beyond that range it is not acceptable by the master potter or even a customer.

Identification of producer

M2 can easily recognize his vessels from similar vessels made by others. He states that it is difficult for a layperson to recognize the maker of the pot. M2 can differentiate the maker of the vessel from whole vessels but even better when he looks at the broken pieces of the rim. For M2, the rim thickness and the weight of the vessel are the most important criteria to differentiate between makers of the pots.

The customer

According to M2, the middlemen are particular about dimensions and come with measuring tapes at times. Therefore, the potter has to create vessels with specific dimensions, or they will not sell. M2 initially states that he decides what to teach his children in terms of technique of pottery making. After rephrasing the question several times, he admits that the customer does influence his teaching because ultimately the product has to sell. He also states that it is because of the customers that he is so rigid about the dimensions of the produced pottery; otherwise he would give more freedom to his children.

Interview of E

E is 44 years of age and started learning to make pots when he was 8 years old. For the first few years, he would prepare clay and watch how others in the workshop manufactured pottery. His father first taught him at the wheel and later he started making vessels using the hammer and anvil method. At 16 years of age, he started making pottery professionally[23]. E has a 19-year-old son MH.

Identification of producer

E can recognize his pottery much like he can recognize his own handwriting. He is very particular about metric dimensions and does not go beyond the range of measurements followed by the workshop, determined by his teacher. He looks at the rim, shape and weight of the pot as identifying features of the manufacturer. According to him, rim thickness is the most important attribute as it carries the entire lesson learnt in pottery making and is reflective of the specifics of his workshop.

The customer

Customers such as villagers who buy vessels are very particular, and they carefully inspect pottery before buying. The middlemen measure the vessels before purchase. According to E, rapid change in pottery types happens with newer ideas fueled by the customer demand. The potters will only produce large amounts of new pottery types if there is good sales potential, else they do not. He states that decorative styles change more rapidly than the shape.

[23] A potter becomes a professional potter when his pots can be sold.

Interview of W

W is 50 years old and learnt pottery making from his father and grandfather. He makes vessels on the wheel even though he learnt the hammer and anvil method of making pottery when he was 11-12 years of age. He began learning on the wheel at about 10 years of age.

Identification of producer

W can identify his vessels by looking at the rim and feeling the weight of the pot. As an example, the lower part of the *defayya* is made by other potters in the workshop and then sent to W, who makes the upper part on the wheel and joins the two. W can easily identify the maker of the lower part of the *defayya* by looking at the rim. He knows the work of each potter and on occasion, if the vessel does not appear right, he sends the lower part back to the potter telling him to make it anew.

The customer

W has to be careful about dimensions else the customers will reject the vessel and diminish his earnings. He says making pots is second nature to him, and usually, all the rims made by him are similar in thickness. He knows this as he feels to inspect each rim before the *defayya* is sent off for drying.

Interview of MH

MH is 19 years of age and is E's son. He is quiet and is always aware that E is keeping a watchful eye on him. He started learning the hammer and anvil method from E when he was 13 years old. MH spends more of his time preparing clay at the workshop than making pots. He knows when to stop kneading the clay when the ‘right consistency' is reached. The knowing comes from experience and practice. He would like to spend time making pots, but it is time consuming and he has the additional responsibility of looking after the buffaloes and fields. Therefore, he only focuses on preparing the clay for all the potters.

4.2.1.2. Nazla: workshop of AA, AB and TA	
Description of workshop area	The workshop areas are approached by going down hill from the main road to the bottom of the valley next to a stream. The sale of the vessels takes place above on the roadside.
Number of potters	4
Number of male potters	4
Number of female potters	0
Number of children in workshop	5
Number of helpers	3
Repertoire of pots	Miscellaneous: *bokla (pot), zir (water jar), sahfa (bowl), misa’a (receptacle for water or animal feeder), tabla (drum), ‘asreyya (flowerpot), ‘olla (pitcher with strainer) and hanab (jar).*
Origin of raw material	Clay: from canal/stream (masraf-al-wadi) and fields. Temper: straw or chaff
Origin of water	Canal/stream

Kiln	4
Fuel	Sorghum from fields and wood shavings

Background

AA, AB and TA are brothers. TA was not interviewed.

Interview of AA

AA is 31 years old and started making pottery professionally at 11. He remembers his father beating him with a stick if his pots were imperfect. Perfection was measured by feeling the pot with the hand. He still uses his hands and knows when it feels right.

Identification of producer

AA can recognize his pots by feeling the pot and looking at the way the rim is made.

The customer

His customers are from the same families who used to buy vessels from his father and grandfather. Sometimes, he experiments and makes new forms. If the new forms sell, AA continues to make them.

Interview of AB

AB is 30 years of age and started making pottery professionally when he was 10.

Identification of producer

According to AB, rim thickness is vital in differentiating the makers of the pots.

The customer

AB's customers know which pots he makes by just holding the vessel. If the rim is too thick, the customers do not buy the vessels and have even asked "What happened, were you sick?" And he laughs.

4.2.2. Description of workshops in Fustat

4.2.2.1. Fustat 1: Workshop of K, S and A	
Description of workshop area	Adjacent to Fustat workshop 2
Number of potters	2
Number of female potters	0
Number of children in workshop	2 (male)
Number of helpers	1
Repertoire of pots	Miscellaneous: mainly *khashbooha* (flowerpot) of different sizes and *olla* (pitcher with strainer)
Origin of raw material	Clay transported in mini truck by supplier from Cairo. Temper: Ash and chaff depending on pottery type
Origin of water	Through city supply
Kiln	1
Fuel	Wood shavings, sugarcane stalks and whatever is available

Background

K and S are best friends from childhood and were taught by K's father. A is S's son. K has a school going son who helps on weekends.

Interview of S

S is 37 years of age and started working in the workshop under K's father when he was 8 years old. He remembers K's father as being extremely strict with both of them. He initially just observed and would later practice making small pieces on the wheel.

Identification of producer

S can recognize his own pottery from others by looking at the rim, lip and sometimes by the shape and fingerprint. S senses a pot as his own by holding the vessel because his vessels are comparatively lighter. K's father would reprimand him if he made a vessel beyond a certain thickness and was very particular about the metric dimensions of the vessel. S's ability to know about measurements specific to vessels of his workshop without measuring aids comes from experience and working under K's father. S feels that fingers have a role to play in understanding differences in pottery manufacturing. S states that the size of the hand itself is no standard for making a good or a bad vessel, but practice and observing elders are of great importance. He mentions that standardized forms have very limited metric variation within a workshop. Each workshop has an overarching control over metric dimensions such as thickness. His son A will start making pots professionally when he is 15 years of age (right now A is 13 years and needs perfection and proper training before his pots are ready to be sold).

The customer

According to S, most of the customers prefer tradition and do not like change. However, with the tourist industry and the influx of middlemen, S makes new shapes when there is customer demand. The customers feel the pottery with the hand before buying the vessel to gauge quality and perfection. The customer does not influence the technique of pottery manufacturing but indirectly influences the shapes and sizes of vessels that are to be manufactured. Therefore, pottery making has to be taught keeping in mind the size and dimensions. If there were no customers in the equation, S would have taught pottery making to his son differently and perhaps experimented with new ideas.

Interview of A

A is 13 years old and started learning when he was 5. His father S is very strict when A works at the wheel. S holds A's hand while teaching him and if he fails to make the vessel as per his father's satisfaction (especially the rim), he gets hit with a stick. According to A, S is strict about the rim because if it is thick, the vessel will not sell and that is the reason his vessels get dumped. As I watched, A spoilt 7 *khashboohas* he was attempting to make and got hit with a stick by his father S. A is waiting for the day S fires his *khashboohas* and sells them too. A presently carries out peripheral work in the workshop such as placing vessels for drying, preparing clay, preparing the kiln for firing loading and unloading of the kiln.

Identification of producer

A can recognize his vessels from those made by S and K as he observes them every day.

The customer

Customers are particular as they gauge before buying by holding and feeling the body of the vessel. The potters adhere to traditional shapes and measurements as those vessels sell easily.

Interview of K

K is 41 years old and started spending time with the potters in the workshop when he was 5 and at 11 his father started teaching him. He was able throw pots on the kick wheel with ease when he was age 14 and started making pots professionally at age 15. He remembers his father being very strict with him and S but easy with his other cousins.

Identification of producer

K can estimate the thickness of vessels accurately with his hands. He can also distinguish between his own vessels and those of S, A and other potters who work in the vicinity by looking at the rim and feeling the weight of the vessel. K states that his eyes know who made which vessel. He remembers an incident when he made a series of vessels thicker than usual for his workshop. The customers did not buy that batch and he in turn got a scolding from his father for deviating from the norm.

The customer

K states that new shapes are made by demand of the customers. If K has a new idea and it sells, he will make more but if it does not sell then he will not waste his time making them. According to K when there are many customers, there is no time to think of new ideas for shapes as the old ones such as the *khashbooha* and *olla* are selling well. It is only when there are fewer sales that they experiment with newer shapes.

4.2.2.2. Fustat 2: Workshop of AH, MD, AD and A	
Description of workshop area	Adjacent to Fustat workshop 1
Number of male potters	3
Number of female potters	0
Number of children in workshop	0
Number of male helpers	1
Repertoire of pots	Miscellaneous: mainly *kurs*i (head of a *sheesha* or waterpipe), *hagar* (water pipe), *tabla* (drum), *khashbooha* (flowerpot) and *'olla* (pitcher with strainer)
Origin of raw material	Clay: from supplier in Cairo Temper: chaff depending on pottery type
Origin of water	City supply
Kiln availability	1
Fuel availability	Wood shavings, cane husks and whatever is available

<u>*Background*</u>

MD and AD are brothers. AH is an uncle, and A is a distant cousin. S is a helper

Interview of AH

AH is 65 years old, started learning when he was 8 and became a professional at 16 years of age. AH specialized in the *hagar, tabla* and *kursi*. He says that he can make far more in a day than MD and AD because of his many years of experience. While he was learning, AH's father was very strict with him.

Identification of producer

The rim and thickness of the vessel allow AH to determine who made the vessel. According to AH, the fingers control the thickness of the vessel; the number of oscillations on the kick wheel have nothing to do with this. He also states that eyes are the key to identification as through their eyes, they are able to gauge differences.

The customer

AH puts it simply, high customer demand of a particular type of pottery allows continuity of that type; if there is low demand, it leads to change.

Interview of MD

MD is 42 years old. He started learning at age 11 from his father who was strict and became a professional at 16. MD and AD are brothers.

Identification of producer

According to MD, each potter has his own "fingerprint" and the thickness of the rim is crucial for knowing his own vessels from others. MD agrees with AH that eyes are the key to identification and states that he can recognize his *kursis and khashboohas* anywhere in Egypt. He says that he recognizes “Brand MD” and “Brand AD, AH and A’’ from other *kursi* and *khashbooha* makers in Egypt.

The customer

According to MD, middlemen buy most vessels, and they sell to different shops. A steady demand allows continuity of a type.

Interview of AD

AD is 39 years old and started making pottery at age 16. He started observing and helped out when he was 10 years old and learnt pottery making from his father who was quite strict.

Identification of producer

He knows his pottery from others within and outside the workshop by estimating the thickness of the vessels. AD adds that the family and workshop where one grows up coupled with learning through guidance and practice allows one to internalize all information relating to recipes measurements and other details. According to AD, other workshops and their potters never reveal their secrets. Hence, learning from one's own family and workshop is better for learning as one becomes like them, and the customers also accept one's work.

The customer

According to AD, the customer influences what is manufactured at the workshop. All the workshops have their own ranges of measurements for vessels, and this is to keep a steady supply of customers who prefer a particular type of vessel.

Interview of A

A is 30 years old and started making pottery rather late at age 23. When he was 10 years old, he occasionally observed and helped out at the workshop. A learnt the craft from MD and AD's father who was not very strict with him. He only manufactures *kursis* but not as skillfully or fast or as fine as MD and AD. He wishes he had learnt when he was much younger, and he attributes this as the main cause for his 'imperfect' *kursis*.

Identification of producer

He knows his pottery from others due to the thickness (his *kursis* are very thick) and weight. Because he has not worked in his own workshop for long, he cannot clearly differentiate between the work of potters from other workshops in the vicinity. He can only identify the work of MD and AD as he often makes *kursis* with them.

The customer

A has spent limited time in the workshop as he had been conscripted in the army too. There is only one customer who likes his work, the rest all complain about weight of the *kursi* and their thickness.

4.2.2.3. Fustat 3: Workshop of S2 and ABS	
Description of workshop area	Uphill and adjacent to Fustat workshop 2
Total number of potters	2
Number of female potters	0
Number of children in workshop	2
Number of helpers	3
Repertoire of pots	Miscellaneous: mainly *khasbooha* (small and large flowerpots), *tabla* (drum), *misa'a* (receptacle for water or animal feeder), 'olla (pitcher with strainer) and hand made boxes
Origin of raw material	Clay: from Helawan transported in mini truck by supplier Temper: Ash depending on pottery type
Origin of water	City supply
Kiln availability	1
Fuel Availability	Wood shavings, reeds, cane husks and whatever is available

Background

ABS is the master potter and S2 is his son. They have 3 helpers, one of them just prepares clay and the other two children help in peripheral activities and in making hand built clay boxes.

Interview of ABS

ABS is 55 years old started learning pottery when he was 8 years old and was at the wheel at 12. He did not learn pottery making from anyone in the family but started out as being a first assistant to a professional potter.

Identification of producer

ABS can see differences from the rim thickness, shape and finishing of the vessel. He states that dimensions are very important from the point of view of transportation too; a few millimeters here and there and the vessels will not stack properly. Thus, ABS allows for little margin in the thickness of vessels, and this has to be strictly adhered to. His master-potter would dump his vessels if ABS did not follow the measurements. According to ABS, rim thickness of a vessel type within a workshop will be similar, and the thickness for the same type of vessel from other workshops will be different. He also thinks that fingers play a role in the rims being thicker or thinner. He has always eyeballed and senses measurements but when the middlemen buy their vessels they come equipped with measuring tapes and check the dimensions. The middlemen are not potters and cannot sense or eyeball measurements like he does. He also says that the dimensions of the pottery influence teaching but not the technique. ABS can identify his vessels, and this comes from years of practice. ABS also states that his vessels are the lighter than others as he is more experienced.

The customer

ABS states that when there is less demand, a potter had more time to experiment and gauge the market to see what sells.

Interview of S2

S2 is 25 years old and was 7 years of age when he learnt from ABS and his grandfather. He started professionally making pottery when he was 11 years old. Initially, he carried out peripheral work such as carrying finished vessels for drying and helping with other activities. His learning sessions involved hard work at the wheel and strict discipline. S2 makes *khashboohas* both small and large made at Fustat workshop 1 and 2. He states that the small *khashboohas* from his workshop look similar to the small ones from Fustat workshop 1 but the differences lie in the manner the clay and tempers are mixed, the way the rim is finished and the overall weight of the pot.

Identification of producer

S2 states that he can easily recognize his pottery by looking at the finishing of the rim or the base and by feeling the weight of the vessel. He states that the difference in thickness is not vast, but he can still identify the maker of the pot. Also, size of the hand has no correlation with the variation in this thickness. S2 says that the measurements at his workshop are very strict and allow being off by only a few millimeters. S2 says that he will be very strict with his son (he is 5 years old) when he is ready.

The customer

S2 states that the customers influence vessels. If there is low demand, there is more generation of ideas and experimentation leading to rapid change, but with high demand, one does not have to think of ideas. According to him, ideas are more for the decoration.

4.2.3. Description of workshops in Qena, Egypt

4.2.3.1. Ballas 1: Workshop of AL and AH	
Description of workshop area	Situated in Deir el-Garbhi, the workshop itself is a partitioned room with a kick wheel and a clay levigation area. The outside area has a circular pit in which clay is trampled by a buffalo. The potter himself uses his feet to complete the trampling.
Number of potters	2
Number of female potters	0
Number of children in workshop	0
Number of helpers	2 (1 male and 1 female)
Repertoire of pots	Limited: *ballas* (jar)
Origin of raw material	Clay: Marl from mountain mined by specialists Temper: fine sand
Origin of water	local supply
Kiln availability	1
Fuel availability	Straw, sugar cane stalks and buffalo dung (added automatically during trampling)

Background

AL has one son AH who also makes *ballas*. He has two other helpers who help in loading the kiln and preparing the clay. A buffalo is used to trample the clay.

Interview of AL

AL learnt from his father and grandfather and has been making pots for over 20 years. His son is not interested in making pottery. An elderly customer who regularly buys from the workshop states that AL's vessels are identical to AL's father and son AF.

Identification of producer

AL can easily identify his *ballas* in the market. He uses metaphors and says: "if the head, neck and shoulder are missing in humans, one cannot identify the person, similarly the pottery vessel is unique, the rim, neck and shoulder are identifying features; it is your own signature."

The customer

AL has the same customers as his father and grandfather had. They prefer the same jars, which have thus not changed for generations.

4.2.3.2. Ballas 2: Workshop of AH1, AH2 and AF	
Description of workshop area	Situated in Deir el-Garbhi, the workshop area is divided into two distinct areas in an L shape, one is a longitudinal room equipped with a kick wheel and the other is a room used by the son also equipped with a kickwheel. A circular pit outside the

	workshop is for trampling clay.

Description of workshop area	Situated in Deir el-Garbhi, the workshop area is divided into two distinct areas in an L shape, one is a longitudinal room equipped with a kick wheel and the other is a room used by the son also equipped with a kick wheel. A circular pit outside the workshop is for trampling clay.
Number of potters	3
Number of female potters	0
Number of children in workshop	0
Number of helpers	2 daughters R1 and R2
Repertoire of pots	Limited: *ballas* (jar)
Origin of raw material	Clay: Marl from mountain mined by specialists Temper: fine sand
Origin of water	local supply
Kiln	1
Fuel	Straw, sugar cane stalks and buffalo dung (added automatically during trampling)

<u>*Background*</u>

AH1 has two sons AF and AH2 and two daughters R1 and R2

Interview of AH1

AH1 loves manufacturing pottery, as it is his family tradition. He has two daughters who help in preparing the clay in his workshop and two sons who work at the wheel in the workshop. According to AH1, children can learn pottery making before 14 years of age, after which it gets difficult to master the finer nuances of the craft. For him, pottery is unique and becomes a signature of a particular workshop because behind it is years of practice and observation of elders in the workshop. AH1 takes pride in his workshop and its products and addresses the other potters in Ballas as 'them' and different from 'us' (he and his sons).

Identification of producer

AH1 can easily recognize his work from his sons as well as other potters in the vicinity. He can do this as every hand has a certain way of making pots, and he has a sense of it as he lives in the large community of potters. AH1 has a specific way of finishing the rim, which he learnt from his father and taught his sons; others have a different way of finishing. He can easily identify his jars in the village and the market.

The customer

According to AH1, the customer is important and influences what he manufactures. If the customer demands a certain type of vessel with certain dimensions, he painstakingly manufactures those. The customers acknowledge and know about the similarity of AH1 and his sons' vessels.

Interview of AF

AF is 27 years of age and learnt pottery making from AH1 when he was 8 years old. His father was very strict while teaching and still scolds him at times.

Identification of producer

He can distinguish the manufacturer of the vessels by looking at the rim and also the estimate the weight of the vessel.

The customer

According to AF, his customers say that his vessels are very similar to his father's vessels, and that is why he has no trouble selling.

Interview of AH2

AH2 is 21 years of age and learnt pottery making from his father AH1 and brother AF. He likes marketing more than making the pots.

4.2.3.3. Sheikh Ali 1: Workshop of AHM and MD	
Description of workshop area	An enclosed but open-aired longitudinal area equipped with a kick wheel.
Total number of potters	1
Number of male potters	1
Number of female helpers	0
Number of female potters	0

Number of children in workshop	0
Number of male helpers	1
Repertoire of pots	Miscellanous*:* *zir* (water jar*)* and small pots
Origin of raw material	Clay: from canal and field Temper: ash and chaff
Origin of water	Local supply and canal
Kiln	1
Fuel	Grain stalks from the field and whatever is available

Background

AHM is the sole potter. His son MD is not interested in making pottery and would rather serve in the army.

Interview of AHM

AHM is 35 years old and learnt pottery making when he was 7 years of age. A lot of his playtime was spent helping out his father and grandfather in the workshop. He remembers playing with clay often kneading and making toys in the beginning. He started making vessels when younger but as they were not perfect, his father made him dump the vessels in the levigation tank. His father was very strict about thickness of the vessel and therefore AHM did not start making vessels professionally until he was 14 years of age.

Identification of producer

He can recognize *zirs* he makes by looking at the rim.

The customer

AHM has the same set of customers that his father had who buy his *zirs*. He has been making the same kind of *zirs* that his father and grandfather made with no change. However, sales are dwindling, and he has been trying new shapes and forms.

4.2.3.4. Sheikh Ali 2: Workshop of MA and M	
Description of workshop area	This workshop is built in the courtyard area of the potter's residence. There are two kick wheels and one electrically powered wheel
Number of potters	2
Number of potters	2
Number of female potters	0
Number of children in workshop	1
Number of helpers	2 (wife and daughter)
Repertoire of pots	*brahm* (cooking casseroles) and *zir* (jar)
Origin of raw material	Clay: from canal and field Temper: ash, chaff and *brahm* (the temper)
Origin of water	Local supply and canal
Kiln	1
Fuel	Grain stalks and whatever is available

Background

MA is the son of M.

Interview of MA

MA is 15 years old and started learning from his father M when he was 7. He started helping out by preparing clay, loading and unloading the kiln and gradually started making pots on the wheel. He started making pots professionally just a year ago when he was tall enough to kick and control the wheel. At the initial stages of learning, his father would guide him with his hands to show what dimensions felt right when making the vessel. He adheres to that sense of knowing by touch even today.

Identification of producer

He can differentiate between his and his father's work easily by looking at the rim and treatment of the vessel. He can also differentiate between the *zirs* made by his family and AHM from Sheikh Ali workshop 1.

The customer

The villagers buy the cooking casseroles, and there are a few middlemen from other villages who buy in bulk. The customers like the way their cooking casseroles are made so MA and his father do not change that tradition.

4.2.3.5. Dar us-salaam: Workshop of N	
Description of workshop area	The workshop area is aligned alongside the main road to Qena town.

	The kick wheel is in the open and protected by the shade of trees. The finished pots are sold on the road or by hawking door to door.
Number of potters	1
Number of potters	1
Number of female potters	0
Number of children in workshop	1
Number of helpers	1 (wife)
Repertoire of pots	Miscellaneous: *brahm* (cooking casseroles) and *zir (jar)*
Origin of raw material	Clay: from canal and field Temper: fine sand and *brahm* a material made from rock is procured from Upper Egypt. It is added into the clay for casseroles and helps in thermal conductivity.
Origin of water	Canal and local supply
Kiln	1
Fuel	Grain stalks and whatever is available

Background

N is a sole potter with a wife and adopted son.

Interview of N

N sells the bulk of his cooking casseroles through barter and gets corn in return. He also has a roadside setup from where he sells his vessels. He manufactures *brahm* used in this part of Egypt for fish preparation (also used in Alexandria). He adds a special temper for the cooking casseroles, which comes from *"mil- arbayeen"*. N states that he cannot tell me more than that, as it is a secret and laughs. His wife helps him with sales.

<u>Identification of producer</u>

N can easily recognize the *brahm* he has made if he sees it anywhere in the local market. The rim and feeling the weight of the vessel aid in recognition.

<u>The customer</u>

According to N, he thrives on the sale of *brahm* and is very particular about the dimensions as he does not want to disappoint his customers in any way.

4.2.4. Description of workshops in Rajasthan, India

4.2.4.1. Chhatrikhera 1: Workshop of NB and RS	
Description of workshop area	Work area within the living quarters. The storage area of finished pots is a room rented in the village.
Number of potters	2
Number of male potters	2
Number of female potters	0
Number of children in workshop	0
Number of helpers	1
Repertoire of pots	Limited: *kali* (water pot)
Origin of raw material	Clay: from the river Banas Temper: ash

Origin of water	Local supply
Kiln	Open firing in an area in the village
Fuel	Dry brush and grain stalks

Background

NB is the main potter while his son RS is a tailor and works as a potter when free.

Interview of NB

NB is 65 years old; he started learning pottery making from his father when he was 10 years old. Initially, he spent 2-3 years doing peripheral work. He would get beaten up with a stick if he did not make proper pots. He can make 10 vessels a day. His wife helps in preparing the clay and painting the vessels but is not allowed to touch the wheel. He has a son RS who is 22 years of age and is a tailor but in his free time helps his father manufacture and sell pots.

Identification of producer

He can identify his vessels by looking at the rim and painting on the vessel, and feeling the weight of the vessel. His vessels are lighter in weight than potter SB.

The customer

NB has a steady number of customers from the village who prefer the traditional *kali* or water pot. There are just two potters in the village, and the customers have their own social affiliations.

4.2.4.2. Chhatrikhera 2: Workshop of SB	
Description of workshop area	The workshop area is within the house, and the storage area is on the rooftop.
Number of potters	1
Number of male potters	1
Number of female potters	0
Number of children in workshop	0
Number of helpers	2 (wife and daughter)
Repertoire of pots	Limited: *kali* (water pot) and small pots
Origin of raw material	Clay: from river Banas Temper: ash
Origin of water	Local supply
Kiln	Open firing in an area in the village
Fuel	Dry brush and grain stalks

Background

SB is the sole potter of the workshop with his wife and daughter who help in preparing clay and painting.

Interview of SB

SB is 55 years of age; he started learning pottery making from his father when he was 10. SB and NB are brothers and learnt pottery making together, but they have been living separately for nearly thirty-five years due to a family feud. Sale of the pots takes place from SB's residence.

Identification of producer

SB can recognize his vessels from NB by looking at the rim.

The customer

He keeps up with the traditional *kali* as the customers demand this type. He does experiment with new forms but if they do not get sold, he stops making them.

4.2.4.3. Damodarpura: Workshop of DR	
Description of workshop area	Work area in the courtyard of the potter's residence. The storage area of finished pots is peripheral wall and the roof top.
Number of potters	1
Number of male potters	1
Number of female potters	0
Number of children in workshop	0
Number of helpers	1
Repertoire of pots	Limited: *kali* (water pot)
Origin of raw material	Clay: from the river Banas Temper: ash
Origin of water	Local supply
Kiln	Open firing in an area in the village
Fuel	Dry brush and grain stalks

Background

DR is the sole potter and his wife does peripheral work. DR was not very communicative and seemed unhappy being a potter, complaining that he was not earning enough.

Interview of DR

DR is 56 years old and started learning pottery making from his father when he was 8 years old. His son works in a factory and has no interest in pottery making.

Identification of producer

DR can identify his vessels by looking at the rim and also identify his wife's painting on the vessel.

The customer

DR has a steady number of customers from the village. He is the only potter in Damodarpura, only 4 kilometers away from Chattrikhera which has 2 potters.

4.2.4.4. Amer 1: Workshop of Baba and NK	
Description of workshop area	The workshop is situated across a cremation ground and adjacent to the potter's residence. A wheel moved by a stick (*charkha)* is located on the ground at one end of the empty plot adjacent to the house, while an electrically powered wheel is set in the front courtyard of the house. The storage area is a large mud brick room next to an empty plot.
Number of potters	2
Number of male potters	2

Number of female potters	0
Number of children in workshop	2
Number of helpers	4
Repertoire of pots	*Matka* and *matki* (gendered water pots)
Origin of raw material	Clay: procured from a quarry nearby, Temper: from a mountain and ash from the kiln
Origin of water	City supply
Kiln	1
Fuel	Cow dung, dry brush, ash, straw or chaff

Background

BABA and his son NK are the main potters, while his grandson NA and his brother's grandson V help in peripheral activities.

Interview of Baba

BABA is 70 years old and started learning pottery when he was 12. He has a son NK, who also makes pottery using the hammer *(pindi*) and anvil *(thapa*) like him and wheel thrown pottery. BABA's wife, his daughter-in-law and grandson NA and his brother's grandson V help in preparing the clay, loading and unloading the kiln and painting the vessels. BABA's father taught his son how to make pots. His son NK makes pots faster than him as he is much younger and possesses more energy. BABA states that the *matka* and *matki* in Amer look the same but the rim, combinations of different temper (he uses a temper which gives additional shine and gets it from a secret place unknown to other potters in Amer), type of hammer and anvil and the style of the potters make each type different. He and his son are consistent in the type they make as that is the way they were taught in their workshop by their elders.

Identification of producer

According to Baba, there are 4 other potters in the village who use the same technique of pottery making. He can easily distinguish between his vessels and the others by looking at the rim and also by feeling the weight of the pot. He states that he knows this as it is registered in his mind because of all the training and seeing fellow potters in the village. According to him, rim measurements are specific to each potter and the dimensions are understood by feel. He can feel the rim and know that he made it.

The customer

Baba has been making the same pottery types as his grandfather and father. He does not intend bringing about any change to the *matka* and *matki* as they sell as is. However, with the influx of tourists, the rise of refrigerators and other utensils, they have to devise new types to sell. For Baba, customer is god. He says from generation to generation, almost 300 years, they have been making the same type of pot. In the last 40-50 years they have made slight changes because the customers wanted a change but the identity of the pot has overall been the same. The customers always hold and feel the pot before buying.

4.2.4.5. Amer 2: Workshop of SK	
Description of workshop area	The workshop is situated in the village. The space doubles up as a residence. The porch is utilized as a workspace too.
Number of potters	1
Number of male potters	1
Number of female potters	0
Number of children in workshop	0
Number of helpers	1
Repertoire of pots	*matka* and *matki* (gendered water pots)
Origin of raw material	Clay: procured from a quarry nearby, Temper: ash from the kiln
Origin of water	City supply
Kiln	1
Fuel	Cow dung, dry brush, straw, chaff or rags

Background

SK is the lone potter.

Interview of SK

SK says he is either 55 or 60 years old and was forced into learning pottery at age 10 by his father. He enjoyed taking care of animals, but his father was persistent.

Identification of producer

According to SK, each pot has an individual signature almost like a map where the rim and lip will be different. He can identify his pots from those made by others.

The customer

SK's customers do not like change

4.2.4.6. Amer 3: Workshop of BL	
Description of workshop area	The workshop area is on the porch and the front lane of the potter's house.
Number of potters	1
Number of male potters	1
Number of female potters	0
Number of children in workshop	0
Number of helpers	1
Repertoire of pots	*matka and matki* (gendered water pots)
Origin of raw material	Clay: procured from a quarry nearby, Temper: ash from the kiln
Origin of water	City supply
Kiln	1
Fuel	Cow dung, dry brush, ash, straw or chaff

Background

BL is an old potter, has hearing problems and therefore I could not interview him.

4.2.4.7. Jagatpura: Workshop of H1 and H2	
Description of workshop area	The workshop is situated behind an urban residential locality. The residence is within the precincts of the workshop. A wheel moved by a stick (*charkha)* is located in one corner of the enclosed courtyard. The storage area is a large shed; pots are also stored next to the courtyard wall.
Number of potters	2
Number of male potters	2
Number of female potters	0
Number of children in workshop	3
Number of helpers	1
Repertoire of pots	Miscellaneous: *matka* and *matki, ghara (*small and large water pots), and *diya* (oil lamp) and money pots
Origin of raw material	Clay: is procured from a water canal nearby Temper: ash
Origin of water	City supply
Kiln	1
Fuel	Cow dung, rags, sawdust and whatever is available

<u>*Background*</u>

H1 and his son H2 are the sole potters in the workshop.

Interview of H1

H1 is 77 years of age and started learning potter when he was 8. He has a 45-year-old son who also makes pottery.

Identification of producer

According to H1, there are 2 other potters in the village. He can differentiate his own vessels from the others by looking at the painting and the rim of the pots.

The customer

H1 has difficulties in selling pottery at times because the urban residence has enclosed their village. Earlier they were next to the main road and so there was easy access. Now his son has to take the pottery to a cross- road and set up shop there. He has lean periods but during festivals his pottery sales are much better. During the lean period, he experiments with new shapes and forms and if they sell; he makes more of those types.

4.2.5. Description of workshops in Kerala, India

4.2.5.1. Chedamangalam: Workshop of O, T and C	
Description of workshop area	The workshop area is built in a brick structure without doors or windows a residence. The actual residence of the potters is behind this structure. There are separate spaces for storage, levigation of clay and pottery making.

	Storage of pots is also within the brick structure.
Number of potters	3
Number of male potters	0
Number of female potters	3
Number of children in workshop	1
Number of helpers	
Repertoire of pots	*mattam* (small and large pots for tapping *toddy* or coconut sap)
Origin of raw material	Clay: available locally from rice paddy fields Temper: ash
Origin of water	City supply
Kiln	1
Fuel	Coconut fiber and firewood

Background

T, O and C are the sole potters in the workshop. O is T's daughter, and C is T's sister

Interview of T

T is 80 years of age and learnt pottery making from her maternal grandmother and mother[24].

Identification of producer

T can recognize her pots from others by feeling the rim and the weight of the pot.

[24] Kerala society is matrilineal: the husband moves to the wife's house, and the wife dominates traditions.

The customer

T has customers who specifically like her *mattams* and thereafter prefer her daughter O's *mattams*. Her customers prefer tradition, and it is still continuing.

Interview of O

O is the only one in the younger generation left to continue the tradition of pottery manufacturing. She does not want her daughter (now 4) to be in this profession as it involves a lot of hard work and low returns. According to her the recipes, order of tools and even the posture are all a part of learning and what sets workshops apart.

Identification of producer

O can easily differentiate between her pots and ones made by her mother and aunt by looking at the rims. She can also spot hers from others in the market by holding and feeling the *mattams* by the rim.

The customer

The customer influences the tradition and therefore she does not make changes unless accepted by the customer. In the village, the *mattam* for fermented coconut drink and the small ritualistic pots are the only vessels in demand. She, therefore, manufactures only what is sold. Hence, she is very particular about the way a vessel is made.

Interview of C

C is 73 years old and is the aunt of O and sister of T. She learnt pottery making from her mother when she was 10-11 years of age.

Identification of producer

She can differentiate her pottery from other potters as she knows the work of others.

The customer

The customers have been loyal, and there is always a demand for products from their workshop. They follow the same stages of manufacture so that the result is the same and customers are happy that is most important for them.

4.2.5.2. Tathapilly: Workshop of SR, SG, Y, T, A and others	
Description of workshop area	Workshop is situated behind the residence of the potters. The work area is rectangular. The storage space for pots is in a shed. The clay is stored adjacent to the work area.
Number of potters	7
Number of male potters	0
Number of female potters	7
Number of children in workshop	0
Number of helpers	3
Repertoire of pots	Miscellaneous: *mattam* (small and large pots for tapping *toddy* or coconut sap) and other vessels

Origin of raw material	Clay: available locally from rice paddy fields Temper: ash
Origin of water	City supply
Kiln	1
Fuel	Coconut fiber and firewood

Background

The workshop has 5 main potters SR, SG, Y, T and A (in addition there are 2 other potters and 3 helpers). SR and SG are related by marriage. SG is SR's brother's wife. SR has one younger sister Y who is 62 years old and 2 elder sisters T and A who are 76 and 78 years old respectively. All of them are active potters.

Interview of SR

SR is 70 years old and started making pots professionally when she was 17. She learnt pottery making from her mother and maternal grandmother. SR makes the small and large *mattams* and the small pot or *kalaskoda* used for worship rituals at temples.

Identification of producer

She can easily recognize pots made by her especially if the rims are broken.

The customer

SR caters to the demand of the customers and makes the vessels she has been taught how to make without changing anything.

Interview of SG

SG is 67 years of age and started making pots professionally when she was 16. SG and SR learnt pottery together. She knows that the entire region makes the same kind of vessel, the *mattam*, but her vessels are different from the ones that others manufacture. Her workshop has a specific way of applying the technique, mixing ingredients and shaping.

Identification of producer

She can easily differentiate between the vessels made by potters in her workshop as they have worked together for many years and know each other's work well. She knows when a *mattam* is not from her workshop by looking at the rim and feeling the weight of the vessel.

The customer

The customer buys the pots, so she has to make sure the pots are made as per their satisfaction. She prefers tradition because that is what sells and is preferred by the customer too.

4.2.5.3. Karumaloor 1: Workshop of KS	
Description of workshop area	The working area is open to the air at the back of the house. The clay is located in the back of this area, with spaces designated for trampling of clay.
Number of potters	1
Number of male potters	0
Number of female potters	1

Number of children in workshop	1
Number of helpers	1
Repertoire of pots	*Mattam* ((small and large pots for tapping *toddy* or coconut sap)
Origin of raw material	Clay: available locally from rice paddy fields Temper: ash
Origin of water	City supply
Kiln	1
Fuel	Coconut fiber and firewood

Background

KS is the sole potter in the workshop.

Interview of KS

KS makes the *mattam*. She learnt pottery making from her mother and maternal grandmother. Her husband helps with the sale of the pottery.

Identification of producer

KS can identify her pots from others, by the way the rim is formed and at times the weight of the pot. She states that her pots are lighter than others in the village.

The customer

The customers always grip the *mattam* by the rim. According to her, this is because the rim thickness is important for the customer even though they may not consciously know this.

4.2.5.4. Karumaloor 2: Workshop of T	
Description of workshop area	In the courtyard behind the house with a shed on the side for pottery manufacturing activities. The clay is stored near the shed.
Number of potters	1
Number of male potters	0
Number of female potters	1
Number of children in workshop	2
Number of helpers	4
Repertoire of pots	*mattam* (small and large pots for tapping *toddy* or coconut sap)
Origin of raw material	Clay: available locally from rice paddy fields Temper: sand and ash
Origin of water	City supply
Kiln	1
Fuel	Coconut fiber and firewood

Background

T is the sole potter in the workshop while her daughters help with peripheral work.

Interview of T

T is 40 years old, holds an undergraduate degree and has been making pottery by hand since she was 10. She learnt it from her maternal grandmother and mother. She would be reprimanded if her posture or the way she held her tools or her rim were not proper.

Identification of producer

She can recognize her pots from others in the market by looking at the rim.

The customer

She has customers who have been buying from her family for generations, and this has allowed continuity of the *mattam*.

4.2.5.5. Karumaloor 3: Workshop of S	
Description of workshop area	An industrial set up equipped with clay cutting machines, indoor levigation tanks, measuring scales and electrically powered wheels.
Number of potters	6
Number of male potters	6
Number of female potters	0
Number of children in workshop	0
Number of helpers	4
Repertoire of pots	Flowerpots (different sizes)
Origin of raw material	Clay: supplied by dealer Temper: sand
Origin of water	City supply
Kiln	4

Fuel	Wood shavings, firewood and coconut fiber

Background

The workshop is owned by S. P is the only potter interviewed. He works with several others in the workshop.

Interview of P

P makes vessels on the wheel. The workshop is industrial and equipped with measuring tools to ensure the vessels are of uniform dimension. The potters have their own working space in the covered shed. The potters work on contract for 6-12 months and go back to their villages. They sometimes come back and renew the contract. P is happier working in his village, but he has to work in the workshop of S to make a living.

Identification of producer

The potters cannot identify other potters' work. According to P, he has not worked long enough to know and understand the work of other potters. The workshop is also not conducive to chatting, experiencing each other's work. It is very noisy and industrial. P can identify the makers of the vessels made in his village but is not able to sense the work of the industrial workshop at Korumuloor. He says that he grew up learning the craft in his native village by observing, interacting and practicing; therefore he knows his own work and that of a few others. According to P, the personal touch, feel and sense are missing in the industrial setup.

The customer

The customer is most important, and the middlemen buy the vessels in bulk according to the size of their truck. The potters cannot change the dimension of the vessels on their own. The storage and transport of the vessels are all dependent on the dimensions requested by the market.

4.3. Analysis

The interviews have allowed me to understand the importance of learning, teaching and interaction within a community of potters, where the pottery workshop is a social context and pottery manufacturing is learnt through observation and practice. I have summarized the points of commonality that have emerged from the interviews below:

1. In pottery workshops, potters, usually, start learning when young, the exact age varies from child to child and is generally between 6 to 14 years of age (earlier the better). Practice, observation and getting the right ‘feel’ are stated as being important in learning. There is also a pattern of discipline accompanied with physical punishment that is associated with the process. The young potters are considered professional when the master potter deems the vessels marketable.

2. All potters making similar vessels share (a) similar stages of pottery manufacturing but (b) different actions and processes within the main stages of manufacturing specific to a particular workshop tradition. The know-how of the actions and processes is only disseminated to potters working within a workshop creating a community of practice

within the larger (village) community.

3. Potters have a strong sense of group identity and understand themselves as separated from other groups of potters while still being a part of a larger community.

4. Each workshop is strict about a vessel's dimensions. Young potters get reprimanded for not getting them right. In each workshop, the apprentice is taught the technique and the 'range' of acceptable dimensions of a particular vessel through constant practice.

5. Potters have a sense of whether the vessel is made with proper dimensions by feeling or simply looking at it. According to them, knowing what is acceptable comes through practice and experience.

6. A majority of potters can separate the vessels that they made from similar vessels made by other potters by looking at the rim, or the neck of the vessel, or by feeling its weight. The rim in particular is like a signature. The ability to identify one's work and that of others in the same workshop comes from practice and working closely together.

7. According to the potters, the customers and middlemen handle the vessel before purchase, and if the 'feel' is not right or the dimensions are not acceptable, they do not buy.

8. Customers are very important to the potters, and they influence learning; if the customer likes innovation, the potters experiment and allow other potters in the workshop to come

up with newer ideas. However, most customers like the traditional vessels and so the potters continue manufacturing these vessels.

9. The potters do experiment with newer forms when sales are low or when they cater to tourists and demands of middlemen, but when demand of traditional vessels is high, they do not experiment.

10. Each community of practice has its own trajectory of continuity or change dependent on demands of the customers.

The main themes that have emerged from the interviews are, the role of apprenticeship; community of practice, identification of the producer and the role of customer in continuity and change. I have discussed the themes substantiating them with specific examples from the interviews below.

4.4. Role of apprenticeship

The process of learning can be best realized in an apprenticeship[25] setting where the transmission of culture takes place silently and gradually through a formal or informal teacher- pupil relation, as individuals or groups (Wendrich 2012: 2). The typical approaches for learning employed in workshops such as in Fustat workshop 1 *(section 4.2.2.1)* included play, observation, imitation, performance of peripheral tasks by potter S's son A and his younger brother. The young keep practicing and dumping their products back into the clay pile as evident from examples of potter

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25. I use the word apprenticeship to include individuals who are both related by family and those who are not, but are tied together by a student- teacher apprenticeship relation. In the case of potters the master and pupil are often father and son, or mother and daughter.

A in Fustat workshop 1 and potter AHM's childhood at Sheikh Ali workshop 1 *(section 4.2.3.3)*. Nearly all the potters emphasize the role of observation, practice and discipline while learning. A visit to any modern day pottery studio reveals that adults can be taught pottery making at any age. However, an apprenticeship from early childhood prepares the child to be a perfectionist in the craft and pursue the profession for economic gains (Kamp 2001: 17).

Individuals who grow up surrounded by artisans begin the process of learning a craft with much greater understanding of the skills involved than individuals who grow up without such representations (Greenfield and Lave 1982). In Fustat workshop 2 *(section 4.2.2.2)* potter A states that he is less skilled than his counterparts. He even states that the customers were not entirely happy with the *kursis* made by him, as they were much thicker and heavier than MD's and AD's. According to A, the reason for the imperfection in his work is that he started learning pottery making at the age of 23. According to A, others in his workshop were better potters in comparison, as they learnt it young and had a strict teacher to guide them. Starting young helps in enculturation and learning. During the enculturation process, children learn values as well as skills (Kamp 2001: 15). The child is guided by the elders, is involved in peripheral activities and gains an understanding of making specific ceramic forms along with dimensions specific to the workshop tradition. MA from Sheikh Ali workshop 2 *(section 4.2.3.4)* mentions that during learning, his father would guide with his hands to show the right dimensions.

4.5. Role of community of practice

Learning does not happen in isolation but, usually, takes place through interaction in a space in which a group works together, such as a pottery workshop, and the group together shapes the individual. Interaction and exertion of control are important in a workshop setting. Interaction allows the transmission of skills and information; control makes sure that the transmission is taking place as per the satisfaction of the teacher and the inherent tenets on which the practice of the workshop is based.

From raw material to technology, the potter faces choices and the decisions made are specific to the workshop. The knowledge (both empirical and tradition based) regarding ratios, recipes and manufacturing techniques, operational sequences are all disseminated within the group through repeated guidance, interaction and practice, which allow internalization. AD from Fustat workshop 2 *(section 4.2.2.2)* states that guidance and practice allows one to internalize all knowledge regarding recipes, measurements and other details. The expression of this knowledge is reflective of a specific *habitus* and gets embedded in the product of that workshop. *Habitus* is communicated and gets defined through subtle body language, involuntary movements and nonverbal communication. Therefore, "transfer of knowledge encompasses the entirety of operational sequences, mental models, appropriate behavior and involuntary gestures, within a social context" (Wendrich 2012: 3-4). According to Mauss (1934), body techniques are highly developed body actions that embody aspects of a given culture. The teaching and consequent learning of a craft in a workshop setting transmits the culture embedded in the craft.

The sense of identity is part of a community of practice. As an example, in the Indian context there are a number of myths associated with the origins of the potters granting exclusivity to their craft. The potters call themselves *Prajapati* literally the "lord of the governed" and claim descent from the son of *Brahma*, the creator who is one of the prime deities of the Hindu triad.

The background of this invented tradition and related social knowledge gives the potters a sense of larger group identity that binds them along with the craft in the community of practice.

Apart from the larger community identity, the interviews indicate that the potters from specific workshops within the larger community identify themselves as distinct groups. Potters from a workshop, usually, address themselves as "we" or "us" and address other potters from different workshops as "them". The relevant examples are of: 1) Fustat workshop 2 *(section 4.2.2.2)* where potter MD talks about 'knowing his *kursis* and *khashboohas* brand MD, AD, AH and A and can identify them anywhere in Egypt', alluding to the identification of work by his fellow potters in the workshop 2) potter AH1 at Ballas workshop 2 *(section 4.2.3.2)* refers to other *ballas* makers as 'them' and 3) SG from the workshop at Tatthapilly *(section 4.2.5.2)* who states that her *mattams* are different from the ones that other make in the region.

The group identity is also apparent by the fact that potters speak of carefully guarding their secrets from other pottery workshops. To illustrate with examples: 1) potter AD from Fustat workshop 2 *(section 4.2.2.2)* mentions that secrets of manufacturing are not divulged unless one belongs to family or workshop, 2) Potter N from the workshop at Dar as-salaam *(section 4.2.3.5)* mentions getting *brahm* temper from *mil-arbayaeen*, a secret place and 3) Potter BABA from the workshop at Amer 1 *(section 4.2.4.4)* mentions getting temper for water pots from a secret place unknown to other potters in Amer.

The various examples illustrated above prove that within the larger community of practice, there is a strong sense of differentiation. The groups create boundaries and disseminate workshop specific nuances of pottery manufacturing. The framework has within it, both conceptual and body knowledge that together embody nuances of culture, which find expression in material culture and get transmitted. Teaching in the long term allows the apprentices within the group to be predisposed to certain patterns of behavior and bodily movements, which get reinforced and routinized through observation, guidance and interaction within the group. The community or group members inculcated in this specific tradition keep transmitting the internalized and routinized gestures, bodily movements and knowledge of various actions to new group members through practice.

4.6 Role of the ability to identify the producer

The potters from nearly all the workshops profess about the ability to recognize their own vessels from similar vessels made by others. They all point to the rims as being the main marker for identifying the maker of the vessel. To illustrate with examples: 1) ABS from Fustat workshop 3 *(section 4.2.2.3)* states that the ability to recognize one's own vessels from others comes from years of practice. 2) Potter P at Karumaloor workshop 3 *(section 4.2.5.5)* illustrates that working intermittently in an industrial set up is not conducive to potters identifying each others work due to an absence of opportunities to observe or interact. Potter P also mentions that he can identify his work among other potters in the village as he has 'learnt' the craft by observing and practicing for a very long time.

The potters work in a group, follow a daily routine, practice, interact and observe each other's activities. The structure and consistency in pottery manufacturing help in internalizing patterns that allow potters to identify signatures of individuals they work with. Therefore, the ability of potters in identifying the producer highlights the role of the *habitus* in shaping individuals in a close-knit group such as workshop. According to potter ABS from Fustat workshop 3 *(section 4.2.2.3)* rim thickness of a vessel type within a workshop will be similar and the thickness for the same type of vessel from other workshops will be different.

4.7. Role of the customer in continuity and change

The potter and customer (middlemen and regular customers) share a close relationship, and vessels are produced with customer behavior in mind. The statement of potters during interviews confirms that customers do not buy vessels if they do not match their expectations. At Fustat workshop 1 *(section 4.2.2.1)* potter K remembers an episode when he made a vessel thicker than usual at his workshop and the customers did not buy the batch of vessels. Another example showing potter-customer relationship is when potter AB mentions how customers examine vessels at the Nazla workshop *(section 4.2.1.2)* and then enquire whether potter AB was sick while making the vessels because the rims were too thick.

It is evident from the interviews of almost all the potters that the rim thickness is of particular importance to each workshop. The potters also state that they would get scolded, beaten and reprimanded if they went beyond the accepted parameters of thickness. M2 from the Kom Aushim workshop *(section 4.2.1.1)* specifically mentions that the workshop has a range of measurements that has to be complied with. Thus, there is an acceptable 'range of measurements', determined by the workshop and worked out on the basis of customer demand and satisfaction. The range is an unwritten one and is followed by the potters by feel and sight. The range cannot be transgressed because it would violate the unspoken rules of the workshop and the preferences of the customers. The rim thickness doe not affect the functionality of the vessel but is closely related to the dynamics between producer and consumer.

Flexibility and rigidity in continuity and change

If there is metric variability beyond the accepted parameters in a particular workshop, it indicates flexibility, which might be related to rapid change. For example, potter M2 *(section 4.2.1.1)* clearly states that if there were no customers (if pottery was a leisurely activity), he would give his children more freedom to experiment while teaching and be less rigid. On the other hand, if there is metric variability within the accepted parameters, there is more control, which might be a cause for continuity and allow for change at a slow pace. For example, S from Fustat workshop 1 *(section 4.2.2.1)* states that each workshop has a control over dimensions such as rim thickness, indicating rigidity. The workshop, potter and the customer together determine the dimensions of the vessel.

According to Joyce (2012: 150), continuity and change can also be viewed from a conscious perspective when potters periodically innovate, and at some point their innovations are acceptable to users, who encourage sustained production, and may attract emulation by other potters, leading new practices to spread. High production and sales would indicate positive feedback from the customers' side. For example, potter H from the Jagatpura workshop *(section 4.2.4.7)* mentions that he usually experiments with new shapes and forms during the lean period to be able to sell. If they start selling more of the new types, he produces more. However, during the festive season when demand is high, he does not need to experiment because sales are good. Innovating when sales are low is also recorded in the statements of potters from Kom Aushim. Potter BABA from the workshop at Amer *(section 4.2.4.4)* states that there was no change in the *matka* or *matki* water pot for almost 300 years as the vessels were easily sold. However, it is not always that innovation alone allows the introduction of a novel thing and consequent change;

change can occur with the slowly expanding or shifting metric variability of a type within a specific community of practice. I pose in *chapter 6* that forms may appear similar and standardized, but there is metric variability within a type specific to each workshop. Metric attributes have 'range of measurements' indicating different communities of practice as they are based on practice and enculturation i.e. indicating a particular group. In *chapter 6* using ethnoarchaeological data and transposing the method while examining ancient Karanis, I show that clusters of ranges of measurements falling together would indicate specific communities of practice because individuals working together will be closer than the clustering of 'range of measurements' of individuals working elsewhere

Thus, a new type may appear to be an innovation but in fact carries with it an embedded history of the development of that type moving slowly away from the accepted metric range of measurements, which affect all attributes (morphological and metric) of the type. This process may be slow but is crucial in understanding how transmission affects continuity and change. From the information and analysis gained through interviews, observation and methods to distinguish communities of practice, I pose in chapter 6 that transmission of skill influenced continuity or change in locally manufactured utilitarian ware at Late Roman Karanis, Egypt.

4.8. Methods inferred from interviews

Communities of practice can be inferred from the following examples: 1) potter S2 from Fustat workshop 3 *(section 4.2.2.3)* states that the small *khashboohas* from his workshop look similar to the ones from Fustat workshop 1 *(section 4.2.2.1)* but that there are subtle differences in the mix of clay and temper, the rim, as well as the weight of the vessel. 2) AH1 from Ballas workshop 2 *(section 4.2.3.2)* mentions that he was taught by his father to finish the rim in a specific way. He has taught the technique to his sons too and so he can easily spot the Ballas jars from his workshop in the village or even the market. According to him, other potters have a different way of finishing the rims, 3) Potter BABA from the workshop at Amer 1 *(section 4.2.4.4)* states that that although the water pots manufactured in Amer all look similar, there are small differences. These can be in the shape of the rim, or result from a different combination of temper, the type of hammer and anvil, or the style of the potter. BABA, for instance, uses a temper that gives his vessels an additional shine. He obtains this from a place unknown to other potters in Amer. He and his son are consistent in the type they make, as that's the way they were taught in their workshop, and finally, 4) SG from Tathapilly *(section 4.2.5.2)* states that the *mattam's* from her workshop are different from those of other potters as they have a specific way of applying the technique, mixing ingredients and shaping.

The above examples from my fieldwork indicate that it is possible to discern modern communities of practice by focusing on the operational sequences and also associated microvariables such as body movements and gestures that are specific to each workshop. Because we cannot interview or observe potters of the past, it becomes necessary to devise ways to show how learning and teaching are transmitted within workshops and impact ceramics in the past, and only accessible to us through interpretation of the archaeological context. This can be done by identifying the markers left on the vessels due to differences in operational sequences and associated microvariables We should investigate such markers only on similar vessels, rather than different types, so that we are able to detect the subtle differences that mark objects produced by different communities of practice. The stages of manufacture of similar vessels would remain the same but the differences between workshops would be in the sub-processes such as recipes, body movements, gestures and vessel dimensions to name a few (*see chapters 5 and 6 for details*).

As stated earlier, the interview sessions and observations of various potters in Egypt and India allowed me to develop a method used in *chapters 5 and 6* to define transmission markers in specific communities of practice, which can be transposed from an ethnoarchaeological to an archaeological context. These are:

1) scan-sample space usage for activities of potters to bring out *similarities* within workshops and *differences* between workshops.

2) analyze qualitative microvariables (gestures and body postures) using Anvil, a gesture and movement analysis software to bring out the *similarities* within workshops and *differences* between workshops while manufacturing similar vessels.

I then investigate the archaeological context and focus on markers found in archaeological ceramics by:

3) conducting visual analysis of *similar* sherds to show *similarities* of temper within workshops and *differences* between kiln areas or possible workshops (*see chapter 5 for details)*.

4) conducting spot chemical tests on *similar* rim sherds at Karanis to show the scale of reactivity in order to ascertain *similarities* and *differences* in the constituents of the fabric.

I then progress to *chapter 6* where *1)* through experiments in the ethnoarchaeological context, I examine the veracity of the potters statements relating to their ability to recognize the work of different producers by identifying vessels through rims and the existence of 'range of measurements' of similar vessels in a workshop and finally, *2)* I examine archaeological ceramics at Karanis using metric analysis inspired by the findings from my ethnoarchaeological investigations.

Chapters 5 and 6 detail the methods based on the findings presented the current chapter along with the results of these investigations.

Chapter 5

Discerning communities of practice through action analysis

The current chapter uses ethnoarchaeological and archaeological data to discern communities of practice by analyzing aspects within the framework of chaîne opératoire. These aspects include time spent in specific pottery manufacturing areas, body movements, gestures, transitions and observations of actions for pottery manufacture. The insights help in finding markers left on ceramics, which are a result of actions specific to each workshop and can be useful in discerning communities of practice.

Chaîne opératoire functions as a methodological tool for the analysis of technical processes in the step-by-step production of artifacts. In *chapter 3*, I have discussed the *chaîne opératoire* of pottery manufacture in some detail. It is important to include hand gestures and body movements integral to artifact production within the framework of *chaîne opératoire* to make an assessment about specific communities of practice. The operational sequences for certain types of pottery manufacture are all 'culturally shared' (Rouse 1960). For example, the steps involved in making a certain type of cooking vessel form in ancient Karanis is similar across groups of potters. Some of the actions performed are different between and specific to particular workshops. In *chapter 3*, I have discussed the concepts of *habitus*, enculturation and daily practice and how they relate to use of space, gesture and movement, and to activities within the framework of *chaîne opératoire* of pottery manufacture. In *chapter 4*, I demonstrate through interviews with potters that when they work together for years in one workshop, they make pottery in a similar way. This suggests that actions such as gesture and postures should also be similar due to the influences of enculturation, and daily practice. The main actions for vessel production for the potters (even if they belong to different workshops) will be similar but the differences will lie in some of those actions that would help discern communities of practice. The *chaîne opératoire* is an ordered and abstracted representation of the production process valid for different workshops, while the actual production activities are much more variable between workshops.

To test the veracity of the statements made by the potters in *chapter 4*, I try to ascertain similarities and differences within and between workshops, by using scan sampling for space usage patterns associated with artifact production. I use a video annotation tool (anvil) for gesture and movement analysis, and analyze the transitions between actions and express these in diagrams. In space analysis, I compare the total time spent by potters in different workshops in a particular part of the workshop (clay preparation area, wheel, drying area). The analysis of the gesture and postures measures the frequency of actions while making two vessels, for instance, the number of left hand or right movements while making the vessel, rather than the total time it takes to make a vessel. Modern potters do not consider total time spent as a significant aspect in discerning their workshop from others. They say being fast or slow paced is age related and sometimes work pressure forces them to fastidiously complete a batch. From insights derived in the ethnoarchaeological section, I show similarities and differences of presumed actions in the past, such as adding temper. This can be compared to the ancient material through visual examination and spot chemical tests of the fabric of ancient ceramics.

5.1 Ethnoarchaeological approach

5. 1.1. Scan sampling

To reiterate from *chapter 3*, scan sampling is a structured method that includes timed observation periods and behavioral coding. Scan sampling or tracking is well suited for research in which intra-and inter-group comparisons of activities, uses of objects, and uses of space are an analytic goal (Ochs et al. 2006: 391). Use of space tends to follow the sequence of manufacturing stages, where the *chaîne* opératoire is imprinted in the espace opératoire of the workshop (Hasaki 2011: 24).

Scan sampling of potters within and between workshops

Aim: To show similarities and differences between individual potters within workshops and between workshops, in total time spent in specific functional spaces for pottery manufacture.

Reason: similarities and differences between individual potters and workshops in the amount of time spent in specific spaces for pottery manufacture highlight the role, enculturation and daily practice in a specific community of practice.

Method: Potters K and S, and S2 and ABS were scanned for space usage while making the *khashbooha (flowerpot)* every five minutes for a total of 120 minutes. I calculated the absolute percentage of time spent in making two pots. A sample size of n=2 for each workshop was chosen because there were only two individuals working on similar activities.

Potters scanned: K, S (Fustat1) and S2, ABS (Fustat 2)

Workshop: Fustat 1 and Fustat 2

Figure 5-1
Scan sampling of space usage for potters at Fustat

Scan sampling of potters within workshops

Absolute percentage of space usage within workshops:

	Fustat 1		***Fustat2***	
Activity area	***Potter K %***	***Potter S%***	***S2%***	***ABS%***
Trampling	13	14	0	0
Wheel	62	81	87	92
Drying	25	5	13	8

Table 5-1
Absolute percentage for space usage

Description:

The Fustat 1 workshop has three areas where the *khashbooha*-flowerpot *is made*: 1) trampling area for the clay 2) wheel area where the vessel is formed and 3) the drying area where the shaped vessel is placed to dry. In accordance to *Figure 5-1* and *table 5-1* above, both potters K and S spend similar amounts of time in the trampling area for clay preparation. K spends 25% of the time in the drying area, while S spends only 5% of the time. However, the percentage difference between the two is because S is helped by his son A, who carries the finished vessels from the wheel area to the drying area; K on the other hand prefers to place his vessels for drying on his own, and therefore ends up spending more time in the drying area. The overall effect is that S with the extra help of his son, is able to spend 62% time at the wheel, which is 20% more time than K. Drying is not relevant for potter S but the differential organization of work within the workshop is relevant in understanding similarities and differences.

Fustat 2 workshop also uses three areas while making the *khashbooha*-flowerpot. As per *figure 5-1* above, both potter S2 and ABS do not spend time at the trampling area because the trampling is done by the helpers. S2 spends 87% of the time in the wheel area, while ABS spends 92% of the time. S2 spends 13% of the time in the drying area while potter ABS spends 8% of the time. This difference is because the helpers intermittently aid both S2 and ABS.

Conclusion:

The space usage for the Fustat 1 and Fustat 2 workshop both involve three spatial areas while making the *khashbooha*. On comparing the time spent by two potters in the same workshop, there seem to be more similarities than differences. The data shows a high degree of similarity between potters K and S of the Fustat 1 workshop in usage of the trampling area. The similarity between S2 and ABS of the Fustat 2 workshop as stated above, is that both do not use the trampling area but are able to spend equal amounts of time in the wheel area. This is because the helpers do the trampling. In Fustat 1, there is a wide difference in the use of the drying area between potters K and S. As stated above, this is because S is helped by his son, while potter K undertakes this activity on his own. In Fustat 2, both the potters S2 and ABS are aided by helpers. There is slight discrepancy in the percentage of time spent by S2 in the drying area when compared to ABS. The reason is that ABS, because of his old age and his position as a master potter is aided by the helpers more than S2. In all, the potters of Fustat 2 are able to spend more time at the wheel compared to the potters from Fustat 1 due to the difference in organization of work.

Scan sampling of potters between workshops

In view of the specific circumstances relating to the drying area for Fustat 1, where S is aided by a helper, the drying area for Fustat 2, where the potters are intermittently aided by helpers and the non usage of the trampling area by the potters of Fustat 2, it is best to compare the differences between the two workshops at a qualitative level instead of a quantitative one.

Activity	***Fustat 1***	***Fustat 2***
Trampling by potters	Yes	No
Trampling by helpers	No	Yes
Wheel by potters	Yes	Yes
Wheel by helpers	No	No

Drying by potters	Yes, one potter is helped regularly	Yes, both potters are helped intermittently
Drying by helpers	Yes, aided by 1 helper	Yes, aided by 3 helpers

Table 5-2
Qualitative comparison between Fustat 1 and Fustat 2 workshops

Description:

At a qualitative level, from *table 5-2* above, the similarities are noticed in the operational sequences for the Fustat 1 and Fustat 2 workshop; both divide up space for the three main stages in the same qualitative way- the three spatial areas while making the *khashbooha*-flowerpot. The differences between the two workshops are noticed in the role of helpers that aid the potters in the trampling area. In case of trampling, the potters of Fustat 1 engage in trampling on their own while the potters of Fustat 2 do not engage in the activity at all. As trampling of clay is integral to pottery production, it has to be done by somebody. In Fustat 2 it is apparently not done by the potters, but by helpers. This would allow the potters at Fustat 2 to spend more time at the wheel when compared to the potters of Fustat 1. Perhaps this difference has an effect on the production output of the vessels.

Conclusion:

If we were to calculate only the relative percentage of time spent in the wheeled area by the potters of both the workshops, it would be equal. However, the differences in the absolute percentage for usage of space reveals a lot about workshop organization between two workshops making the same type of vessels. The three pronged division of space for carrying out the three main activities within the framework of the *chaîne opératoire* suggests similarities between the two workshops; a shared *chaîne opératoire* at a qualitative level. The qualitative difference between the two workshops indicates that in Fustat 1 and Fustat 3, the helpers have a role in the amount of time a potter is able to spend at the wheel while making the *khashbooha*-flowerpot. The scan offers insight and demonstrates that a comparison between two workshops is indeed possible to discern communities of practice through scan sampling.

5.1.2. Gesture and posture analysis

Aim: To show that similarities and differences in body movement patterns can be detected in actions for the processes within the framework of the *chaîne opératoire*

Reason: Similarities and differences in body movements while manufacturing pottery could possibly show the role of enculturation and daily practice in a specific community of potters.

Method: Analysis of potters engaged in actions while manufacturing pottery using video footage, anvil, a gesture and posture analysis software and statistics to show similarities within workshops and differences between workshops. Anvil is software developed by Michael Kipps (2012) and is a video annotation research tool. I utilize the software for gesture and posture analysis of potters. This has been done by undertaking manual annotation[26] of video footage.

[26] Heidi Lynn Hilliker completed the manual annotation of majority of the files while Diya Singh completed two of those files. I am indebted to both of them for their work.

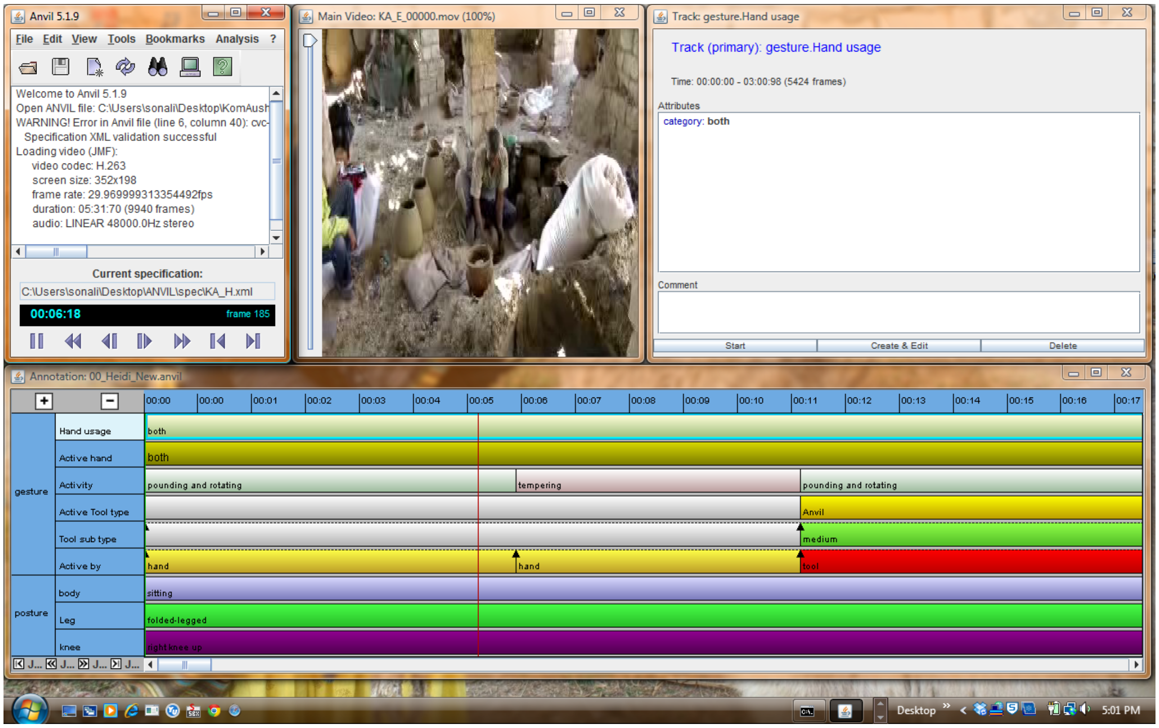


Figure 5-2
Coding session on anvil

There is no mechanism to store the coding process in platforms other than anvil; I have therefore taken a screen shot of a coding session in progress displayed in *figure 5-2* above. The coding of the video footage was done on the parallel tracks under the time axis bar in blue. I have recorded an encoded clip on anvil as *Video clip encoding*, which can be seen at the following link: http://vimeo.com/111276451 with the following password: sonalianvil

The coding includes the transcription of values under each sub track highlighted by distinct colors on the parallel tracks. The use of different colors was to make it easier for the annotator to code.

An evaluation of the similarities and differences of gestures and postures within and between workshops can highlight the boundaries of the communities of practice. The tracks have therefore been divided into two 1) Gesture and 2) Posture. The two tracks can be seen on the left side of the parallel tracks highlighted in blue in *figure 5-2* above. The gesture track relates to sub tracks for hand movements such as hand usage, active hand, active tool type, tool sub type and active by hand or tool. The posture track related to sub tracks such as body, knee, leg and foot postures. These sub tracks are further divided into attributes, for example the hand usage has attributes such as left hand, right hand, both hands or no use of hands at all or none. The attributes are each adapted to manufacturing processes for specific vessels.

The main tracks, sub tracks with attributes are encoded using the specification editor displayed in *figure 5- 3* below. Each video clip has its own specification file written in XML. The annotation is done by playing the video footage in slow motion followed by annotation of the gestures and posture involved in each frame. To illustrate, the main gesture track has a sub track, hand usage, which has various attributes. The coding involves right clicking on the running tracks and the transcription of various sub tracks and attributes highlighted by distinct colors on the parallel tracks.

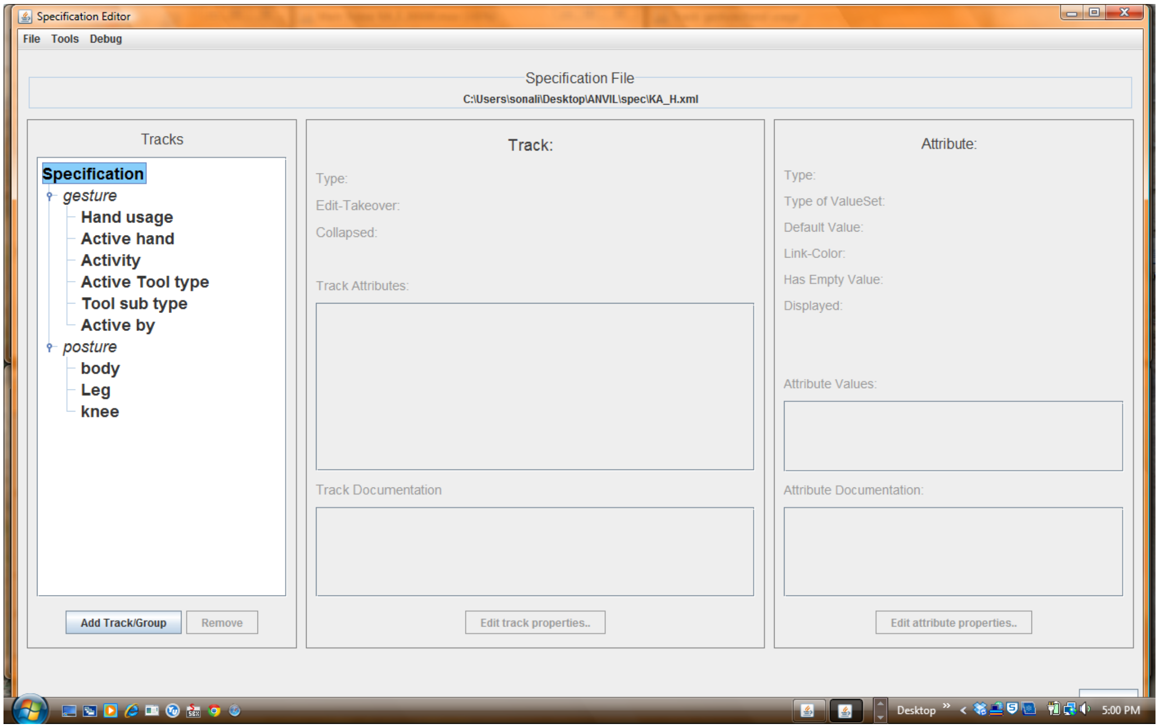


Figure 5-3
Specification editor

The use of different colors while visually pleasing, also makes the task of the annotator much easier. Each action of the potter is annotated in the way described above.

A screen shot of the attributes or values with their distinct colors are displayed in *figure 5-4* below. These values and colors are seen in the parallel tracks of the final encoding. After completing an annotation, the specification file is linked to the anvil file.

The annotations are converted into quantitative files that are exported first to excel sheets and then subjected to statistical analysis. Each file is then subjected to absolute percentage computation (sometimes with bar graphs) for the gesture and posture sub tracks to evaluate similarities and differences within and between workshops.

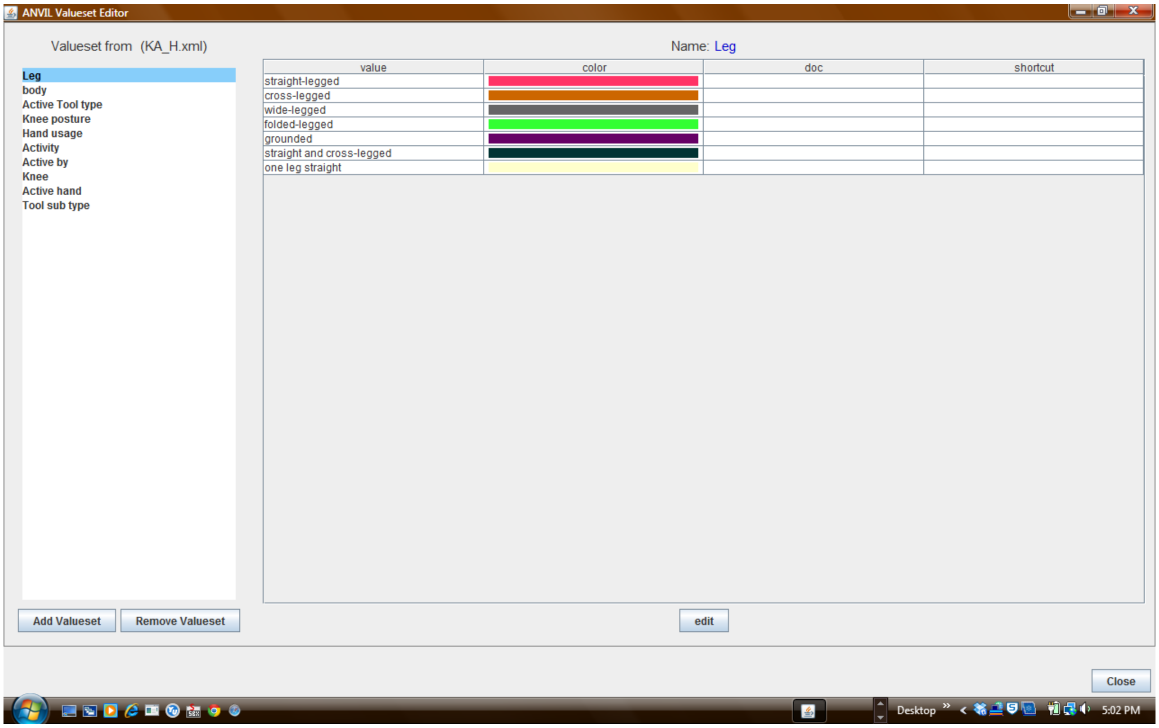


Figure 5-4
Value set from specification file

<u>Action analysis of two Indian workshops from the same region:</u>

Aim: To show similarities and differences between SB and NB from Chattrikhera workshop 1 and 2 while making the *kali*-water pot

Method: To show quantitative and qualitative similarities and differences between the potters. The charts below show the amount of time spent in making two pots by one potter. The actual number of minutes spent in making the pot is irrelevant for the purposes of my analysis. I am interested in the actions and frequency of those actions used by the potters in making the pots.

Name of vessel: Kali-water pot

Technique: Ground level wheel

Workshop: Chattrikhera 1 and 2

Potters: SB and NB

Video clip SB: http://vimeo.com/112204365

Video clip NB: http://vimeo.com/112204372

Hand usage

		SB%	***NB%***
0	None	0	0
1	Left	0	34
2	Right	0	0
3	Both	100	66
	Total	100	100

Table 5-3
Absolute % for total hand usage of potters SB & NB while making two water pots

Quantitative assessment:

From *table 5-3* above, as is evident, SB engages both his hands while making the pot, while NB engages his left hand 34% of the time and both his hands 66% of the time.

Qualitative assessment:

NB sometimes works with just his left hand, while SB always uses both his hands.

Hand position

		SB%	NB%
0	None	0	0
1	Left inside vessel	32	30
2	Right inside vessel	5	9
3	Both inside vessel	0	0
4	Left outside vessel	0	13
5	Right outside vessel	18	0
6	Both outside vessel	45	48
	Total	100	100

Table 5-4
Absolute % for total hand positions of potters SB & NB while making two water-pots

Quantitative assessment:

As is evident from *table 5-4*, both SB and NB are quite similar in using their left hand inside and both hands outside the vessel. However, there are differences in using their right hand inside the vessel.

Qualitative assessment:

It is important to note that both SB and NB are right- handed individuals. SB uses his right hand outside the vessel while NB uses only his left hand outside the vessel. The two potters never use both hands inside the vessel.

Active finger

		SB%	NB%
0	None	0	0
1	Thumb	32	37
2	Index	6	11
3	Middle	0	0
4	Ring	0	0
5	Little	0	0
6	Thumb with index	0	3
7	Thumb with little	16	11
8	Thumb, index with middle	0	0
9	Both thumbs	25	26
10	Index with middle	20	11
	Total	100	100

Table 5-5
Absolute % for total active fingers of potters SB & NB while making two water pots

Quantitative assessment:

As is evident from *table 5-5*, SB and NB are quite similar in using both thumbs together. There are variations between the two in their usage of the thumb, index finger, thumb with little finger and the index with the middle finger.

Qualitative assessment:

A difference is seen in the usage of the thumb with index finger by NB and not by SB.

<u>*Activity*</u>

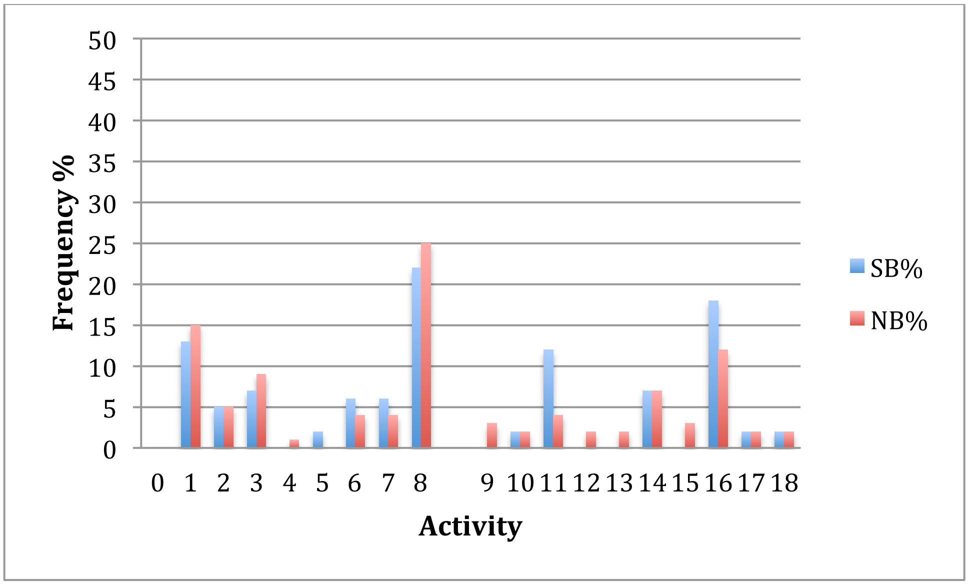


Figure 5-5
Absolute % for total activities of potters SB & NB while making two water pots

		SB%	***NB%***
0	none	0	0
1	Cleaning	13	15
2	Rotating wheel	5	5
3	Placing the clay lump on the wheel	7	9
4	Slapping	0	1
5	Cupping the clay	2	0
6	Drawing up the cone	6	4
7	Drawing up the cone	6	4
8	Adding temper	22	25
9	Opening the vessel downward	0	3
10	Opening the mouth of the vessel wide	2	2
11	Controlling wheel	12	4
12	Raising wall	0	2
13	Shaping base	0	2
14	Shaping body	7	7
15	Shaping neck	0	3
16	Shaping rim	18	12

17	Cutting	2	2
18	Holding	2	2
	Total	100	100

Table 5-6
Absolute % for total activities of potters SB & NB while making two water pots

Quantitative assessment:

The 18 activities outlined above are part of the *chaîne opératoire* followed by potters SB and NB in making the water pot. Some of the activities occur repeatedly at various stages of the pottery manufacturing process. As is evident from *table 5-6* and *figure 5-5,* both SB and NB are similar in holding the vessel, opening the mouth of the vessels wide, shaping the body, cutting the vessel, rotating the wheel and centering the clay. They are fairly similar in placing the vessels, (placing involves placing the lump of clay in the center of the wheel while is the symmetry achieved after cupping, coning up and down several times), adding temper to the vessels, cleaning the wheel, so that the residue clay from the previous vessels does not spoil the next one, and coning the clay up, a process crucial for centering of the vessel. The differences are seen in shaping the rim, SB uses 18% of the time while NB uses 12% of the time to shape the rim. SB controls the wheel 12% of the time while NB controls it 2% of the time. Controlling the wheel allows adjustment of speed in the turning of the wheel.

Qualitative assessment:

The qualitative differences may be seen in the activities carried out by NB for slapping the lump of clay on the wheel, raising the wall, opening the vessel downward (the vessel is initially closed atop, with the help of the downward thrust of the thumb and the fingers, the vessel is opened; this opening will later become the mouth of the vessel and finally shaping the neck. It is important to remember that the actions outlined for NB above are directly acted upon the water pot. SB on the other hand is able to achieve similar results indirectly by carrying out actions on other parts of the vessel, which give desired height, mouth and neck. SB cups the clay up (cupping is the act of bringing both hands together in a cupped position over the lump of clay and allowing the clay to rise by exerting little pressure) while NB does not do this.

Active tool type

		SB	***NB***
0	None	0	0
1	Wire	29	34
2	Stick	57	67
3	Cloth	0	0
4	Rope	0	0
5	Shaper	14	0
	Total	100	100

Table 5-7
Absolute % for total active tool type of potters SB & NB while making two water pots

Quantitative assessment:

From *table 5-7,* both SB and NB use the wire and the stick during the process of pottery manufacture (the wire is used to separate the vessel from the wheel). SB uses it 29% of the time while for NB it is 34% of the time. The stick is used to set the ground wheel in motion and when the wheel seems to lose momentum. SB uses it at 57% while NB uses it at 67%.

Qualitative assessment:

The only difference is seen in the use of the shaper by SB (14%), while NB does not use the shaper at all. It is important to remember that both the potters are making the same type and size of vessel.

Body posture

		SB	*NB*
0	None	0	0
1	Standing	9	0
2	Sitting	55	100
3	Bending	0	0
4	Lifting and leaning	36	0
	Total	100	100

Table 5-8
Absolute % for total body postures of potters SB & NB while making two water pots

Quantitative assessment:

From *table 5-8*, SB spends 55% of the time sitting while NB spends all his time sitting while manufacturing pottery. SB stands 9% of the time and lifts and leans 36% of the time while bringing pots to the drying area.

Qualitative assessment:

The differences between the two are SB stands, lifts and leans over to pick up the finished vessel from the wheel while NB does not transition into these postures, he just picks the vessel up while sitting and places it aside.

Leg posture

		SB	*NB*
0	None	0	0
1	Folded	72	100
2	Left leg straight	0	0
3	Right leg straight	0	0
4	Bent	28	0
	Total	100	100

Table 5-9
Absolute % for total leg postures of potters SB & NB while making two water pots

Quantitative assessment:

From *table 5-9*, SB folds his legs 72% of the time while NB folds his 100% of the time.

SB bends his legs 28% of the time. This is because he gets up in the bent leg position.

Qualitative assessment:

The only difference is seen in SB bending his legs while NB does not bend them at all.

SB bends his legs while getting up.

<u>*Foot posture*</u>

		SB	*NB*
0	None	0	0
1	Left foot up	47	0
2	Left foot down	0	0
3	Right foot up	0	0
4	Right foot down	0	0
5	Both feet up	0	0

6	Both feet down	54	100
	Total	100	100

Table 5-10
Absolute % for total foot postures of potters SB & NB while making two water pots

Quantitative assessment:

As is evident from *table 5-10,* SB and NB place both their feet down at 54% and 100% of the time.

Qualitative assessment:

The only difference is that SB lifts the front of his left foot up 47% of the time, while NB does not place his left foot up at all. The lifting of the foot takes place during the shaping of the vessel at the wheel.

<u>*Knee posture*</u>

		SB	***NB***
0	None	0	0
1	Left bent	0	0
2	Right bent	0	0
3	Both bent	100	100
4	Both straight	0	0
	Total	100	100

Table 5-11
Absolute % for total knee postures of potters SB & NB while making two water pots

Quantitative assessment:

SB and NB have both their knees bent equally at 100% of the time during the process of pottery manufacture.

Qualitative assessment:

The actions of the knee posture are similar for both the potters.

Conclusion:

From the *figures* and *tables* above, there are three types of similarities and differences between the potters:

1) Whether both the potters carry out similar actions while the frequency of actions differs.
2) Whether both the potters carry out similar actions and the frequency of actions is similar or fairly similar.
3) Whether one of the potters performs an action while the other one does not.

1: Similar actions but different frequency between SB and NB:

Hand usage: use of both hands together have different frequencies

Body posture: sitting posture has different frequencies

Leg posture: folded posture has different frequencies

Foot posture: both feet down has different frequencies

2: Fairly similar frequency for similar actions between SB and NB:

The actions not performed by either of them also qualify as similarities.

Hand positioning: similar frequency for left inside vessel, right inside vessel and both outside vessel.

Active fingers: similar frequency for thumb, index, thumb with little finger, and both thumbs.

Activity: similar frequency for holding, placing, tempering, opening the vessel wide, shaping the body, cutting the vessel, rotating the wheel, centering and coning up of clay.

Active tool type: similar frequency for usage of wire

Knee posture: similar frequency

3: Performance of an action by only one potter:

Hand usage: use of left hand by NB (but not by SB)

Hand position: use of left hand outside vessel by NB, use of right hand outside vessel by SB

Active fingers: use of thumb with index finger by NB (but not by SB)

Activity: cupping up of clay by SB; shaping neck and base, raising the wall, slapping the vessel and opening the mouth with downward thrust by NB.

Active tool type: use of rope by SB.

Body posture: SB lifting and leaning his body over the wheel while picking up the vessel.

Leg posture: SB bending his legs

Foot posture: SB placing his left foot up.

When potters belong to different workshops, they are not a part of the same enculturation and daily practice. Therefore, we expect to find more differences than similarities in gestures and postures while manufacturing similar vessels. On analyzing the two potters, it appears that similar actions are common to a large group of potters but the differences in frequencies are workshop or potter specific. In our example the actions may be common to the entire group of potters in southeastern Rajasthan.

The number of similarities in both actions and frequencies between the potters point to both potters belonging to one workshop. Against expectation there are more similarities than differences between the two potters SB and NB, who work in different workshops. However, it is important to note that even though potters SB and NB are from two different workshops, they are brothers who learnt pottery manufacturing from their father and separated their workshops at a later period (*see chapter 4 for details*). The similarities then strengthen the theory that enculturation and daily practice form habits of gestures and postures. This happens during the apprenticeship period and would explain the fact that brothers SB and NB show many similarities in the way they sit and move while they work.

3 suggests that the performance of one action by a potter, while the other potter does not perform that same activity, is indicative of differences within the workshop and a personal signature of the potter. The separation of the two brothers, working in different workshops would explain why they developed their own specific ways of doing things.

<u>Action analysis of two Egyptian potters from the same workshop</u>

Aim: To show similarities and differences between E and M2 from the Kom Aushim workshop while making the *deffaya*-heater

Name of vessel: deffayya-heater

Technique: Hammer and anvil

Workshop: Kom Aushim

Potters: E and M2

Video clip E: http://vimeo.com/111262732

Video clip M2: http://vimeo.com/111276199

Hand usage

		E%	***M2%***
0	None	0	0
1	Left	22	34
2	Right	22	0
3	Both	55	66
	Total	100	100

Table 5-12
Absolute % for total hand usage of potters E & M2 while making one deffaya-heater

Quantitative assessment:

From *table 5-12*, it is evident that E uses his left hand 22% of the time while M2 uses his at 34%. Both E and M2 use both their hands 55% and 66% of the time.

Qualitative assessment:

E used his right hand while M2 does not use his right hand singularly at all.

Active hand

		E%	***M2%***
0	None	0	0
1	Left	22	34
2	Right	22	0

3	Both	56	66
	Total	100	100

Table 5-13
Absolute % for total active hands of potters E & M2 while making one deffaya-heater

Quantitative assessment:

From *table 5-13,* it is evident that E's active hand is his left one, which is used 22% of the time, while for M2 it is active at 34%. Both E and M2 use both their hands 55% and 66% of the time.

Qualitative assessment:

E used his right hand while M2 does not use his right hand singularly at all.

<u>Activity</u>

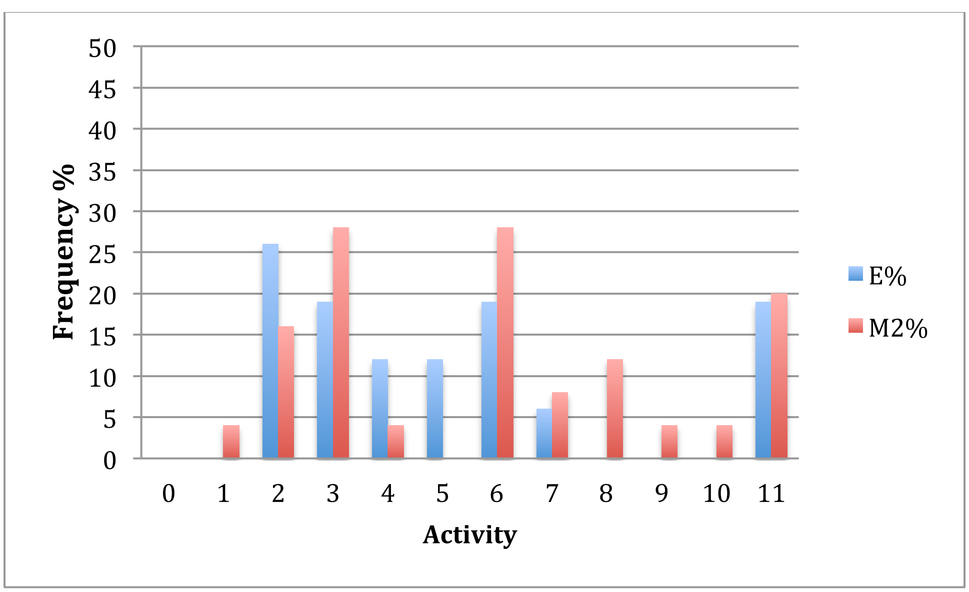


Figure 5-6
Absolute % for total activities of potters E & M2 while making one deffaya

		E%	***M2%***
0	None	0	0
1	Pounding the clay	0	4
2	Pounding the clay with rotation	26	16
3	Adding temper	19	28
4	Slapping the vessel	12	4
5	Smoothing the vessel	12	0
6	Adding temper	19	28
7	Removing clay from rim	6	8
8	Pinching the vessel	0	12
9	Talking	0	4
10	Listening	0	4
11	Placing the vessel	19	20
	Total	100	100

Table 5-14
Absolute % for total activities of potters E & M2 while making one deffaya-heater

Quantitative assessment:

The 11 activities outlined above are part of the *chaîne opératoire* followed by potters E and M2 in making the *deffaya*-heater. The activities such as slapping the walls, pounding the clay with rotational movements, smoothing, pinching the vessel to fix it, are repeated at every stage of the manufacturing.

From *table 5-14* and *figure 5-6,* it is evident that both E and M2 are fairly similar in removing clay from the rim of the *deffaya* and placing it once done. They differ in slapping the surface of the vessel; E does it more often than M2. E adds temper 19% of the time while M2 adds temper more frequently at 28%. E also pounds the clay while rotating the vessel more than M2.

Qualitative assessment:

E smoothens and holds the vessel while M2 pinches the vessel and engages in conversation and pauses to listen as well.

Active tool type

		E%	*M2%*
0	None	0	0
1	Hammer	25	40
2	Anvil	75	60
	Total	100	100

Table 5-15
Absolute % for total active tool types of potters E & M2 while making one deffaya-heater

Quantitative assessment:

From *table 5-15,* it is evident that E uses the hammer less than M2, while the anvil is used more by E than M2.

Qualitative assessment:

None

Active tool sub-type

		E%	*M2%*
0	None	0	0
1	Narrow	0	0
2	Wide	0	0
3	Small	0	0

4	Large	100	100
	Total	100	100

Table 5-16
Absolute % for total active tool sub-types for potters E & M2 while making one deffaya heater

Quantitative assessment:

From *table 5-16,* it is evident that both E and M2 use the large anvil. It is important to note that at a workshop at Nazla where potters manufacture the same vessel, the choice of tool sub types during the manufacturing process ranges from small to medium and large anvils.

Qualitative assessment:

None

Active by

		E%	***M2%***
0	None	0	0
1	Hand	72	52
2	Tool	28	48
	Total	100	100

Table 5-17
Absolute % for total active by hand or tool of potters E & M2 while making one deffaya heater

Quantitative assessment:

From *table 5-17,* it is evident that E is more active by hand than M2. M2 is more active by tool.

Qualitative assessment:

None

Body posture

		E%	*M2%*
0	None	0	0
1	Standing	0	0
2	Sitting	100	100
3	Bending	0	0
	Total	100	100

Table 5-18
Absolute % for total body postures of potters E & M2 while making one deffaya-heater

Quantitative assessment:

From *table 5-18,* it is evident that both E and M2 remain in the sitting position while making the *deffaya*.

Qualitative assessment:

None

Leg posture

		E%	*M2%*
0	None	0	0
1	Straight-legged	0	0
2	Cross-legged	0	0
3	Wide-legged	0	0
4	Fold-legged	100	100
	Total	100	100

Table 5-19
Absolute % for total leg postures of potters E & M2 while making one deffaya-heater

Quantitative assessment:

From *table 5-19,* it is evident that both E and M2 have their legs in a folded position.

Qualitative assessment:

None

<u>Knee posture</u>

		E%	*M2%*
0	None	0	0
1	Left bent	0	0
2	Right bent	0	0
3	Both bent	20	0
4	Both straight	0	0
5	Right knee up	40	50
6	Left knee up	40	50
	Total	100	100

Table 5-20
Absolute % for total knee postures of potters E & M2 while making one deffaya-heater

Quantitative assessment:

From *table 5-20,* it is evident that both the potters are quite similar in keeping their right and left knees up.

Qualitative assessment:

For E, both knees are bent 20% of the time.

Conclusion:

From the *figures* and *tables* above, the three types of analysis to assess similarities and differences between the potters are as follows:

1: Similar actions but different frequency between E and M2:

Hand usage: Frequencies are different for the usage of left and both hands

Active hand: Frequencies differ for the active hand

Activity: Frequencies differ for slapping, tempering, pounding while rotating the vessel.

Active tool type: Frequencies differ for hammer and the anvil usage

Active by hand or tool: Frequencies differ for both

2: Fairly similar frequency for similar actions between E and M2:

Here, the actions not performed by either of them also qualify as similarities.

Activity: Both are similar in placing and removing the clay from the rim of the vessel

Active tool sub type: Both use the large tool sub type

Body posture: Both have similar sitting positions

Leg posture: Both are similar

Knee posture: Both are similar

3: Performance of an action by only one potter:

Hand usage: E uses right hand while M2 does not

Active hand: E's right hand is active

Activity: E performs smoothing and holding of the vessel. M2 pinches and pounds the vessel and also engages in conversation and listening while manufacturing vessels.

It is my suggestion that when potters belong to the same workshop, they are a part of the same enculturation and daily practice. Therefore, there should be more similarities than differences in gestures and postures while manufacturing similar vessels. On analyzing the two potters, it appears that in 1, similar actions are common to a large group of potters but the differences in frequencies are workshop or potter specific.

2 indicates that the number of similarities in both actions and frequencies between the potters point to both the potters belonging to one workshop. Here, exact similarities are seen in the body, leg and knee postures as well as usage of the tool sub type and a few activities.

3 suggests that the performance of one action by a potter and the non-performance by the other potter is indicative of the differences at the level of workshop. Here, only the hand usage and active hand categories differ. Further, though, it appears that talking and listening can be attributed to the nature of an individual rather than to an activity integral to pottery manufacturing but in reality, each community of practice has its own thresholds of tolerance for breaks and chatting. Activities such as chatting or resting with occasional tea breaks (as I have witnessed), may not be related to the production process, but 'provide effectiveness and sustainability of the work' (Wendrich 2013:201). At the Kom Aushim workshop, M2 does have freedom for talking and listening. It would be interesting to note whether E also engages in talking and listening like M2. During my video research, E did not do so but on other occasions I have seen him taking breaks to smoke the hookah and chatting.

In my opinion 3 is the main indicator to suggest differences at the level of workshop. Here, the differences between E and M2 are minimal compared to the similarities seen in level 2 and level 3

Action analysis of two potters from the same workshop and one potter from a different workshop

Aim: To show similarities and differences between Y, SR and O when making the small

Name of vessel: small pot

Technique: Hammer and anvil

Workshop: Tathapilly and Chedamangalam

Potters: Y, SR and O

Video clip Y: http://vimeo.com/111277956

Video clip SR: http://vimeo.com/111277957

Video clip O: http://vimeo.com/112129909

Hand usage

		Y%	***SR%***	***O%***
0	None	0	50	0
1	Left	0	0	0
2	Right	0	0	0
3	Both	100	50	100
	Total	100	100	100

Table 5-21
Absolute % for total hand usage of potters Y, SR & O while making one small pot

Quantitative assessment:

As per *table 5-21*, Y and O are both similar in using both their hands 100% of the time, while SR is different as she uses them 50% of the time.

Qualitative assessment:

SR takes breaks when she does not use any of her hands 50% of the time. This is the time she is talking to someone.

<u>*Active hand*</u>

		Y%	***SR%***	***O%***
0	None	0	0	0
1	Left	34	34	60
2	Right	0	0	0
3	Both	66	66	40
	Total	100	100	100

Table 5-22
Absolute % total active hands of potters Y, SR & O while making one small pot

Quantitative assessment:

Y and SR both use their left hands 34% of the time while O uses it at 60%. Y and SR equally use both their hands 66 % of the time while O uses both her hands at 40%.

Qualitative assessment:

None

Activity

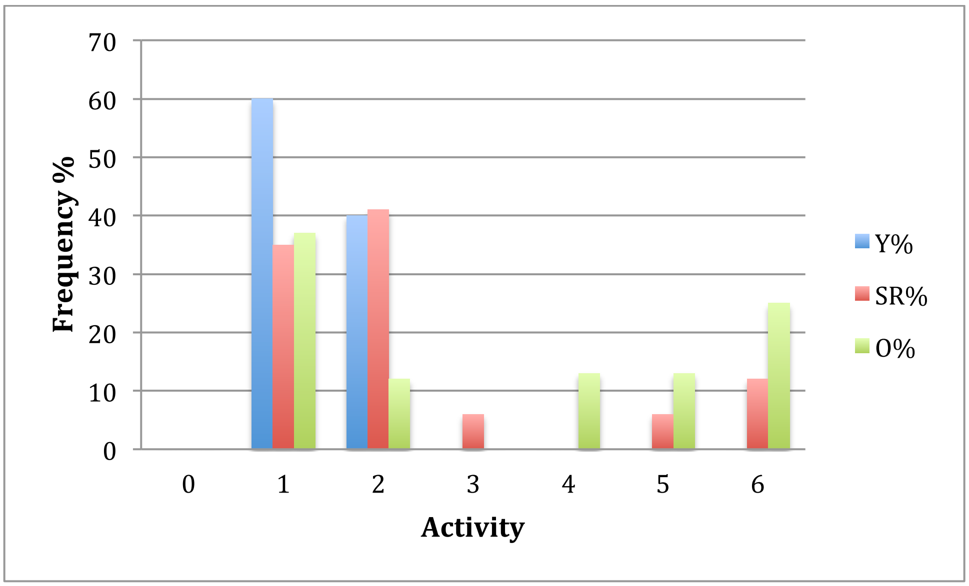


Figure 5-7
Absolute % for total activity of potters Y, SR & O while making one small pot

		Y%	SR%	O%
0	None	0	0	0
1	Beating	60	35	37
2	Tempering	40	41	12
3	Smoothing	0	6	0
4	Fixing	0	0	13
5	Holding	0	6	13
6	Placing	0	12	25
	Total	100	100	100

Table 5-23
Absolute % for total activity of potters Y, SR & O while making one small pot

Quantitative assessment:

As per *table 5-23* and *figure 5-7*, the six activities outlined above are part of the *chaîne opératoire* followed by potters Y, SR and O in making the small pot. The activities such as beating, tempering, smoothing, holding and fixing are repeated at every stage of the manufacturing.

Potters Y and SR are similar in tempering the vessels, while O is different in this regard. Potter Y seems to beat the vessel more often at 60% than SR and O who do it less frequently.

Qualitative assessment:

SR is the only potter who smoothens the vessel. SR and O hold the vessel while Y does not (holding the vessel without any action). Both SR and O place the vessel (purposefully getting up and placing the vessel in a separate area). Y does not carry out this activity, perhaps due to her old age (she is in her 70's) or due to availability of space for placing the vessels right next to her. In relation to SR and Y, who do not spend time fixing the vessel, O spends 13% of her time fixing while manufacturing.

<u>*Active tool type*</u>

		Y%	***SR%***	***O%***
0	None	0	0	0
1	Hammer	100	100	100
2	Anvil	0	0	0
	Total	100	100	100

Table 5-24
Absolute % for total active tool types of potters Y, SR & O while making one small pot

Quantitative assessment:

As per *table 5-24*, all three potters use the hammer as the active tool type.

Qualitative assessment:

None

<u>*Active tool sub-type*</u>

		Y%	*SR%*	*O%*
0	None	0	0	0
1	narrow	0	0	0
2	Wide	0	0	0
3	Small	0	0	0
4	medium	100	100	100
	Total	100	100	100

Table 5-25
Absolute % for total active tool sub-type of potters Y, SR & O while making one small pot

Quantitative assessment:

As per *table 5-25*, all three potters use a medium hammer.

Qualitative assessment:

None

<u>*Body posture*</u>

		Y%	*SR%*	*O%*
0	None	0	0	0
1	Standing	0	0	0
2	Bending	0	0	0
3	Sitting with cushion	100	100	0
4	Sitting without cushion	0	0	100

Table 5-26
Absolute % for total body postures of potters Y, SR & O while making one small pot

Quantitative assessment:

As per *table 5-26*, Y and SR both are in a seated position with a cushion while manufacturing the vessel

Qualitative assessment:

O sits without a cushion through the pottery manufacturing process

<u>*Leg posture*</u>

		Y%	***SR%***	***O%***
0	None	0	0	0
1	Straight-legged	34	50	100
2	Cross-legged	0	0	0
3	Wide-legged	0	0	0
4	Fold-legged	0	0	0
5	Folded with feet on ground	0	0	0
6	Straight and cross-legged	66	50	0
	Total	100	100	100

Table 5-27
Absolute % for total leg postures of potters Y, SR & O while making one small pot

Quantitative assessment:

As per *table 5-27*, For Y and SR, the leg posture is straight-legged 34% and 50% of the time while for O this position occurs 100% of the time.

Qualitative assessment:

The straight and cross-legged posture for Y and SR is at 66 % and 50% respectively.

Knee posture

		Y%	*SR%*	*O%*
0	None	0	0	0
1	Left bent	0	0	0
2	Right bent	0	0	0
3	Both bent	0	0	0
4	Both straight	100	100	100
	Total	100	100	100

Table 5-28
Absolute % for total knee postures of potters Y, SR & O while making one small pot

Quantitative assessment:

As per *table 5-28*, for Y, S and O, the knee posture is the same.

Qualitative assessment:

None

Conclusion:

From the *figures* and *tables* above, there are three types of analysis to assess similarities and differences between the potters. I will first analyze potters Y and SR who belong to the same workshop and later contrast them with O separately

Potters Y and SR

1: Similar actions but different frequency between Y and SR:

Hand usage: use of both hands with different frequencies

Activity: both beat the vessel with different frequencies

Leg posture: both sit straight legged and straight and cross-legged with different frequencies

2: Fairly similar frequency for similar actions between Y and SR:

Here, the actions not performed by either of them also qualify as similarities.

Active hand: both use their left and both hands equally

Activity: both are similar in tempering the vessels

Active tool type: both are similar in using the tool type

Active tool sub type: both are similar in using the active tool sub type

Body posture: both are similarly seated

Knee posture: both are similar in their knee posture.

3: Performance of an action by only one potter:

Hand usage: SR does not use hands 50% of the time as she engages in conversation

Activity: SR smoothens, holds and places the vessel, while Y does not do that.

To reiterate, it has been my suggestion that when potters belong to the same workshop, they are a part of the same enculturation and daily practice. Therefore, in my assessment, there should be more similarities than differences in gestures and postures while manufacturing similar vessels. On analyzing potters Y and SR, it appears that in 1 similar actions are common to a large group of potters but the differences in frequencies are workshop or potter specific.

2 indicates that the number of similarities in both actions and frequencies between the potters point to both the potters belonging to one workshop. Here, there are quite a number of similarities between Y and SR.

3 suggests that the performance of one action by a potter and the non-performance by the other potter is indicative of the differences at the level of workshop. For the hand usage category, SR does not use hands 50% of the time as she engages in conversation. This may be indicative of the level of tolerance that a workshop has towards such breaks. In terms of activities for holding and placing the vessel (while getting up), on closer inspection of the video footage, I noticed that potter Y had a lot of space available to place the vessels immediately instead of getting up and placing them. Thus, these two activities appear to be related to space crunch in the activity area than a real difference at the level of workshop enculturation. The only difference is that SR smoothens the vessel while Y does not.

Potters Y and O

1: Similar actions but different frequency between Y and O:

Active hand: both use their left and both hands with different frequencies

Activity: tempering and beating the vessel with different frequencies

Leg posture: straight legged with different frequencies

2: Fairly similar frequency for similar actions between Y and O:

Here, the actions not performed by either of them also qualify as similarities.

Hand usage: both hands

Active tool type: both are similar

Active tool sub type: both are similar

Body posture: both are similar

Knee posture: both are similar

3: Performance of an action by only one potter:

Body posture: different

Leg posture: Y sits straight and cross-legged, O does not

To reiterate, when potters belong to the different workshops, they are a part of different enculturation and daily practice. Therefore, there should be more differences in gestures and postures while manufacturing similar vessels. On analyzing the two potters Y and O at the three levels, it appears that in 1 similar actions are common to a large group of potters but the differences in frequencies are workshop or potter specific.

2 indicates that the number of similarities in both actions and frequencies between the potters point to both the potters belonging to one workshop. Here, there are similarities between Y and O.

3 suggests that the performance of one action by a potter and the non-performance by the other potter is indicative of the differences at the level of workshop. Here, the body posture of the two potters is different and so is one of the leg postures.

In the above analysis, it is not too clear to relate the two potters to separate workshops.

<u>Potters SR and O</u>

1: Similar actions but different frequency between SR and O:

Hand usage: use of both hands has different frequencies

Active hand: left and both hands have different frequencies

Activity: holding, placing and tempering have different frequencies

Leg posture: straight legged with different frequencies

2: Fairly similar frequency for similar actions between SR and O:

Here, the actions not performed by either of them also qualify as similarities.

Activity: both are similar in beating the vessels

Active tool type: both are similar

Active tool sub type: both are similar

Knee posture: both are similar

3: Performance of an action by only one potter:

Hand usage: SR does not use hands 50% of the time, engages in conversation

Activity: SR smoothens the vessel while O only fixes the vessel.

Body posture: SR sits with a cushion, while O does not.

Leg posture: SR sits straight and cross-legged but O does not.

When potters belong to different workshop, they are a part of different set of enculturation and daily practice. Therefore, there should be more differences than similarities in gestures and postures while manufacturing similar vessels. On analyzing potters SR and O, it seems that in 1, similar actions are common to a large group of potters but the differences in frequencies are workshop or potter specific.

2 indicates that the number of similarities in both actions and frequencies between the potters point to both the potters belonging to one workshop. Here, there are few similarities between SR and O.

3 suggests that the performance of one action by a potter and the non-performance by the other potter is indicative of the differences at the level of workshop. Here, there appear to be a number of differences such as in the hand usage category, SR does not use hands 50% of the time (perhaps workshop tolerance to breaks). In terms of activities, SR smoothens the vessel (Y did not smoothen the vessels) while O does not. Further, O fixes the vessel but SR does not. In terms of body posture, SR sits with a cushion underneath, just like Y from her workshop but O sits with a back support and no cushion. In terms of leg posture too, SR sits straight and cross-legged just like Y but O does not.

On comparing all three potters together, many actions in 1 appear to be culturally salient or common to the potters but the differences in frequencies of those actions indicate workshop affiliation. The frequencies for potters Y and SR are closer to each other than potter O.

Further, in 2, the frequencies for Y and SR are exactly similar to each other rather than O's. This indicates that Y and SR work closely together and are a part of the same workshop.

Initially, I had compared potters SB and NB from two different workshops who were brothers and had learnt the basics of pottery manufacturing together from their father, hence, a number of similarities in 1 and 2 were seen. I then compared potters E and M2 from the same workshop, here too similarities in 1 and 2 were noticed. On comparing potters Y and SR from the same workshop and contrasting each of them with potter O from a different workshop, all making similar vessels, it became clear that the indicators of workshop affiliation are the 'closeness of frequencies in 1 and 2' and the 'differences in actions in 3'. Thus, closeness in performance of actions between potters of the same workshop is indeed due to enculturation and daily practice.

5.1.3. Transition diagrams

Aim: To gauge subtle gesture, bodily movements and tool usage transitions during pottery manufacture

Why: If gestures, bodily movements and tool usage transitions for potters were more similar, it would suggest they belong to the same workshop. The properties left on such vessels would also be similar.

Method: When the tabulation of different attributes does not show clarity as above, then transition diagrams may be used for evaluating similarities and differences within and between potters of workshops. In some cases, transition diagrams are generated by the anvil software to visualize a) how often a category of attributes occurs, and b) how often one category follows another one. The frequency of occurrences in each category is indicated in the size of the dot at each category. Every arrow from a category A to another category B indicates with its size the amount of times that B followed A. The number is a percentage relative to all outgoing arrows from A. An arrow from A to B with 60 means "for all occurrences of category A, in 60% of the cases it was followed by a B" (Kipp 2013). All outgoing arrows therefore add up to 100%.

Transition diagrams to show similarities in gestures within workshop

Name of vessel: ballas-water jar

Technique: kick wheel

Workshop: Ballas 1

Potters: AH1 and AF1

<u>*Hand position*</u>

Figure 5-8
Potter AH1 Hand position

Figure 5-9
Potter AF1 Hand position

Analysis:

Both AH1 and AF1 have exactly similar transition diagrams for their hand positions while making the *ballas* water jars. An arrow from 'left hand inside vessel' to 'both hands outside vessel' and vice versa indicates that in 100% of the cases each was followed by the other. This shows that both potters AH1 and AF1 follow the same order in positioning their hands while making the *ballas* jar. The frequency of the two hand positions is also high as shown by the size of the dot. AH1 and AF1 are father and son *(details see chapter 4*) and both belong to the same pottery workshop at Ballas 1, where AF1 learnt pottery making from his father and grandfather.

Conclusion:

The similarity between two potters from the same workshop can aid in discerning boundaries between workshops, which do not share such similarities. Shared similarities in transition of movements from one phase to another (illustrated in examples above) emphasize the important roles of learning through observation, enculturation and daily practice. It is important to note that gestures and postures of potters working together in a workshop are usually fairly similar but not identical.

Transition diagrams within between workshops

Name of vessel: mattam-pot for fermenting coconut sap

Technique: hammer and anvil

Workshop: Tathapilly and Chedamangalam

Potters: SR, SA and O

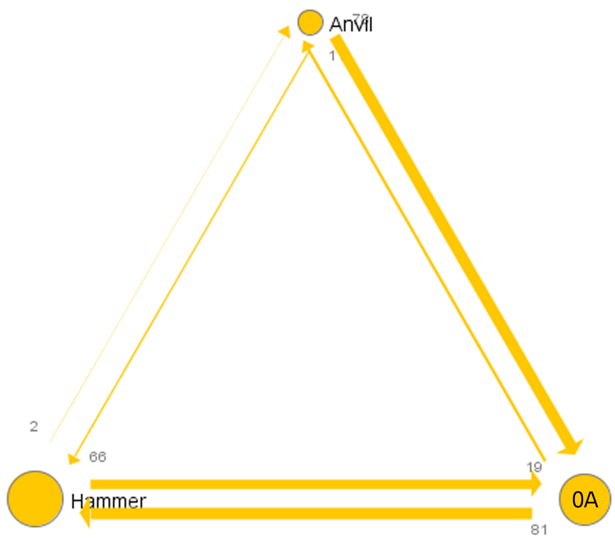


Figure 5-10
Tool usage schema for potter SR

Legend	
Hammer	Use of hammer
Anvil	Use of Anvil
0A	No activity

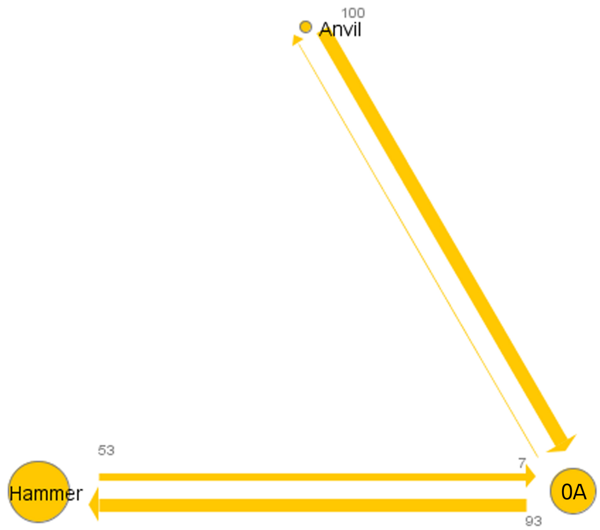


Figure 5-11
Tool usage schema for potter SA

Legend	
Hammer	Use of hammer
Anvil	Use of anvil
0A	No activity

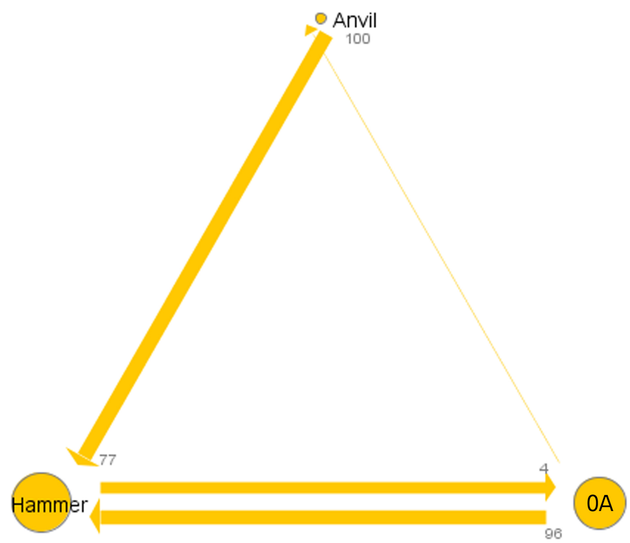


Figure 5-12

Tool usage schema for potter O

Legend	
Hammer	Use of hammer
Anvil	Use of anvil
0A	No activity

Description:

SR and SA have similar transition diagrams for the order of tool usage while making the *mattam (pot for fermenting coconut sap)*. In the case of SR, 78% of the time the no activity follows the anvil usage stage. In the case of SA, the transition from anvil to a no activity stage happens 100 % of the time. On the other hand for potter O the no activity stage does not occur after the anvil usage stage; the potter transitions from the anvil stage directly to the hammer use stage 100% of the time.

SR transitions from the no activity stage to the hammer use stage 81% of the time while SA makes this transition 93% of the time, for O the transition happens 96 % of the time.

SR transitions from the hammer use stage to the no activity stage 66% of the time, while SA transitions 53% of the time, for O the transition happens 77% of the time.

The thinner lines and smaller dots indicate less frequent transitional activities. For SR and SA, the transition from a no activity stage to the anvil stage happens 19 % and 7% of the time. For, O the transition is 4% of the time.

The transition from Hammer to anvil use for SR is 2% of the time and for SA and O it is nil.

The transitional results indicate that both potters SR and SA have a fairly similar order in using the hammer and anvil tools while making the *mattam*. The use of the hammer and anvil is usually interrupted with a period of no activity or rest, perhaps to regain the expended energy. SR and SA are related *(details see chapter 4*) and both belong to the same pottery workshop at Tathapilly.

Conclusion:

Transitions between actions can be used to enhance the inventory of (dis) similarities of individual craftsmen and thus can aid in discerning different workshops. Shared similarities reveal the important roles of enculturation, daily practice and observation. The transition diagram of O is seen to be markedly different from those of SR and SA. O is from a different workshop situated in Chedamangalam and even though the potters make similar *mattams*, there is a difference in the order in which tools are used.

5.1.4. Detailed observation of production actions

Aim: To check whether there is variability in the production actions within the framework of the *chaîne opératoire* of adjacent workshops manufacturing a standardized vessel.

Reason: The stages of manufacture of similar vessels in different workshops may be identical and make it seem that the vessels are all standardized across workshops. However, it is possible to discern communities of practice by observing the production actions of manufacture within the main stages of manufacture.

Method: observation of activities

Observation 1

Khashbooha – flowerpot manufacture

A *khashbooha* or a flowerpot is widely manufactured and sold in Egypt. The stages of the *chaîne opératoire* from procurement to the preparation of clay before shaping of the *khashbooha* at three adjacent workshops in Fustat, Cairo is indicated in table 5-29. It is important to note that the *khashbooha* from all three workshops appear quite similar in form.

Production sequence	**Fustat A (1)**	**Fustat B (2)**	**Fustat C (3)**
Stage 1 Raw material procurement	Supply from dealer A in Cairo	Supply from dealer B in Cairo	Supply from dealer C in Helawan
Stage 2 Preparation: mixing of clays	Mix equal amounts of Aswan clay to nile silt: 2:2	Mix more Aswan clay to nile silt: 2:1	Mix one-third nile silt to two third desert clay
Stage 3 Storage &	Store for 3 days in water	Store for 2 days in water	Storage for 5 days in water

levigation			
Stage 4 Kneading	Clay kneaded by potter to remove air pockets	Clay kneaded by professional to remove air pockets not potter	Clay kneaded by professional to remove
Stage 5 Adding temper & water	Ash and chaff as temper is added periodically along with water while kneading	Only chaff temper is added periodically along with water while kneading	No temper
Stage 6 Gauging of Clay consistency	Potter decides the consistency of clay	Professional decides the consistency of clay and hands clay to potter	Professional decides the consistency of clay and hands clay to potter
Stage 7 Readiness of clay paste	Clay paste ready for use on the kick wheel	Clay paste ready for use on the kick wheel	Clay paste ready for use on the kick wheel

Table 5-29
Select stages of manufacture (khashbooha)

Analysis:

In accordance to *table 5-29* above, at stage 1, the raw material for Fustat A and B is procured from two different dealers in Cairo who may have sourced the clay from different areas. The clay for Fustat C comes from a dealer in Helawan. At stage 2, Fustat A mixes Aswan clay and nile silt in a 2:2 ratio, Fustat B mixes them in a 2:1 ratio while Fustat C follows an entirely different recipe mixing nile silt with a desert clay in a different ratio. These different ratios are workshop specific keeping in mind the consistency of clay paste needed for the final product. The ratios could also have an effect on the color of the *khasbhooha* after firing as the Aswan clay gives off a pink color on firing. The products from Fustat B may be a darker shade of pink than Fustat A due to the ratio of Aswan clay mixed with nile silts. It is clear that the *khashbooha* made at Fustat C will not have a pinkish tinge at all due to absence of Aswan clay. At stage 3, the storage of clay for levigation is also different for Fustat A, B and C. At stage 4, the manpower employed for kneading clay is also different: in Fustat A the potter himself kneads clay while in Fustat B & C a professional helper (a non potter) does the initial kneading. From my conversations with the potters at all three workshops, Fustat B and C were getting more orders for *khasbhooha* than the Fustat A potters. This could be one of the reasons that Fustat A did not have a professional helper for kneading and utilized the son for this task at times. At stage 5, Fustat A adds ash and chaff temper; Fustat B adds only chaff temper while Fustat C adds no temper at all. The workshops may have their own reasons for adding specific types and amounts of temper for the *khashbooha*. On asking, the potters at Fustat A stated that their grandfather added ash along with chaff temper to make the clay feel better; the potters at Fustat B said they only add chaff temper as they have always done so, while the potters at Fustat C stated that their *khashbooha* is perfect with the clay it is made from without a temper. At stage 6, in Fustat A, the potter gauges the consistency of the clay paste while at Fustat B and C the professional helper feels the consistency. The clay paste at stage 7 is ready at all three workshops but the clay differs in content and treatment.

<u>Observation 2</u>

Olla manufacture:

The *olla* is a water jug manufactured from Nile silt and desert clay. The *olla* necks sometimes have a filter in them to keep flies away. I did not witness the making of the *olla* but observed the preparation of clay and the final product at the workshops a few days later.

Production sequence	Fustat A (3)	Fustat B (1)
Stage 1 **Raw material procurement**	Silt supply from dealer A in Cairo; desert clay from Helawan	Silt supply from dealer B in Cairo
Stage 2 **Preparation: mixing of clays**	Mix half silt with half desert clay: 1:1	Nile silt only
Stage 3 **Mixing of temper**	Add ash from kiln	No temper
Stage 4 **Kneading**	Clay kneaded by potter to remove air pockets	Clay kneaded by professional to remove air pockets not potter
Stage 5 **Gauging Clay consistency**	Potter decides the consistency of clay	Professional decides the consistency of clay and hands clay to potter
Stage 6	Clay ready for use on the kick wheel	Clay ready for use on the kick wheel
Sale Price of Olla	15 Egyptian pounds	8 Egyptian pounds

Table 5-30
Select stages of manufacture (olla)

Analysis:

In accordance to *table 5-30* above, at stage 1, the raw material is not procured from the same dealer. This could also mean that the dealers themselves could possibly be procuring the clay from different sources. At stage 2, during mixing of clays, Fustat A mixes Nile silt and desert clay in a 1:1 ratio while Fustat B does not mix nile silt with other clays at all. At Fustat A, the potter adds ash as temper, while at Fustat B no temper is added. Further, at Fustat A, the potter himself kneads clay while Fustat B has a professional helper who kneads clay and who is not a potter. The clay paste is ready for shaping the vessel on the kick wheel but the paste differs in content and has been handled differently in the two workshops. Thus, it is obvious that the two workshops differ in the stages leading to clay preparation. I was not able to observe the *olla* shaping on the wheel but viewed the finished products after a few days. The pricing for both the *olla* differs; the one from Fustat A is more expensive than the one from Fustat B. The former appears sturdy and is of a lighter color than the other olla. The different pricing may be due to the clay content where Fustat A used both Nile silt and desert clay and Fustat B used Nile silt only. Most buyers preferred the lighter colored but more expensive Olla stating that it would last longer while a buyer who bought the darker *olla* stated that he buys this type more as it is cheaper and is easily replaceable. This made me think that the darker one appeared flaky and must break easily.

<u>Observation 3</u>

Mattam manufacture:

The *mattam* is a traditional vessel from Kerela made for holding fermented coconut sap.

Production sequence	**Chedamangalam**	**Tathapilly**
Raw material procurement	Clay is brought directly from the river bank in a cart by road	Clay is brought by a vendor
Clay preparation	clay is trampled by the feet	Clay is trampled by the feet and intermittently kneaded by hands
Tool usage	Use two narrow & broad hammers and small, medium sized anvil	Narrow hammer with imprint and narrow hammer without imprint and one sized anvil

Table 5-31
Select stages of manufacture (mattam)

Analysis:

For the Chedamangalam workshop, raw material is procured directly from the nearby river while for potters at Tathapilly, the raw material is bought from a vendor. At Chedamangalam, clay is trampled by feet and at Tathapilly, the clay is trampled by feet and kneaded with hands to gauge consistency of the clay paste. In Chedamangalam, the potters use two hammers (broad and narrow) and two anvils (small and medium). The potters at Tathapilly also use two hammers (both narrow with one having a carved pattern on the sides) and a one sized anvil. I earlier thought that potters use different sized hammers and anvils for different sized vessels. However, when I measured the diameters of the *mattams* from the workshops at Chedamangalam and Tathapilly, they were the same. The different sized tools were integral to manufacturing the *mattam* but the real significance lay in the specific sequence of usage specific to each workshop tradition.

Conclusion:

From the above three observations, it is clear that the production sequence (*chaîne operatoire)* may be identical but the production activities carry the signature of a specific workshop. I have attempted to highlight the differences in the activities through observation of a specific type of vessel. Focusing on the production activities within the stages of pottery manufacture is an important tool to discern communities of practice.

5.2. Archaeological application

5.2.1 Markers of transmission

In the current chapter, I have been able to discern communities of potters by the time spent in a particular production space; usage patterns; gestures; movements; transitional phases and finally observation of the production activities in pottery manufacturing. However, when dealing with archaeological ceramics, the tools that may be used for discerning communities of potters are hardly available (see *table 5-32* below). I have tried to focus on the actions associated with pottery manufacturing that have corresponding methods for investigation in the ethnographic and archaeological contexts. From *section 5.1.4* above, temper and clays are mixed to clay pastes by each workshop in specific ratios. The methods to evaluate the temper and clay markers in the archaeological material range from visual examination, chemical tests to petrographic analysis and trace element analysis methods. For the purposes of my dissertation, I chose the visual examination and spot chemical tests as methods for the interpretation of the fabric of archaeological sherds from Karanis. These sherds have traces of inclusions both natural or deliberately embedded by way of mixing in temper, the particular production activities of pottery manufacture. Traces of different recipes/ratios may be understood by examining the sherds visually and through chemical tests. Such examination is an important tool in discerning communities of practice.

Markers of transmission in ethnographic context	**Methods in ethnographic context**	**Methods in Archaeological Context**	**Interpretation for a specific *habitus***
Activity patterns	Scan sampling	None	Similar patterning could point to a specific community of practice
Gestures and postures	Video analysis	None	Similar gestures and postures for pottery manufacture could point to a specific community of practice
Transitional activities	Video analysis	None	Similar transitional activities for pottery manufacture could point to a specific community of practice
Production activities such as mixing of clay &temper-recipes	Observation	1. visual examination 2. petrographic analysis 3. chemical tests 4.trace element analysis	Similar ratios of clay and types of temper could point to a specific community of practice

Table 5-32
Markers of transmission

5.2.2 Visual examination

Aim: To prove that there is variability in the sub processes of adjacent workshops manufacturing a standardized vessel in an archaeological context.

Reason: To corroborate the results of chemical tests showing presence of carbonates through reactivity to hydrochloric acid, I conducted a visual examination for inclusions in the cross sections of samples of cooking vessels from kiln areas C1 to C6.

Method: I first collected sherds and divided them on the basis of locally manufactured fabric types (see *chapter 1* and *6* for details regarding local fabric types at Karanis). The relevant fabric types were the local and local organic. I then sorted the sherds and selected similar typed cooking vessels from all the kiln areas. A total of 8 samples were collected from different kiln areas. As the surface of sherds acquire accretions over long periods of time, to avoid incorrect identification, a clipper was used to provide a fresh break to aid in analysis. A X 8 magnifying hand held lens and photographs[27] using a dino lite microscopic camera were used to help identify the inclusions in the sherd cross sections. The type of inclusions in the cross sections of these similar cooking vessels from the kiln areas would perhaps indicate similarities and/or differences. The only relevant factors to show these inclusions were carbonates and voids. The table for visual identification of principle inclusions has been adapted from Peacock (1977: 30-32) and a comparison chart for estimating various quantities of different sizes and shapes of particles in a sherd cross section (Rice 1987: 349). The table and chart can be found in Appendix to chapter 5.

Samples C1a and C2a were similar cooking pots from excavated kilns and were of the same type as samples C3a, C4a, C5a and C6a, cooking pots collected from the kiln survey. Samples C1b and C2b were casseroles having the shallow lid seat typed rim from the collection survey. All of the cross sections were from the upper half of the cooking vessel (nearer the rim).

[27]The photographs are zoomed 100 x for clarity

Figure 5-13
Photo showing cross section of sample C1a

Sample	Kiln Area	Type	Inclusion type	Void form	Reaction with HCL[28]	Frequency of voids /inclusions
C1a	C1	Cooking Pot	Not discernable	Elongated	0	2-3 mm: 5%

[28]Reaction with hydrochloric acid is measured on a 0 to 2 scale as follows: 0-no reaction, 1-little reaction, 2-very reactive. A dropper was used to drop a 30% solution of hydrochloric acid (HCl) onto a small area in the cross section of each sample.

Figure 5-14
Photo showing cross section of sample C1b

Sample	Kiln Area	Type	Inclusion type	Void form	Reaction with HCL	Frequency of voids/inclusions
C1b	C1	Casserole	Not discernable	Not discernable	0	-

Figure 5-15
Photo showing cross section of sample C2a

Sample	Kiln Area	Type	Inclusion type	Void form	Reaction with HCL	Frequency of voids/inclusions
C2a	C2B	Cooking Pot	Post depositional Carbonate	Not discernable	2	5-7 mm: 1%

Figure 5-16
Photo showing cross section of sample C2b

Sample	Kiln Area	Type	Inclusion type	Void form	Reaction with HCL	Frequency of voids/inclusions
C2b	C2B	Casserole	Some or all post depositional Carbonate	Irregular/ rhombs	2	2mm-5mm: 3%

Figure 5-17
Photo showing cross section of sample C3a

Sample	Kiln Area	Type	Inclusion type	Void form	Reaction with HCL	Frequency of voids/inclusions
C3a	C3	Cooking Pot	Not discernable as have fallen out	Irregular	0	1-3mm: 5%

Figure 5-18
Photo showing cross section of sample C4a

Sample	Kiln Area	Type	Inclusion type	Void form	Reaction with HCL	Frequency of voids/inclusions
C4a	C4	Cooking pot	Carbonate	Irregular	2	2mm: 1%

Figure 5-19
Photo showing cross section of sample C5a

Sample	Kiln Area	Type	Inclusion type	Void form	Reaction with HCL	Frequency of voids/inclusions
C5a	C5	Cooking pot	Silt size carbonates and larger ones	Irregular	2	0.2-1mm: 10%

Figure 5-20
Photo showing cross section of sample C6a

Sample	Kiln Area	Type	Inclusion type	Void form	Reaction with HCL	Frequency of inclusions/voids
C6a	C6	Cooking Pot	Carbonate/orientation different	Irregular	2	1-4mm:10%

Analysis:

Sample	**Kiln Area**	**Type**	**Inclusion type**	**Void form**	**Reaction with HCL** **0-no reaction** **1-little reaction** **2- very reactive**	**Frequency of voids/inclusions**
C1a	C1	Cooking pot	Not discernable	-	0	2-3mm: 5%
C1b	C1	Casserole	Not discernable	elongated	0	-
C2a	C2B	Cooking pot	Secondary Carbonates	irregular/ rhombs	2	5-7 mm: 1%
C2b	C2B	Casserole	Carbonates	-	2	2mm-5mm: 3%
C3a	C3	Cooking Pot		Irregular	0	1-3mm: 5%
C4a	C4	Cooking Pot	Carbonates	Irregular	2	2mm: 1%
C5a	C5	Cooking Pot	Silt size carbonates and larger ones secondary carbonates?	Irregular	2	0.5-1mm: 10%
C6a	C6	Cooking Pot	Carbonates Orientation different	Irregular	2	1-4mm: 10%

Table 5-33
Analysis for inclusions

No inclusions apart from carbonates are visible in the cross section suggesting that all samples are silts and no other temper was added (See *section 5.2.3* below on chemical spot testing). The cross sections of samples C1a (cooking pot) and C1b (casserole of shallow lid seat type) from excavated kiln area C1 show no carbonates, sample C1a seems to have voids left by organic inclusions. Samples C2a (cooking pot) from excavated kiln C2B and sample C2b (casserole of shallow lid seat type) from the C2B collection survey both appear to have silt sized carbonates and irregular carbonate fragments. The carbonates on sample C2a appear to be post depositional as they are deposited on the break rather than in the section. The samples of the casserole and the cooking pots from both the kilns are morphologically similar yet visually there is a difference in the matrix. The C2 samples contain carbonate particles while the C1 does not show carbonate presence. Even if we consider the carbonate inclusions to be of secondary nature (due to post-depositional processes), the different voids in C1a and C2b indicates that the potters from the two kiln areas were employing different ratios of clay and/or temper to the clay paste.

As already indicated, sample C3a (cooking pot) from the C3 kiln area shows no carbonates while samples C4a, C5a and C6a from kiln areas C4, C5 and C6 all indicate presence of carbonates. Sample C3a, indicates some organic voids (well-defined, deep) and some more rounded voids where inclusions have popped out or were burnt out. Further, in the above-mentioned samples, the structure of voids, orientation and frequency of the carbonate inclusions all indicate differences.

As seen in the detailed observation of production actions (observations 1, 2 and 3) under *section 5.1.4* at various modern pottery workshops, subtle differences are observable at every level; one of them being the ratios and types of temper added by the potters to the clay paste. The matrices of the cross sections in the samples from Karanis are from fresh breaks of similar casseroles and cooking pots. As illustrated above, the samples indicate differences; the manufacturing processes for these cooking pots are similar in relation to the shape and function of the vessel but the differences could be accidental (tempered by chance, firing difference), natural (naturally occurring inclusions) or deliberate. The size, shape and identification of inclusions in the matrix can aid in deciding which inclusions are added deliberately as temper or occur naturally (Bourriau et al 2000).

I refer to the visual identification key by Peacock (1977) for spotting differences in inclusions, voids and reactivity to acid for the samples. I was able to conclude the presence of carbonates due to the reactivity with hydrochloric acid conducted under *section 5.2.2*. However, I was not able to visually identify the form of carbonates present. It is known that the inclusion of angular calcite particles in clay pastes makes the clay workable during shaping and reduces shrinkage during drying while decreasing thermal stress during repeated exposure to fire when in use. Limestone inclusions similarly aid in workability and reduce thermal stress. The difficulty with limestone and calcite is that both are naturally occurring in the Nile sediments and are also used by potters as filler or temper. As a rule of thumb, the presence of inclusions of a particular material, size and shape indicate filler, while inclusions which grade into the silt/clay sized fraction, the matrix are taken to be naturally occurring (Bourriau *et al* 2000). In samples C2b, C4a, C5a and C6a the larger carbonate inclusions may be fillers (temper added intentionally). In C2a all and in C5a some of the carbonate inclusions may be because of post-depositional processes. In C5a and C6a, some white inclusions appear to grade into the silt/clay-sized fraction, which may be naturally occurring.

Conclusion:

In conclusion, there is a definite difference in the cross sections of these similar cooking vessels collected from six different kiln areas suggesting different pottery workshops (see Chapter 6) and different communities of practice. The two samples from kiln C1 show similar matrices except for the probable secondary or post-depositional carbonates; the two samples from kiln C2 also show similar matrices; the similarities within a kiln area could indicate the same community of practice. The differences between other kiln areas may be due to the:

1. mixing ratio of two natural clays (the mixing itself is tempering) by each workshop
2. ratio of filler (temper) added by each workshop
3. the rate of firing as a consequence of the ratio of clay pastes and temper.

5.2.3 Spot chemical tests

Aim: To discern fabric types using spot chemical tests on archaeological sherds.

Method: spot tests on sherds from areas in Karanis to show similarity or differences in matrix inclusions on the basis of reactivity to chemicals

Test for carbonates using Hydrochloric acid:

Aim: The test was conducted to find whether samples from Karanis show presence of carbonates.

Reason: Inclusions in clay may be natural or deliberate. A reactivity test may indicate similarities or differences between sherds from around Karanis possibly shedding light on potters' choices.

Method: A dropper was used to drop a 30% solution of hydrochloric acid (HCl) onto a small area of each sample. Hydrochloric acid reacts with carbonates (CaCO3). The reaction was categorized under '0' for no reaction, '1' for little reaction and '2' for very reactive. Extreme bubbling of the material identified the release of carbon dioxide produced by the following reaction of the hydrogen with calcium carbonate:

$$\mathbf{2HCl + CaCO_3 = Ca^{2+} + Cl_2^- + CO_2\uparrow_+ H_2O}$$

Sample	**Trench**	**Unit**	**Result** **0=no reaction** **1=little reaction** **2=very reactive**	**Fabric**	**Function**
X1	11	23	1	Local plain	-
X2	11	23	2	Local organic	-
A	11	23	1	Local plain	cooking pot
B	11	23	1	Nile silt	Amphora
C	15	42	1	Marl yellow	Bowl
D	15	41	2	Marl pink	-
E	11	50	2	Local plain	Bowl
F	11	50	2	Local (w) plain	Costrel
G	11	51	2	Local organic	-
H	11	0	0	Local plain	Casserole
I	15	47	1	Local plain	Cooking pot
J (excavated Kiln sample)	C1- Trench 8	49	1	Local plain	Pot
N (excavated	C1-Trench 8	?	1	Local plain	Pot

Kiln sample)					
O (excavated Kiln sample)	C2- Trench	?	2	Local plain	Pot
C1a(excavated Kiln sample)	C1	49	0		Cooking pot
C1b (excavated Kiln sample)	C1	49	0	Local plain	Casserole
C2a (excavated Kiln sample)	C2B		2		Cooking pot
C2b	C2B	Surface	2	Local plain	Casserole
C3a	C3	Surface	0	Local organic	Cooking Pot
C4a	C4	Surface	2	Local plain	Cooking Pot
C5a	C5	Surface	2	Local plain	Cooking Pot
C6a	C6	Surface	2	Local plain	Cooking Pot

Table 5-34
Reactivity test for Carbonates

Analysis:

From preliminary observations, like the modern Fayum samples studied by Redmount and Morgenstein (1996: 741-762), the samples of pottery from Karanis and their degree of reactivity to hydrochloric acid show that the samples consist of Nile silt mixed with calcium carbonate. Carbonates in fired clays or fabrics are identified by the dissolution and effervescence when Hydrochloric acid is added at room temperature. When carbonates are exposed to temperatures of around 800 degrees Celsius, they have a tendency to decompose, absorb water from the atmosphere, expand and break (Vitelli 1999). However, if the carbonate temper is used in the right combination, they can produce a watertight body for low-fired ceramics (Vitelli 1999). The potters at Karanis were adding carbonate temper to the local plain cooking pots, some temper to casseroles, while they were certainly adding more of it to the local organic vessels as suggested by the scale of reactivity. The carbonate temper may have been procured from limestone dust or calcium rich clay. The adding of temper was economical and helped in producing watertight bodies for low-fired ceramics.

Comparing the reactivity of the local plain pots (the same type and form) labeled as samples J, N and O, all from excavated kilns (see *table 5-34*), shows that the reactivity of sample O from kiln C2 differs from the reactivity of samples from kiln C1. Just as illustrated under the example at the three workshops in Fustat, it is quite probable that kiln C2 with sample O signifies a community of practice different from kiln C1 with samples J and N. Even if we attribute the reactions from 0-2 to post depositional processes and render the tests as not entirely conclusive, still it might be considered a possible marker for different communities of practice.

Samples C1a (cooking pot) and C1b (casserole of shallow lid seat type) from excavated kiln area C1 show no reaction to hydrochloric acid. Samples C2a (cooking pot) from excavated kiln C2B and sample C2b (casserole of shallow lid seat type) from the C2B collection survey both show reaction to hydrochloric acid. Sample C3a (cooking pot) from the C3 kiln area does not react to hydrochloric acid while samples C4a, C5a and C6a from kiln areas C4, C5 and C6 all react to hydrochloric acid, showing presence of carbonates. The different scales of reactivity to hydrochloric acid in: samples C1b (reaction 0) and C2b (reaction 2) both casserole types and samples C1a (reaction 0), C2a (reaction 2) and C3a (reaction 0) all cooking pots, indicates that the potters had different recipes with different tempers or were procuring different sources for raw material. Perhaps these were different communities of potters having their own specific ways of manufacturing morphologically standardized vessels with differences that can only be detected on closer examination.

To reiterate, I worked with communities of potters who made morphologically identical vessels that appeared standardized. However, through observation and interviews detailed in *chapter 4*, I learnt that the production actions which are a part of the production sequence such as mixing of recipes, order of using tools and body movements, all differ from workshop to workshop when making similar vessels. The evidence of similarities within workshops and differences between workshops in an ethnoarchaeological context has been illustrated in detail through examples in the current chapter. It has also been proven that in the archaeological context, sherds of similar cooking vessels differed between various kiln/workshop areas at Karanis.

I have presented evidence-showing similarities within workshops by interviews of potters, evaluating space usage patterns, body movement and gesture analysis, transitional phases and detailed observations of pottery manufacture. Similarities within the group are possible only when the individuals constituting the group are in agreement with regards to different aspects of the chain of operations. The similarities give the workshop an identity and a specific signature within the larger group of potters at Karanis. The balance between the individual and group is maintained by a specific workshop through teaching, learning and inculcation of both social and technological knowledge.

Through my analysis, I have shown that the actions within the chain of operations followed by each workshop are different from each other when making similar vessels. But what do the workshops gain from being different? From an economic standpoint a subtle differentiation would be desirable. This would enable the potters to distinguish themselves in some way to help build their respective reputations and keep up with long- term social alliances with customers. Therefore, conformity of actions and ways of doing things within a workshop and differentiation between workshops are the hallmarks of the learning process in a group as a whole.

The next chapter focuses on the discerning of communities of practice through variability within standardization.

Chapter 6

Discerning communities of potters

To provide a framework for the experiments and findings in this chapter, I begin with a discussion on standardization, variation and variability. This is followed by experiments to assess variability within standardization using certain dimensions of similar vessels from various modern pottery workshops. The section on the archaeological application of this assessment method begins with an outline of the methods and then uses ceramic data from Karanis to assess variability within standardization for similar vessels. I finally conclude that it is possible to discern communities of potters and transmission of knowledge at Karanis.

In chapters *4 and 5*, I demonstrate that it is possible to assess similarities in the work of individuals working in the same workshops and/or trained by the same master potter. Before presenting the experiments and results in the current chapter, it is important to discuss the concepts of standardization and variability used in metric analysis.

6.1 Standardization and variability

Kostonas (2014:8) concluded that variation and variability are used interchangeably by most archaeologists. To firmly establish the definitions for standardization, variability and variation for archaeology, he reviewed literature regarding these terms. He defines variation as the relative degree of heterogeneity seen in the attributes of artifacts while variability is the liability of attributes of an artifact to change and become more varied or standardized (8). For my research, I am looking at variability within standardization.

To reiterate from *chapter 1*, there are two conceptual systems in the production of vessels: concepts and ideas shared by the cultural system; and concepts and ideas specific to the potter (Read 2007: 91). These concepts and ideas concretize via variables: one set of variables represents the concepts of the culture as a whole, which also comprises the concepts of the customer; and the other set of variables represent the individual concepts of the potter, expressed on the vessel. Certain vessel forms such as cooking pots and casseroles (see *section 6.2 below*) at Karanis appear to be morphologically standardized, indicating the common cultural concept shared by the community of potters and consumers together.[29] Late Roman cooking pots from Karanis are closed forms with ribbed bodies and necks. Casseroles are open cooking vessels.

The rim thickness dimensions represent potter-specific concepts, which are not shared by the larger community of potters. The 'range of variability' (which includes all individual potters) within standardization then is workshop specific. I seek to gauge the 'range of variability' of the rim thickness within these standardized forms (in the archaeological context from specific kiln /workshops areas) to compare how similar or different these dimensions are.

Standardization is the "relative degree of homogeneity or reduction in variability in the characteristics of the pottery, or [to] the process of achieving that relative homogeneity" (Rice 1991:268). Further, standardization can only be defined through comparison of two or more artifact assemblages with differing degrees of homogeneity (Costin 1991: 35). The degree of standardization should be established by comparing the products of the same population and cultural tradition (Arnold and Nieves 1992).

[29] See photographs of cooking vessels in Appendix E.

6.1.1 Assessing standardization and variability

As mentioned earlier, standardization can be approached through comparisons of different attributes in two or more assemblages. In the case of archaeological ceramics, the attributes allowing such comparisons range from mineralogical or chemical composition of fabrics, techniques of pottery manufacture, morphology, metric dimensions and surface decoration (Rice 1981: 220-221; Arnold 1991: 364; London 1991: 183, 187-200; Arnold & Nieves 1992: 95; Blackman *et al*. 1993; Hegmon *et al*. 1995: 34-35; Eerkens and Bettinger 2001: 493-494; Roux 2003: 768; Berg 2004; Duistermaat 2007: 208-217; Kostonas 2014: 9). An ethnoarchaeological approach presents more potential in assessing variability within standardization as in addition to examining the above attributes, it all(Vukovic 2011)ows the researcher to observe potters at work, and alongside explore a range of other factors such as, usage of space, gestures and body posture during pottery making, observation of actions in the chain of operations, availability of raw materials, learning schema of young potters, effect of consumer choices on learning, identifying abilities of potters regarding producers, identity of potters with immediate group and the larger community of potters etc. (see details in *chapter 4 and 5*)

A fair assessment on variability within standardization would include a focus on the above-mentioned attributes for method of analysis and reliance on two or more sets of variables (Frankel 1988; Rice 1989: 112; Arnold 1991: 366; Costin 1991: 35; Kostonas 2014: 9) on the vessels produced. Following from that, in order to discern community of potters, I have tried to understand the role of actions within the larger framework of operational sequences and the nuances of learning in pottery manufacturing, incorporated a combination of archaeological and ethnoarchaeological methods of analysis (such as observing potters at work; space usage analysis through scan sampling; gesture and posture analysis using video footage; observing actions associated with pottery manufacturing in modern pottery workshops) and then through insights from the above mentioned methods used spot chemical tests and visual analysis for assessing variability within standardization for archaeological ceramics (*see chapter 5*). In the current chapter, I report on comparison experiments in *section 6.1* and report on metric analysis for rim thickness of similar vessels for analysis to:

1) demonstrate that there is a difference in rim thickness between workshops.
2) verify the statements made by potters in *chapter 4* regarding their abilities to identify producers through rim thickness of the vessels made by them, versus those made by others.
3) demonstrate that there are similarities in rim thickness measurements of potters working together and differences between potters who do not work together.
4) find the range of variability for specific dimensions that exists in workshops.
5) ascertain the producers of the vessels by measuring the rim thickness of vessels.

Assessments on standardization, variation and variability should involve “cross-cultural comparisons as a means of transcending emic conceptions and testing archaeological data against ethnographic data” (Kostonas 2014: 10). From the insights attained through experiments of ethnoarchaeological data, I transpose methods to archaeological data from Karanis to conclude about transmission of skill, continuity and change in the Late Roman period.

6.1.2 Statistical method for assessing standardization, variability and variation

A number of methods are employed for assessing standardization, variability and variation but for the purposes of the current chapter where I focus on the variability of specific dimensions of morphologically standardized vessel forms, foremost is the test for coefficient of variation or CV. The test for CV has been widely used by archaeologists working in prehistoric Europe (Vukovic 2011), Phillipines (Longacre 1991), American Southwest (Crown 1995) and India (Sinopoli 1991) amongst others. The test is useful for assemblages from a single site or the same cultural setting. The CV documents the variance around the sample mean and is defined as the sample standard deviation divided by the sample mean, multiplied by 100 and expressed as a percentage (Longacre 1999: 53). According to Eerkens and Bettinger (2001: 494-497) for assessing standardization and variation, the upper baseline representing the maximum of standardization that humans can generate without the aid of physical standards such as rulers displays a CV of 1.7 %, and the lower baseline value, representing the maximum of variation, displays a CV of 57.7 %. The baseline values can be used to evaluate the degree of standardization or variation in artifacts. According to them, "CV is an excellent measure of standardization and provides a robust statistical technique for comparing standardization in samples of artifacts" (Eerkens and Bettinger 2001: 493). Further, the test for CV is resistant to outliers and does not let the data be affected by extreme values.

The box plots below are used to visualize the central tendencies of the data using specific parameters- the median and the interquartile range. It allows the visual comparison of similarities or differences between groups to assess variability in the data in a condensed manner. Box plots are useful to gauge dispersion and for scanning errors. I have added kernel density curves, which are an effective way to illustrate the distribution of a variable. A kernel density estimate is a nonparametric graph—meaning that it lacks an underlying probability density function (Yeh, Shi-Tao, 2004). Instead, it is drawn based on the observations in the data. The density plots do not show individual points, but clearly show the differences in range and overlap between each.

Drawing from the interviews in *chapter 4*, where potters state their vessel identification skills on the basis of rim dimensions, I too focus on this variable for examining the scale of variability within standardization. I later include another variable to assess whether the rim thickness of similar vessels is an exclusive dimension for identification as the potters state or if there are other indicators to suggest workshop affiliation.

6.2. Ethnoarchaeological approach

In *chapter 4*, nearly all the potters profess their ability of being able to identify their own vessels from similar vessels made by others by looking at the rim. The rim is thus an identifying marker for ascertaining producers in the ethnoarchaeological context. This is of great convenience in the archaeological context where rim sherds are more common than whole vessels. Therefore, it is my suggestion that the methods relating to understanding rim sherds in the ethnoarchaeological context can be applied to rim sherds in the archaeological context.

6.2.1. Experiment 1

Aim: To prove that there is a difference in rim thickness of vessels made by potters from two different workshops manufacturing similar vessels.

Reasoning: The ability of the potters to recognize their work is linked to rim thickness (*see chapter 4*). The results of the experiment allowed verification of the statements of potters from various workshops across Egypt and India that they know their work from others on the basis of rim thickness.

Method: A total of 52 *ballas* jars made by potters AH1 and AL were measured for their rim thickness (in mm) with calipers.

Summary: AH 1 and AL are potters specializing in manufacturing *ballas* jars. AH1 and AL belong to separate but adjacent workshops *(for details see chapter 4, section 4.2.3.1 and 4.2.3.2)*.

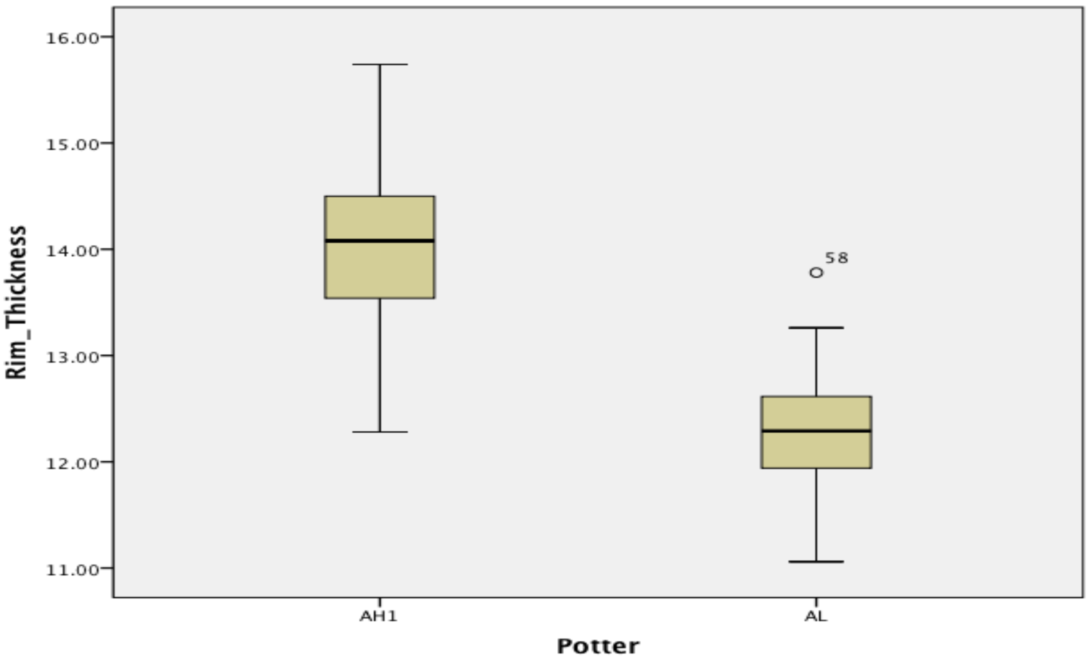


Figure 6-1
Box plots showing rim thickness of vessels for potters AH1 and AL

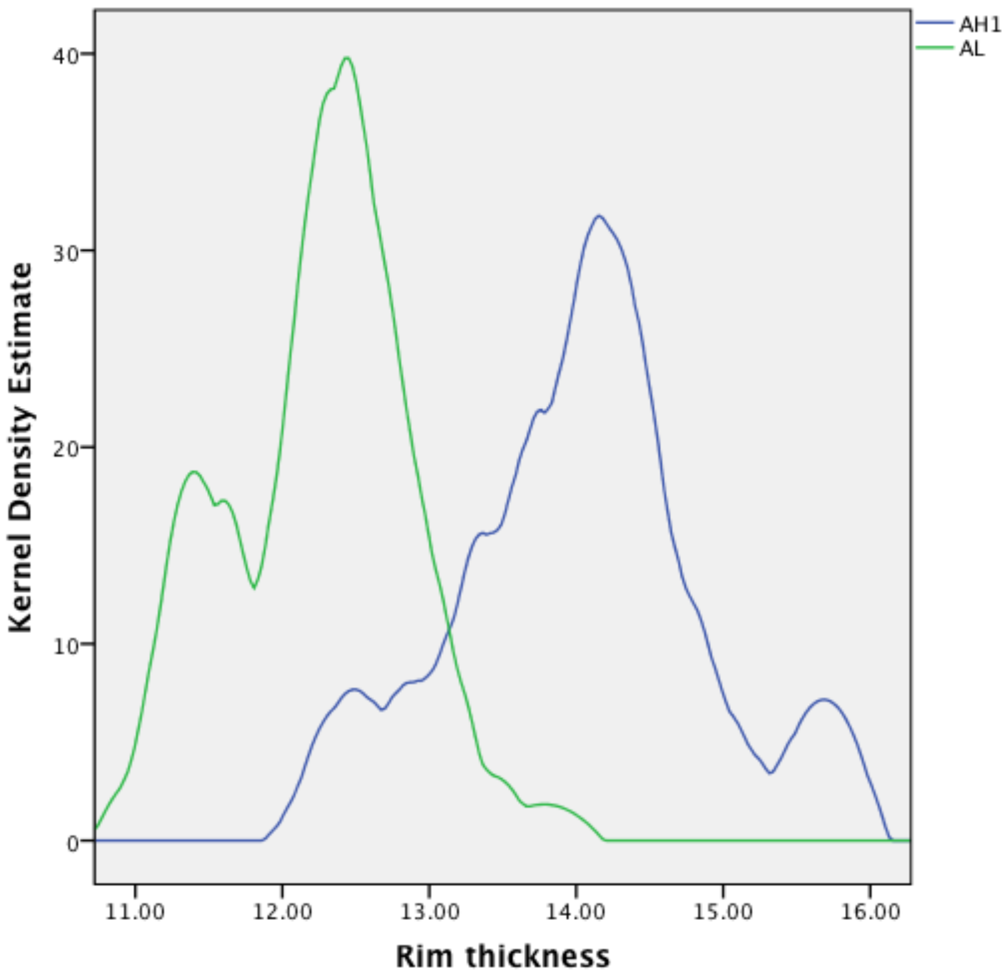


Figure 6-2
Density plot showing rim thickness of vessels for potters AH1 and AL

Potter	**No. Of cases**	**SD**	**Mean**	**CV**
AH1	52	.81368	14.0436	5.79
AL	52	.59497	12.2537	4.85

Table 6 -1
Descriptive statistics for AH1 and AL

Description:

Potters AH1 and AL both manufacture the *ballas* jar and the vessels of both the potters appear to be morphologically similar. The box plots (*see figure 6-1*) for AH1 and AL show the distribution of the rim thickness measurements. The means are quite different for the two when comparing the potters AH1 and AL. The rectangles indicate that both the potters individually are reasonably symmetric. The spread of rim thickness measurements as seen in the box plots is about the same for AH1 and AL. The rim thickness measurements for AH1 are higher than AL. An outlier could represent an error in measurement, in data recording or in data reading or it is a valid extreme value. There is one outlier for AL represented by the number 58 (number in the raw data layout). This appears to be an extreme value. The two inter quartile ranges (the two rectangles) do not overlap along the vertical axis, suggesting that the means differ beyond just random variation.

The density plot in (*figure 6-2*) shows different means but similar spreads and essentially unimodal distribution shapes in the rim thickness measurements, suggesting that each of the two potters has a different target thickness for the rims.

The values for the CV of rim thickness (*see table 6-1*) for AH1 and AL are 5.79 and 4.85 respectively. It is apparent that there is a small difference between the two potters, the difference in CV being 0.94.

Conclusion:

The experiment proves that vessels that appear similar in form have a mean difference, shown above by the rim thickness dimensions. It also shows that the potters have a basis for stating that they can identify their vessels from others by gauging the rim. The next experiment focuses on the ability of the potters to visually identify similar rim sherds of the *ballas* jar without using any measuring aids.

6.2.2 Experiment 2

Aim: To prove that potters without using measuring aids have the ability to visually identify their own vessels from an array of similar rim sherds including those made by other potters.

Reasoning: In Experiment 1, I showed a difference through box plots, density curves and by calculating the CV's of the rim thickness of *ballas* jars made by potters AH1 and AL. The measurements showing differences in rim thickness of similar vessels made by two potters indicates that the potters can potentially gauge these minute differences and isolate their work from others by looking at the rim. The choice of rims as an indicator of producer's identity is particularly important in the archaeological context where whole vessels are seldom found but rim sherds are quite common. For the current experiment, broken rims of similar *ballas* jars were collected.[30] The choice of broken rim sherds is two fold: to attest that the rim indeed is the dimension forming the basis of identification, and to be able to replicate these results in the archaeological context where broken rims of similar vessels are found.

Method: Ten broken rims were collected from four different workshops manufacturing the *ballas* ware all having approximately the same diameter (15 cm). The sherds were numbered with a marker and placed on a tray (*Figure 6-3*). A double blind study was carried out by presenting the broken rims to two potters AH1 and AL from their own, adjacent and, distant workshops.[31] It is important to note that I had no prior knowledge concerning the producers of the rim sherds. I had asked my colleague to pick up the rim sherds from different workshops, and he alone knew the find spots.[32] He marked the sherds and kept a note of the find spots. The first step involved the identification of the vessels by various potters regarding the identity of the producer of the vessel.[33] AH1 and AL are the two potters who were shown the tray with numbered rims. Both potters have workshops located adjacent to each other. The second step was to correlate the identification results to the workshops for validation.

Summary: AH 1, AF (son of AH1) and AL are potters specializing in manufacturing morphologically similar *ballas* jars. AH1 and AF are related and belong to one workshop while AL belongs to an adjacent workshop *(for details see chapter 4, section 4.2.3.1 and 4.2.3.2)*

[31] The names of the potters have been withheld as per request of the potters and IRB protocol.

[32] My colleague Mazher Ezzat from the Supreme Council of Antiquities, Egypt helped me in this experiment.

Figure 6-3
Marked rim sherds for the identification test

Rim number	Identifying Potter : AH1	Identifying potter: AL	Result	Reason
1	AL	AL	Correct	AH1 familiar with AL's work and Al knows own work
2	AF	AF	Correct	AH1 and AL familiar with AF's work
3	AH1	AH1	Correct	AH1 knows own work
4	AL	AL	Correct	AH1 familar with AL's work and AL knows own work
5	AL	AL	Correct	AH1 familar with AL's work and AL knows own work
6	AH1	AH1	Correct	AH1 knows own work
7	?	W	Incorrect	AH1 was not familiar with rim (it was picked up from a distant workshop) ; Al thought it was made by potter W.
8	AF	AF	Correct	AH1 and AL familiar with AF's work
9	AH	AH	Correct	AH1 and AL familiar with AH 's work
10	?	?	?	AH1 and AL were not familiar with the rim (it was picked up from a distant workshop)

Table 6-2
Test for sherd identification

Description:

The results of the identification test (*table 6-2*) were all correct except in cases 7 and 10. In cases 1, 3, 4, 5 and 6, potters AH1 and AL were able to identify their own work. In cases 1, 4, 5 and 9, potter AH1 is able to identify potter AL and son AH as the producers of the vessel. Similarly in cases 2, 3, 6 and 8, potter AL is able to identify AH1 and son AF as the producers. In cases 2, 8 and 9, potters AH1 and AL are able to identify their own sons, AF and AH as the producers. In the case of rim 7, the identification was deemed incorrect; AH1 was unable to identify the producer, while AL thought W, a part-time potter, made the vessel rim. It is important to note that rim 7 was picked up from a workshop situated far from the workshops of AH1 and AL. Both AH1 and AL did not identify the producer for rim 10; this rim was also picked up from an area far from the workshops of AH1 and AL. The non-identification of rims 7 and 10 and the identification of the rest of the rims by AH1 and AL suggests that potters of closely situated workshops can identify specific potters due to familiarity with their work. The identification of the rims of sons AF and AH by their respective fathers AH1 and AL suggests that the similarities in rims is an indicator of separate communities of practice, one of AF and AH1 and the other of AH and AL. This demonstrates the importance of enculturation and the transfer of knowledge, such as the variability that is acceptable, in a community of practice *(see chapter 3 for details)*.

Conclusion:

The experiment proves that the potters can indeed identify makers of vessels by gauging the rim. The reason for the capacity for identification stems from having worked together as a group, enculturation in a specific tradition and working in a community of practice.

6.2.3. Experiment 3

Aim: To show that when potters work closely together, their vessels will show more similar rim thickness measurements than those not working together. This can help discern communities of practice.

Reasoning: Several individuals working together result in similar products. Daily practice and enculturation effect the shaping of the individual in a group such as a workshop. Such grouping of potters may be discerned by assessing the rim thickness of vessels.

Method: Digital calipers were used to take the readings for rim thickness of the traditional *mattam* of Kerala (a pot to store fermented coconut sap). A total of four potters with 15 vessels each were investigated. Two potters each were from workshops at Chedamangalam and Tathapilly respectively. I use box plots, density curves and test for CV to assess the rim thickness measurements for the vessels manufactured by each potter.

Summary: Chedamangalam and Tathapilly are two villages in Kerala that specialize in the production of the traditional *maatam*. O and T work in the workshop at Chedamangalam while SG and SR work at the workshop in Tathapilly. O and T are related by blood while SG and SR are related by marriage *(for further details, see chapter 4, section 4.2.5.1 and 4.2.5.2)*.

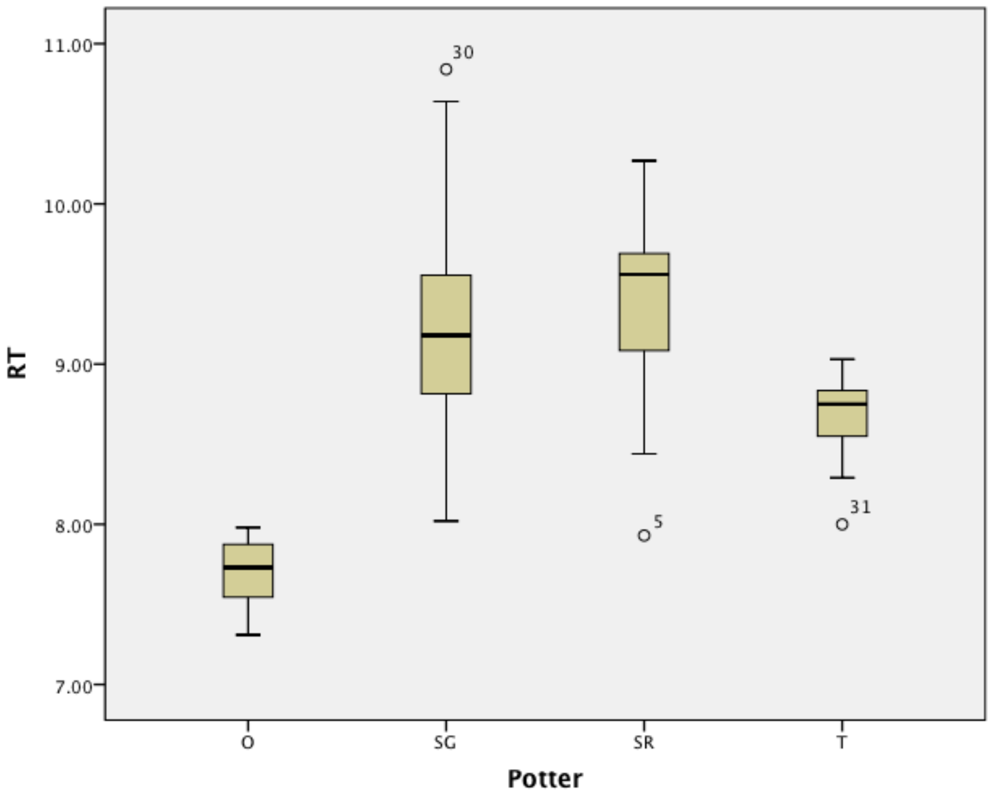


Figure 6-4
Box plots showing rim thickness of the mattam for potters O, SG, SR and T

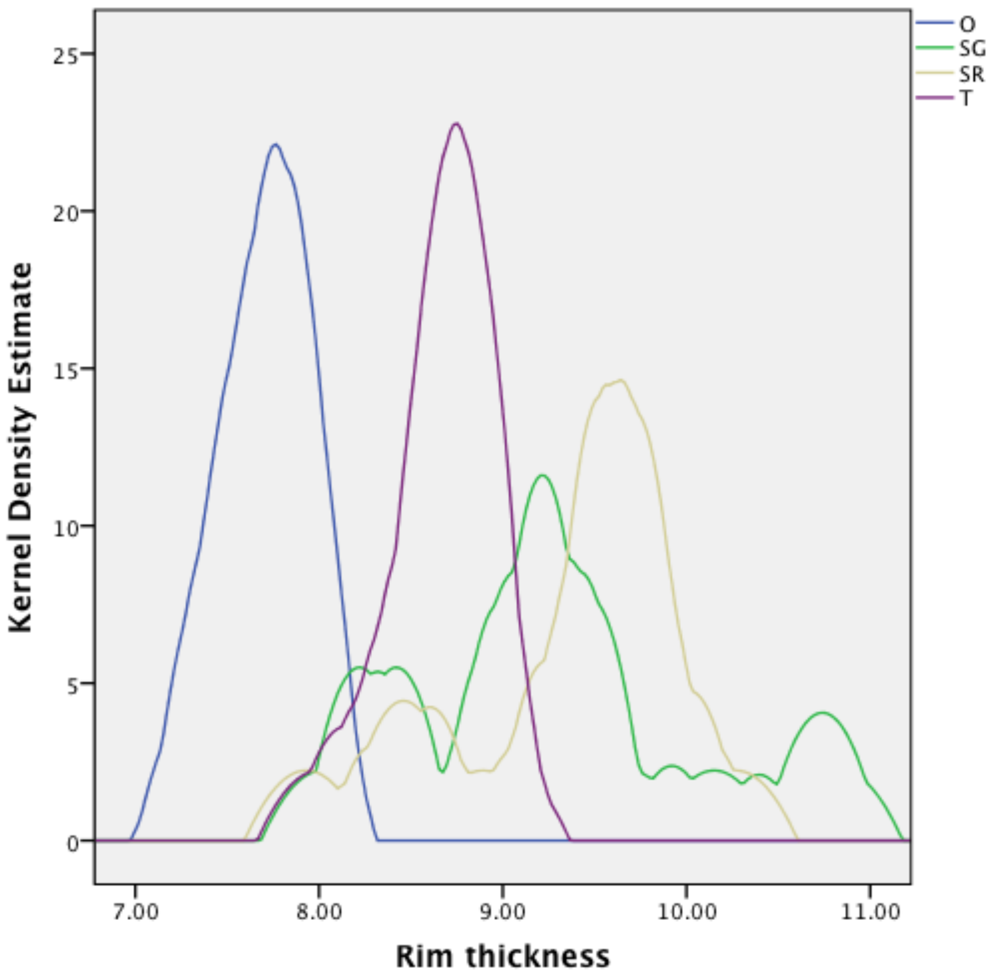


Figure 6-5
Density plots showing rim thickness of the mattam for potters O, SG, SR and T

Potter	***No. Of cases***	***SD***	***Mean***	***CV%***
O	15	.21810	7.7053	2.83
SG	15	.81528	9.2740	8.79
SR	15	.63808	9.3373	6.83
T	15	.26495	8.6660	3.05

Table 6-3
CV values for rim thickness of potters from two workshops

Description:

The box plots (*figure 6-4*) for O and T together show low rim thickness measurements when compared to those of SG and SR. However, there seems to be more variability in the rim thickness measurements of SG and SR individually when compared to O and T; the central tendency of the rim thickness of measurements is consistent. The density plot (*figure 6-5*) enables us to see similarities in SG and SR when compared to potters O and T. The CV's (*see table 6-3*) for the rim thickness of the traditional *mattams* suggests the following:

a) Potters O and T have a CV of 2.83 and 3.05 respectively. The standard deviations also illustrate a similar trend of low rim thickness measurements. The low CV values indicate that there is an increased level of standardization for the vessels. It is important to note that both O and T belong to the Chedamangalam workshop in Kerala, India *(see chapter 4, section 4.2.5.1)*. O is also the daughter of T. The difference of values between O and T suggests that there is room for distinctive individual variability within the workshop. Here the difference is in the *means* while the variation is actually very similar. So in effect what was learned was the concept of *reduced variability,* thus making the means significantly different from each other (see figure 6-5).

b) Potters SR and SG have a CV of 8.79 and 6.83 respectively. The CV values are higher than the values at Chedamangalam workshop and indicate less standardized vessels. The CV values for SR and SG are closer to each other than to the CV values for O and T. The reason is that both SR and SG belong to the Tathapilly workshop *[(see chapter 4, section 4.2.5.2 for details]*. The two are also related by marriage. The CV values at the Tathapilly workshop indicate some variability between the two potters but they still tend to fall within the spectrum of standardization, shown by peaks in each of the two distributions.

c) There is one outlier each for SG, SR and T. The outliers are represented by numbers 5, 30 and 31.[34]

Conclusion:

In view of the above, it appears that the CV values do indicate that potters belonging to the same workshop may be discerned through the closeness of rim thickness dimensions suggesting similarities stemming from enculturation, daily practice and following a tradition in specific pottery workshops. The mean for T is more similar to the other potters than to O, but differs from SG and SR in the CV values. The CV values for both O and T fall within the range of 2-5% for rim thickness, clearly indicating that the two potters were making highly standardized vessels, close to the minimum CV attainable in manual production which is 1.7% (Longacre 1999; Eerkens and Bettinger 2001: 496). In fact what is evident is that the CV is a better predictor of group affiliation than the mean for these data, but it is the combination of the means, the CVs and the shape of the desnity cirves that distinguishes the two workshops from each other. The density curves (*see figure 6-5*) also helps us see that O and T are more similar to each other in creating similar kinds of variance to each other in contrast to SG and SR.

<u>6.2.4 Experiment 4</u>

[34] These are the serial numbers of the data as laid out in the SPSS data sheet. The measurements are against these serial numbers.

Aim: to gauge whether potters from the same workshop follow a range of variability within standardization.

Reasoning: individuals working close together will exhibit a closer range of variability than individuals who do not, due to the effect of daily practice and enculturation in a specific community of potters.

Method: measure the rim thickness of similar vessels of potters from the same workshop and compare it to different workshops

Summary: Baba, NK and BL are potters from Amer, Rajasthan *(see chapter 4, section 4.2.4.4 and 4.2.4.6*)

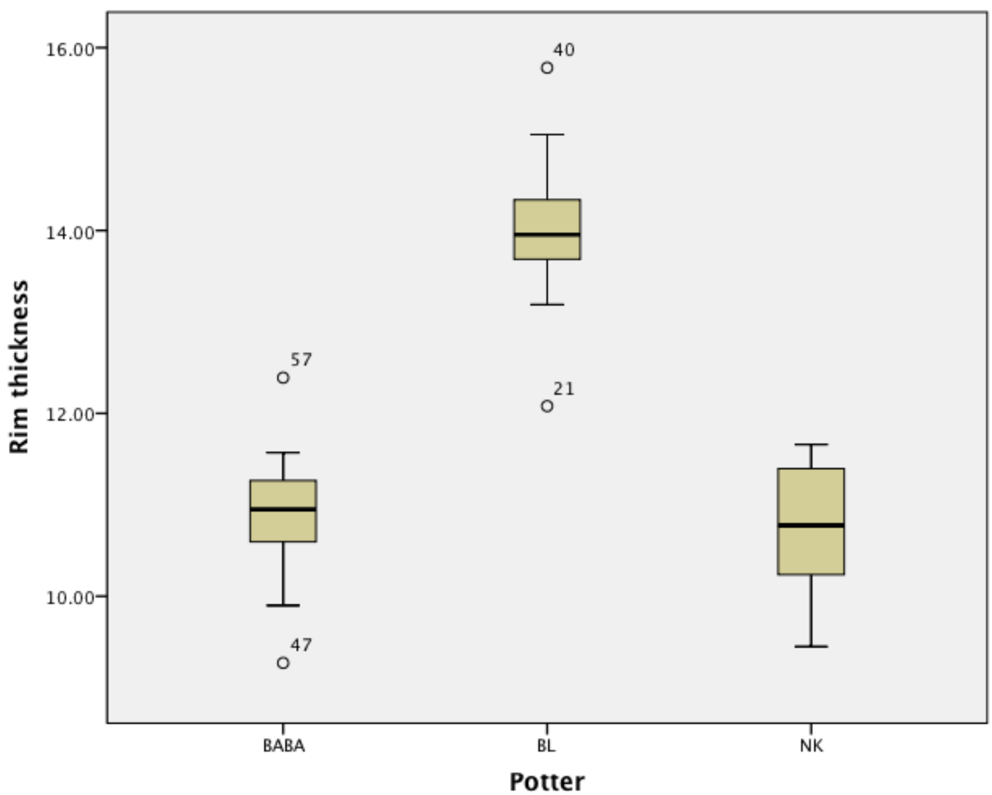


Figure 6-6
Box plots showing rim thickness of the matkas-water storage pots *for potters BABA, BL and N*

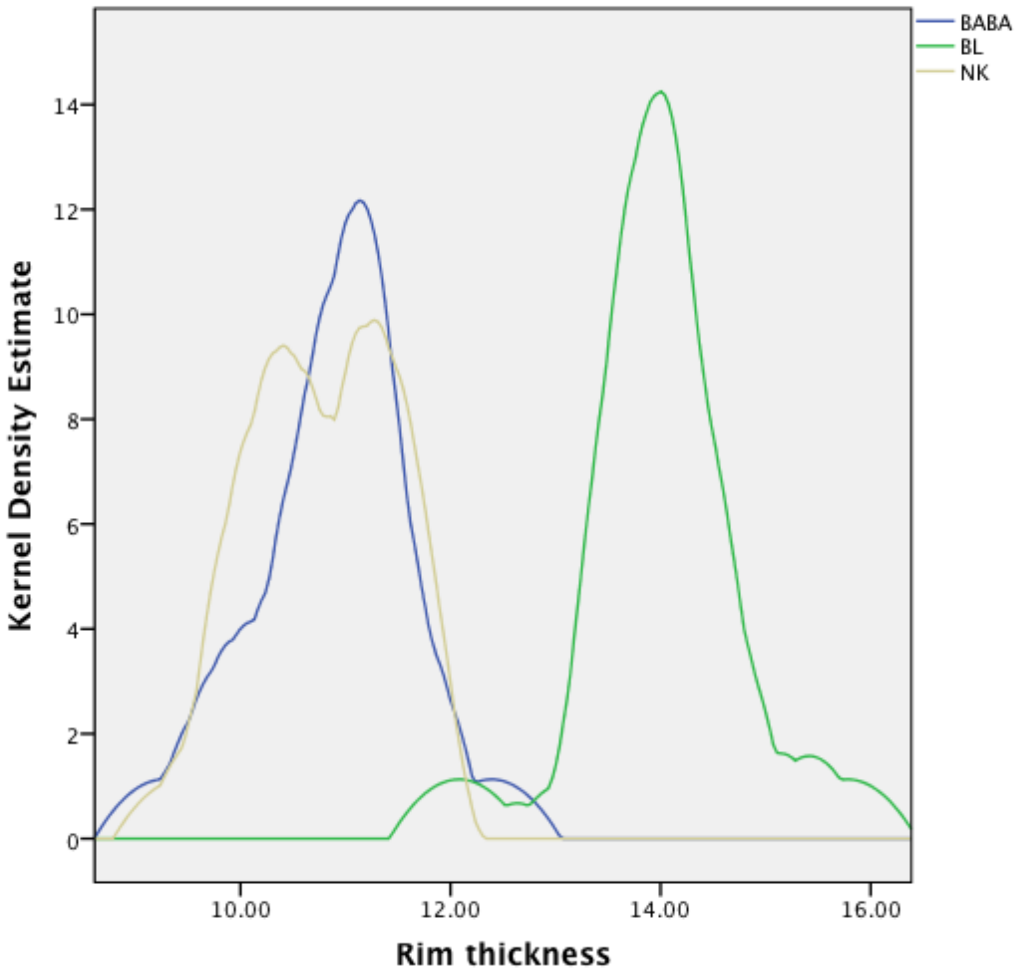


Figure 6-7
Density plot showing rim thickness of the mattam for potters BABA, BL and NK

Potter	***N of cases***	***Min thickness***	***Max thickness***	***Mean***	***Std. Deviation***	***CV***
NK	20	9.45	11.66	10.7695	.65307	6.06
BABA	20	9.27	12.39	10.8820	.69619	6.39
BL	20	12.08	15.78	14.0045	.72942	5.20

Table 6-4
CV values for rim thickness of potters from two workshops

Workshop	*Relationship*	*Range of measurements*
BABA & NK	Father and son	9.27 -12.39
BL (sole potter)	-	12.08 - 15.78

Table 6-5
Range of measurements for two workshops

Description:

The shape of the boxplots in (*figure 6-6*) for NK and BABA are more similar to each other than the one for potter BL from another workshop. The density curve (*figure 6-7*) show BL is quite different from BABA and NK. Here, the means of the rims between BL and BABA/NK are very different.

Tables *6-4* and *6-5*, show the following:

a) The means of potters NK and BABA are closer to each other than potter BL.

b) The CVs for the rim thickness of vessels made by potters NK and BABA are 6.39 and 6.06 while that of BL is 5.20. The closer CVs show similarity in rim thickness. BABA and NK belong to the same workshop and are bound by a father and son relationship. BL on the other hand belongs to another workshop in Amer and therefore the CV is also farther off from the two potters.

c) The range of measurements for the rim thickness of vessels is between 9.27-12.39 for BABA; 9.45-11.66 for NK; and 12.08-15. 78 for BL.

d) The range of measurements for BABA and NK (from one workshop) varies between a minimum rim thickness of 9.27 to a maximum thickness of 12.39 mm. BL's range of measurements fall between a minimum of 12.08 to a maximum of 15.78 mm.

e) There are two outliers each for BABA and BL represented by numbers 21, 40, 47 and 57.

Problem:

There is an overlap between a part of BABA and BL's range of measurements i.e., between 12.08 to 12.39 mm (This is the cumulative blur discussed under *section 6.3).*

Conclusion:

The present experiment shows that potters follow a constrained range of variability when forming the rim. In the sample of 20 rims, BABA and NK together did not go below the 9.27mm or beyond the 12.39 mm mark. BL, the potter from another workshop did not go below 12.08 mm or beyond the 15.78mm mark. However, in the analysis an overlap is noticed between a part of BABA and BL's range of measurements i.e., between 12.08 to 12.39 mm. The question is whether this overlap is critical.

6.2.5 Experiment 5

Aim: reverse order test to identify producers of vessels using measurements of rim thickness.

Reasoning: When analyzing the range of variability of rim thickness, one can find the producers of the vessels as long as the rim thickness measurements for each producer do not overlap (see *section 6.3* on cumulative blurr). This method (finding range of variability) can be transposed to archaeological ceramics (to a certain extent) to identify specific workshops of vessels.

Method: This experiment has two parts:

1) to measure the rim thickness of two potters manufacturing the same vessel on two different days.

2) a reverse order test to identify the producers of vessels on the basis of rim thickness measurements.

Summary: Chattrikhera is a small village nestled in the desert state of Rajasthan in western India. I carried out my ethnoarchaeological research working with two potters NB and SB. Both the potters learnt pottery making from their father. NB is 65 years of age and SB is 55 *(for further details see chapter 4 sections 4.2.4.1 and 4.2.4.2).*

1) Measurement of rim thickness of two potters manufacturing the same vessel on two different days:

Rim thickness measurements of vessels day 1

I worked with the two potters and observed how they made vessels on two different days. On day 1, I measured the rim thickness of the vessels made by NB and SB and noted that they follow a pattern.

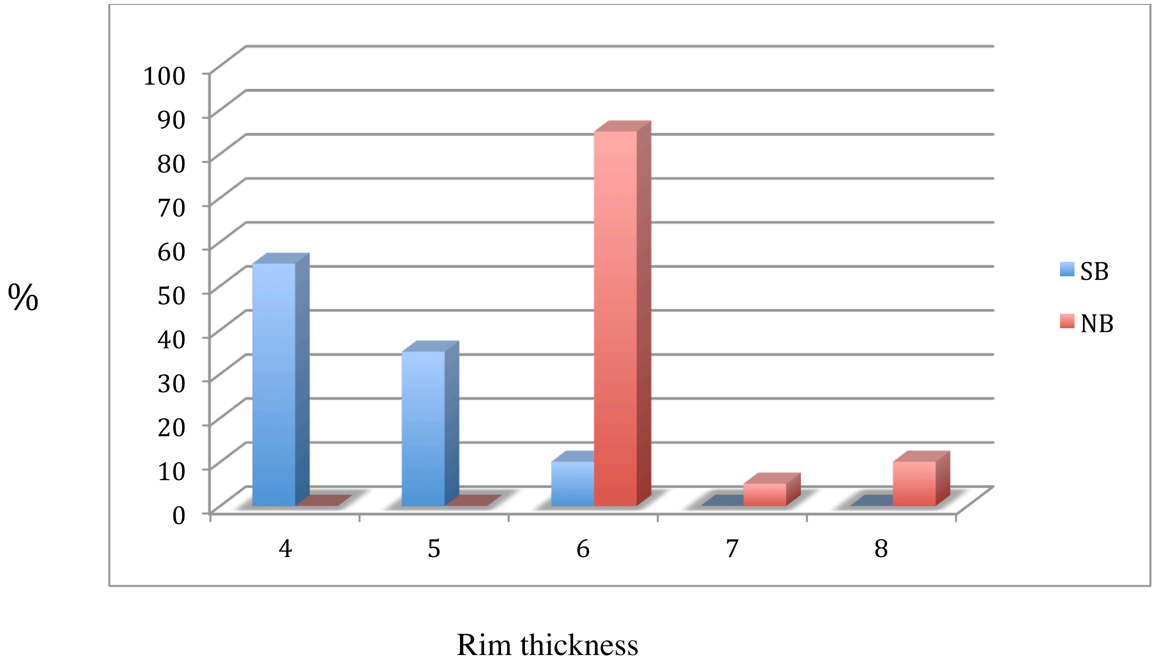


Figure 6-8
Frequency % for vessel rim thickness for potters SB and NB (day 1)[35]

[35] Frequency here is the number of times the potters make similar vessels with a specific rim thickness, when n=20. The frequency is expressed as percentage.

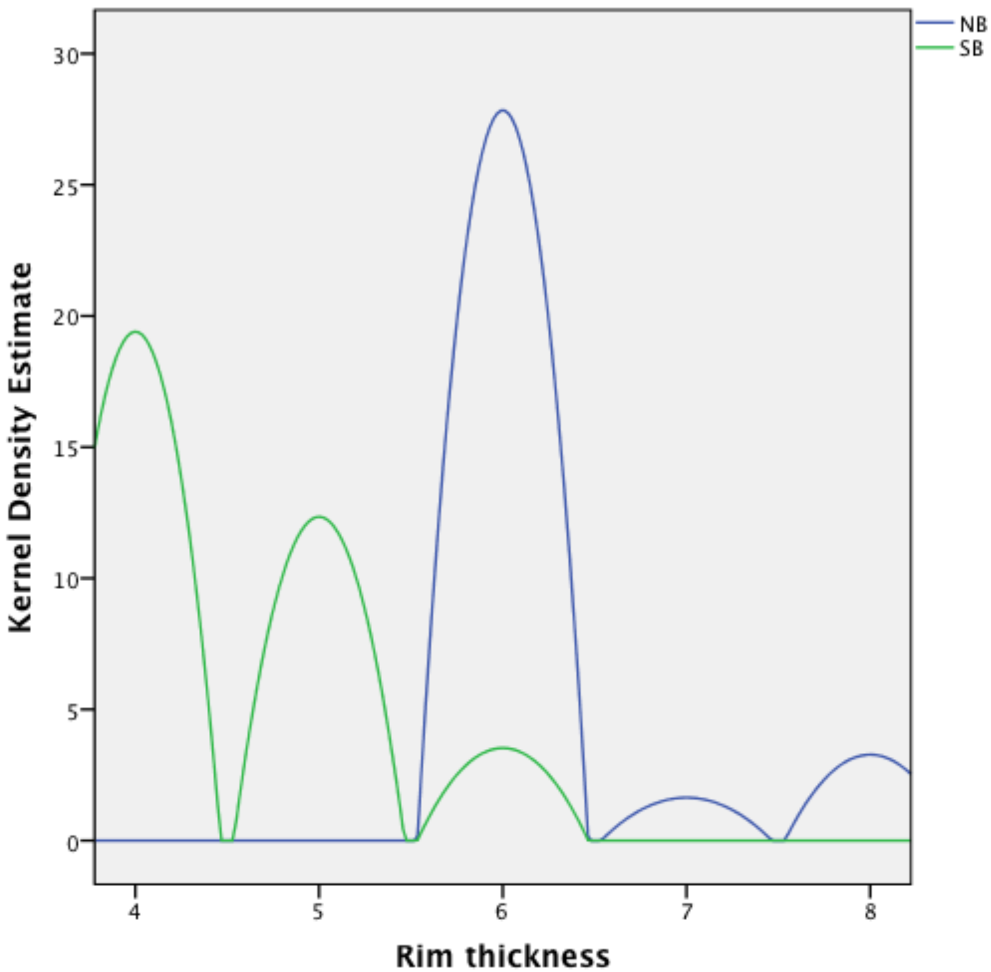


Figure 6-9
Density plot for vessel rim thickness for potters SB and NB (day 1)

Potters	***Rim thickness***				
	4 mm	*5 mm*	*6 mm*	*7 mm*	*8mm*
SB%	55	35	10	0	0
NB%	0	0	85	5	10

Table 6-6
Frequency % for vessel rim thickness for potters SB and NB

Potter	*No. Of cases*	*Min thickness (mm)*	*Max thickness (mm)*	*SD*	*Mean*	*CV%*
SB	20	4	6	.686	4.55	15.076
NB	20	6	8	.639	6.25	10.224

Table 6-7
Descriptive statistics for vessel rim thickness for potters SB and NB (day 1)

Description:

In Experiment 6.2.5.1 the following points emerge:

1. The vessels made by SB have a range between 4mm to 6 mm; while NB's vessels have a range between 6 mm to 8 mm.
2. It is, therefore, easy to identify vessels made by SB falling between the 4mm to 5 mm range and NB, falling between the 7mm to 8mm range.
3. 55% of the vessels made by SB have a 4 mm rim thickness, while 85% of the vessels made by NB have a 6 mm rim thickness. This indicates that NB is more consistent in attaining a specific thickness in creating the vessels, while SB's rims show more variation (*see figure 6-8 and table 6-6*).
4. The CV values indicate that there is a difference in the rim thickness index between the two potters (*see figure 6-9 and table 6-7*).

Problem:

The problem in identification arises in identifying vessels made by both the potters that fall in the 6mm category, which is the minimum thickness for NB's rims and the maximum thickness for SB's rims. (This is discussed under *section 6.3,* the cumulative blur effect).

Conclusion:

There is greater variability in the rim thickness of vessels made by SB than NB, who seems to consistently aim for a certain size (see density curves in *figure 6-9*). The results (see *table 6-6 and 6-7*) indicate that even though the pottery made by the two potters is morphologically standardized, the rim thickness measurements for the vessels point to either individual variation or different communities of potters.

Rim thickness measurements of vessels Day 2:

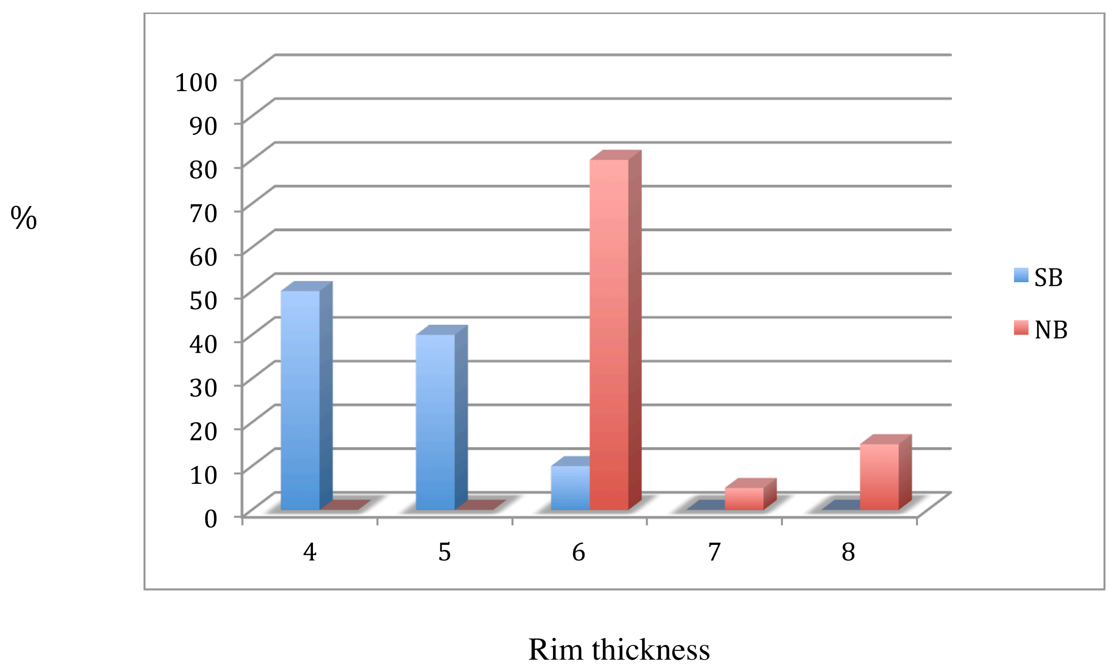


Figure 6-10
Frequency % for vessel rim thickness for potters SB and NB (day 2)

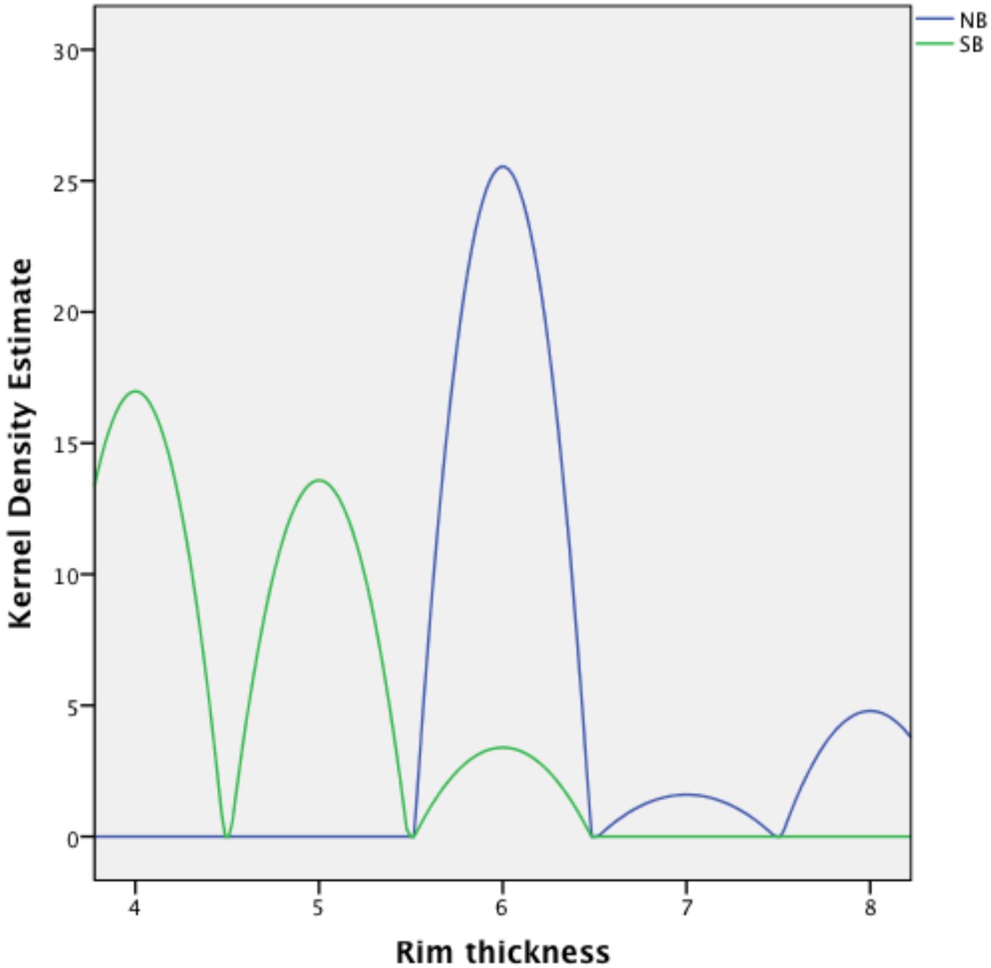


Figure 6-11
Density plot for vessel rim thickness for potters SB and NB (day 2)

Potters	***Rim thickness***				
	4 mm	*5 mm*	*6 mm*	*7 mm*	*8 mm*
SB%	50	40	10	0	0
NB%	0	0	80	5	15

Table 6-8
Frequency % for vessel rim thickness for potters NB and SB

Potter	No. Of cases	Min thickness (mm)	Max thickness (mm)	SD	Mean	CV%
SB	20	4	6	.681	4.60	14.80
NB	20	6	8	.745	6.35	11.73

Table 6-9
Descriptive statistics for rim thickness for potters SB and NB (day 2)

In Experiment 6.2.5- 2 the following points emerge:

1. The vessels made by SB have a range between 4 mm to 6 mm; while NB's vessels have rim thickness measurements ranging from 6mm to 8mm.
2. It will be easy to identify vessels made by a) SB falling between the 4 mm to 5 mm range and b) NB, falling between the 7 mm to 8 mm range.
3. Vessels made by SB are 50% of the time of 4 mm rim thickness, while those made by NB are 80% of the time of 6 mm thickness (similar to day 1).
4. The CV values indicate that there is variability in the rim thickness index between the two potters.

Problem:

The problem in identification arises in identifying vessels made by both the potters that fall in the 6 mm category, which is the minimum thickness for NB's rims and the maximum thickness for SB's rims. (This is the cumulative blur effect discussed in *section 6.3*)

Conclusion:

The coefficient of variation test was conducted on the rim thickness measurements for potters NB and SB. The results (see *table 6-8 and 6-9*) indicate that even though the pot made by the two potters is morphologically standardized, the rim thickness measurements for the vessels point to either individual variation within one community or different communities of potters. The point regarding overlapping measurements is discussed in *section 6.3*- cumulative blurr effect. There is greater variability in the rim thickness of vessels made by SB than NB, who seems to consistently aim for a certain size (see density curves in *figure 6-11*)

2) Reverse order test for identification of producers through rim thickness measurements.

Aim: In this part of the experiment, my goal was to identify the producer of vessels on the basis of rim thickness measurements alone.

Method: I went to random homes in the village of Chattrikhera and asked the residents to show me the *kali,* the water pot made by SB and NB. The pot owners are represented in *table 6-10* below from A to J (a total of 10). As the villagers buy the pots directly from the potters and know the identity of the producers, I specifically urged them not to reveal this. I only asked them to validate the identity of the producer of the pot, once I mentioned the name *after* taking measurements. The pot owners agreed to proceed in that manner.

Pot owner	***Rim thickness (mm)***	***NB***	***SB***	***Unknown***	***Result through validation of owners***
A	4		X		Correct
B	6	X	X		NB
C	8	X			Correct
D	6	X	X		NB
E	8	X			Correct
F	6	X	X		SB
G	6	X	X		NB
H	9			X	Correct
I	9			X	Correct
J	4		X		Correct

Table 6-10
Test for identity based on rim thickness measurements

Description:

1) I correctly identified NB as the producer of vessels C and E. In C and E, NB through years of practice has laid out the range of the vessel's rim thickness between 6 mm to 8 mm.
2) I correctly identified SB as the producer of vessels A and J. The range of potter SB is between 4 mm to 6 mm.
3) I correctly identified pots H and I as unknown or outliers. When the rim thickness falls away from the two categories (4 mm – 6 mm and 6 mm -8 mm), the producer of the vessel is neither NB nor SB. On further enquiry from the pot owners, I learnt that the vessels were purchased in another village and transported to Chattrikhera.
4) I could not categorically place either NB or SB to the rim thickness dimensions of 6 mm (overlapping measurements of potters) but the owners revealed the true results.

Problem:

The problem arises in the case of pots with pot owners B, D, F and G. Here, the rim thickness of the vessels is 6 mm, which is both the minimum and maximum rim thickness for vessels made by NB and SB respectively. Without prior knowledge for the rim thickness patterns of the two potters, or the validation of the pot owners, the overlap of rim thickness measurement of 6 mm leads to confusion over the identity of the vessel producer. The overlap known as the '*cumulative blur effect'* is discussed next.

6.3 Cumulative blur effect and methods to resolve it

In the archaeological context things are more complicated, because there is no information on individual potters, their range of measurements, observations of potters in workshops to aid identity of vessel producers or validation by owners of vessels regarding producers. In *table 6-10*, the last column, "results through validation of owners", shows validation and confirmation of the identity of the vessel producer by the pot owners. A similar situation to what we are faced with in archaeology is created when we rely only dimensions from the pots, which makes it difficult to ascertain the producer (s) of the vessels due to the potential of cumulative blur.

The cumulative *blurr* effect or overlap is seen in experiments 4, 5 and 6, because of the overlap in measurements of similar vessels made by different people. In the above example, the blur is created in the case of rim thickness of vessels at 6 mm, which is within the range of measurements for potters SB and NB. In scenario (6.2.5.1, 6.2.5.2 and 6.2.5.3), we cannot relate the over lapping rim thickness measurements to a particular potter or a workshop due to possible cumulative blurring nor can we work out the means, standard deviation or CV values for the possible number of potters represented by the rim thickness of sherds in the pool.

According to Blackman and colleagues (1993:60), the cumulative blur effect increases sample variability but does not obscure the overall homogeneity of the ceramics. Standardization can be a reliable index for *craft specialization* under conditions of close spatial and chronological control over the archaeological record (60). My suggestion is that standardization can also be a reliable index in the *grouping of potters* under close spatial and chronological control. For the purposes of my research, I have chosen kiln areas that are located at a distance from each other and are therefore spatially controlled. The workshops C1 and C2 at Karanis are far apart in space do not overlap and can be regarded as separate workshop areas. Thus, the cumulative blurr is curbed because of the spatial distance between the two workshops (see map of kilns in appendix to *chapter 6*). The kilns and the ceramic sherds in the kiln areas are from the Late Roman period and therefore; there is chronological control as well (*see chapter 1*). Thus, the possible occurring of the cumulative blur effect is low due to both spatial and chronological control. In addition, since most of the pots with a 6 mm rim thickness were made by NB, statistically I can assume that NB is the maker of the pots with a 6 mm rim thickness. With this added criterion, I would only be incorrect once. In an archaeological context, I would assign the sherd to the distribution contributing the most to the overlap in two distributions.

6.4. Archaeological application

The date range of the ceramic corpus at Karanis has already been discussed in *chapter 1*. My final goal is to identify communities of potters in the archaeological context. Before I can compare similar archaeological vessels from kiln areas, I need to address the following questions in a four- step method:

1) What were the production areas in Karanis?

2) What were the common vessels produced at Karanis?

3) Do kilns represent separate workshops at Karanis?

4) Does the evidence allow one to discern communities of potters at Karanis?

6.4.1 Production areas in Karanis

Kiln indicators

Identification of ceramic production locations, production facilities and related debris is important for the reconstruction of the spatial, technical and social context of production (Costin 2000: 384; Marchiniak and Yalman 2013: 5). Kilns furnish 'incontrovertible evidence' of the presence of pottery production locations (Peacock and Williams 1986: 9; Demesticha 2000: 549). A systematic study of both the architecture and the pottery found at a kiln site provide information on the production system and manufacturing methods used in the workshop (Demesticha 2000: 549)

I conducted a surface survey in Karanis to identify potential production areas. The survey identified areas, which had surface remains indicating the probability of pottery firing activity. It is important to note that the areas investigated are "probable kilns" because they have not been excavated (except for kilns C1 and C 2).

Figure 6-12
Pottery workshops and kilns located at el-Nazla next to stream

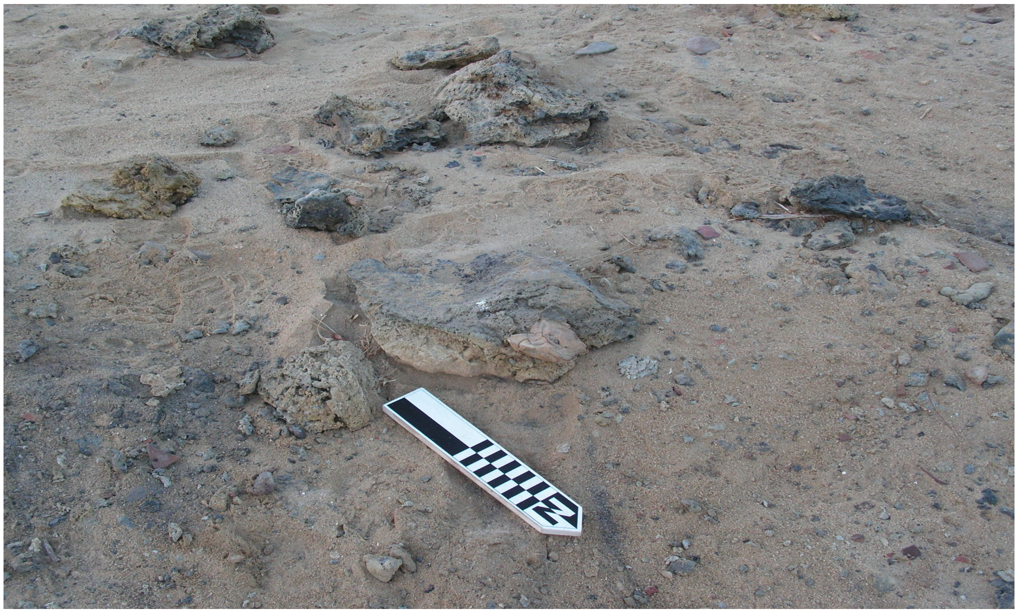


Figure 6-13
Kiln debris from kiln areas

Figure 6-14
Wasters and vitrified material from kiln areas

Criteria used to discern kiln areas were:

Location relative to prevailing wind direction: In a town, kilns are usually built downwind from the settlement area (*figure 6-12)*. In the Fayum, the wind generally blows from the north from early February to early march (Hewinson: 2001). Exceptionally in the period between March and May a hot wind, known locally as the *Khamsin* comes in from the southwest (Hewison: 2001). Similar arrangements can be seen at present day villages, such as El-Nazla in the Fayum. Most of the kilns at Karanis are located the edge and downwind of the settlement.

Slope areas: The kiln areas are usually built on slopes. At Karanis, most of the kilns were located on the southeastern slopes. This positioning provides better heat insulation, greater stability against thermal shocks during firing (Hasaki 2002: 73).

Proximity to canal, stream or river: The kilns are preferably located in close proximity to a canal, stream or river to provides access to water, clay and transportation (*figure 6-12* shows this situation). In Karanis there is evidence for an ancient canal, which runs at the south side of the town in the proximity of where majority of the kilns have been found (Cook 2011).

Kiln debris: Even when kilns are buried, damaged or partly or mostly destroyed, their location can often still be approximated because of the presence of kiln debris, such as fired bricks, kiln lining and large concentrations of ashes. Kiln lining can be recognized because it is a flat, often very overfired kind of debris. At Karanis there is evidence of this in each of the areas identified as kiln areas (see *figures 6- 13*). The kiln debris is relevant for the localization for kiln areas.

Wasters and debitage: The stacking of pots in a kiln determines a successful firing. Vessels damaged during firing primarily due to an unbalanced load are known as wasters. There are other causes for wasters including defects in the vessel walls due to insufficient drying or from faults in the composition of the clay and abrupt changes in temperature (Hasaki 2002: 96-97). Overburnt and damaged vessels found at the surface provide insight in the fabric types of locally produced ceramics. The surveyed area at Karanis provides evidence of misfired ware near and within the surveyed area and in the immediate vicinity. There is also evidence of sherds with vitrified material (*figures 6-14*).

6.4.2. Common vessels produced in Karanis

In order to understand transmission of skill as influencing continuity and change in Late Roman Karanis, it is important to focus on locally produced vessels. The first step is to to do a survey in the probable kiln areas at Karanis.

6.4.2.1 Surface survey of probable kiln areas

As the site of Karanis is covered by windblown sand, it is not always easy to find individual features. In the survey to locate potential kilns, I looked for areas with concentrations of vitrified mudbrick scatters, debitage, wasters. The areas were marked by recording the latitude and longitude of the sites using a Garmin hand held GPS. A total of 7 kiln areas were detected. The results of the survey are detailed below. I used the dog leash method to layout circular transects using the central point recorded by the GPS. The diameter of the circle was 10 m (radius 5m). A smaller circle of a diameter of 5 m was drawn using a string with 2.5 m length, The outer circle was divided into four transects namely Up slope (US), Left side (LS), Down slope (DS) and Right side (RS). The surface ceramics were collected from four transects and the inner circle, the center of the kiln where visible (*see section 6.6.2)*.

C1 or kiln area 1 (trench 8 excavated in 2007):

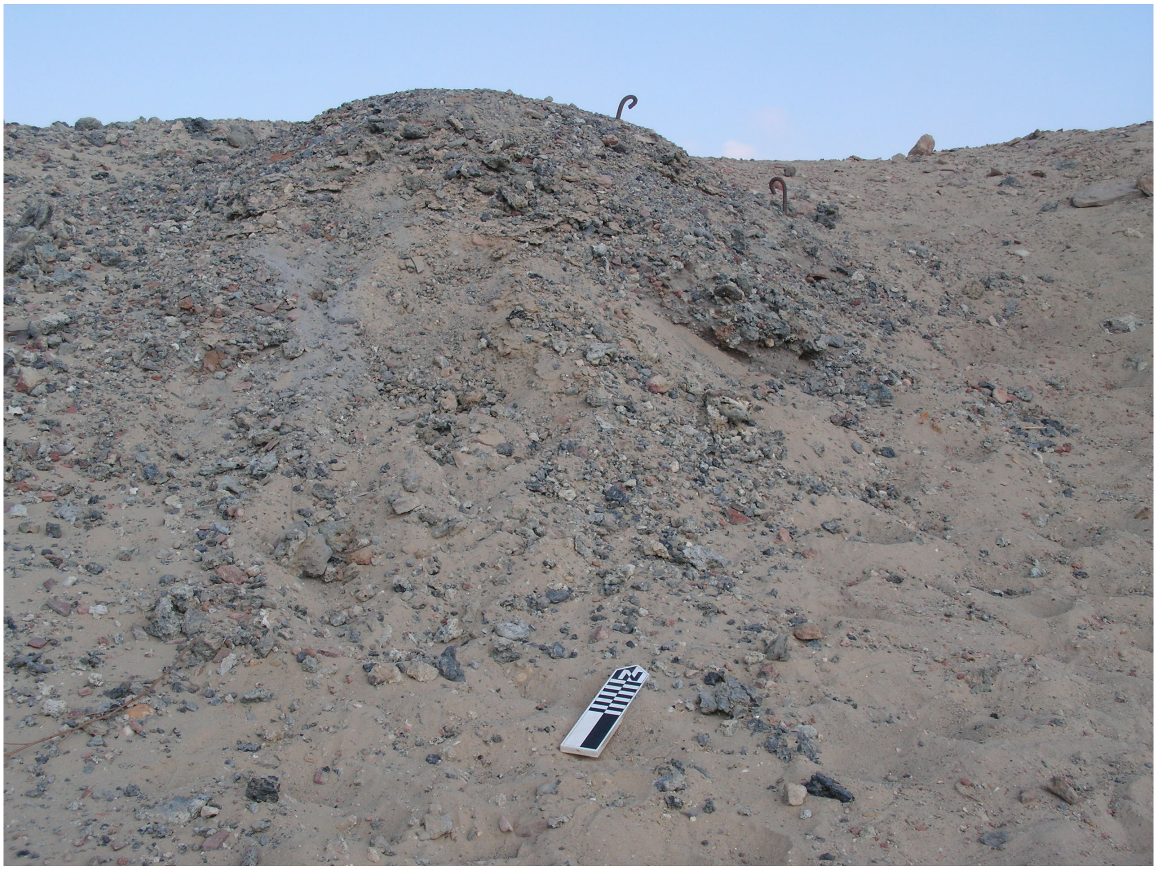


Figure 6-15.
View of kiln area C1 littered with kiln debris.

Kiln Area No.	Location	N	E	Inner diameter
1	257	*29 30 '58.3''*	*030 54' 07.9''*	not discernable

Description of area:

Kiln area 1 is located on the southern periphery of the settlement. To the south of this kiln area is the location of a canal (Cook 2011). Beyond this, further south, lies an asphalt road separating the agricultural land from the site. To the north, west and east lies the ancient settlement of Karanis. The kiln when excavated turned out to be an updraft one, typical of the Late Roman Period. The inner circle of the kiln drawn by the 2.5 m string was named C1-IC. The orientation of the kiln with regard to the four transects is as follows:

Left side: kiln lining/ debris (see figure 6-15) + concentration of sherds+ ashy deposit on outer 5 m circle	**Inner Circle:** sherd scatter	**Up slope:** sherd scatter
Down slope: kiln lining scatter + sherds+ ashy deposit on outer 5 m circle		**Right slope:** Diagnostics and body sherds

C2 or kiln area 2 (trench 30 excavated in 2011) :

Figure 6-16
View of kiln area C2 which are two adjacent kilns 1 and 2

Kiln Area No.	Location	N	E	Inner diameter
C2	260	*29 30' 59.4''*	*30 54' 5.0'*	*1.52 m*

Description of area:

This area is located at the south edge of the city and much disturbed by *sebakh* diggers. The circle encompasses two adjoining kilns C2 1 and 2 (see *figure 6-16*), hence to avoid overlapping in survey, a center point No. 260 was identified which brought within its domain the two kilns. The boundary of the inner circle of C2 touched the walls lying adjacent to both the kilns. The two kilns seem to lie in an open courtyard and are bounded by walls on part of the northwest and southeast sides. These walls are made of mud-brick and show no traces of high firing. The lower, northeast part of the kiln shows evidence of fired bricks, red in color. Also, half of kiln 2 has been destroyed by the *sebakhin*. The bricks are thin at several places and there is evidence of vitrified mortar. The corner of the wall appears to have been dug by the sebakkhin. Here, a Late Roman 7 Egyptian amphora was found placed upside down, perhaps to fill the gap between the interior of the walled structure and the kiln.

Left side: South west portion of L.S had a nile silt amphora in situ, built into the wall. evidence of plaster on wall	**Inner Circle:** evidence of plaster on wall	**Up slope:** low density of sherds
Down slope: evidence of wasters. One Late Roman Amhora-7 (Egyptian) was found embedded in the overfired kiln lining		**Right side:** In the north east part, evidence of overfired kiln lining scatter. Low density of sherds

C 3 or kiln area 3

Figure 6-17
View of kiln C3 showing burnt bricks (evidence of high temperatures).

Kiln Area No.	Location	N	E	Inner diameter
3	463	*29 31' 39.9''*	*30 54' 24.2''*	*2.49m*

Description of area:

No real slope in the kiln area was identified, hence in order to plot transects, I decided to take the North-South orientation instead. The kiln seems to be in an open courtyard. To the east lies a wall running south east to south. There is a scatter of kiln debris on the northeast and southeast sections of the area (See *figure 6-17*).

<table>
<tr><td>Up slope: high density of sherds</td><td rowspan="2">Inner Circle: high density of sherds</td><td>Right side: kiln lining & debris scatter & sherd scatter</td></tr>
<tr><td>Left side: sherd scatter</td><td>Down slope: kiln lining & debris scatter & low density of sherds</td></tr>
</table>

C4 or kiln area 4:

Kiln No.	Location	N	E	Inner diameter
4	261	*29 31' 01.2''*	*030 54' 09.2''*	not discernable

Description of area:

The area around the kiln slopes from north to south. Its left slope has a lot of body sherds and diagnostic scatter. A couple of African Red Slip ware sherds, a large quantity of Late Roman 1 amphora sherds, Nile silt clay fabric and one faïence sherd were spotted within the 5 m radius. The southern part of the inner circle radius showed remnants of another fired brick area subjected to high temperatures (perhaps a kiln?). A wall is seen running north south to the kiln's eastern area. The left and the down slope are very steep. The steep slope ends in a sandy area.

There are remains of overfired kiln lining in its north eastern and south eastern and southern sections.

Left side: Concentration of sherds & diagnostic scatter	**Inner Circle:** remnants of a brick kiln? Very high density of sherds	**Up slope:** sherd scatter
Down slope: sherd scatter		**Right side:** sherd scatter

C5 or kiln area 5:

Kiln No.	Location	N	E	Inner diameter
5	262	*29 30'59.8"*	*030 54' 09.2"*	*not discernable*

Description of area:

This area of the kiln is a small mound. The slope from west to east is not steep. The right slope yielded one coin, lots of overfired kiln lining and ash. The upper slope had very few diagnostics/sherds. The down slope and left slope yielded sherds and the inner circle yielded a higher density of sherds. The south and the south east part of the general area is sandy.

Up slope: low density of sherds	**Inner Circle:** high density of sherds	**Right side:** one coin. High density of

		overfired kiln lining scatter and ash
Down slope: sherd scatter		**Left slope:** sherd scatter

C6 or kiln area 6:

Kiln Area No.	Location	N	E	Inner diameter
C6	263	*29 31 9.4''*	*30 54 0.1''*	*not discernable*

Description of area:

This kiln area lies in the northwest part of Karanis. The area is characterized by the same type of kiln debris as the other areas, but the location is at the opposite end of the settlement and the prevailing northern winds would have blown the smoke towards the town. This was the only kiln area in which I could not locate a structure. The indicators for this kiln included vitrified kiln lining with stone and pottery attached to it, ash and over-burnt pottery-Nile silt amphorae (see page 55 under local versus Nile silt clay fabric discussion) below for discussion on why it is still not considered a kiln for amphora production). An ashy deposit and a bloated and corroded coin were seen on the down slope; while the right side had a curved wooden door handle on the surface. The northwest part of the kiln area away from the 5 m radius showed evidence of an oven in situ. The south, west and east part of the area all slope towards the northwestern side of the area. Kiln lining debris was seen in the northeast part of the inner circle and left slope. A structure, perhaps a wall is visible on the eastern part of the area. This kiln follows a different pattern from the kilns in the southeast part of Karanis.

Down slope: Ashy deposit**,** sherd scatter	**Inner Circle:** one coin , high density of sherds	**Left side:** low sherd scatter
Right side: door handle		**Up slope:** sherd scatter

*The dividing line between the down slope and left slope is at 350 degrees (-10 degrees from north)

C7 or kiln area 7:

Kiln No.	Location	N	E	Inner diameter
C7	264	*29 30' 58.8''*	*030 54'09.6''*	*not discernable*

Description of area:

The down slope and the upper slope both yielded the kiln-lining scatter with some having pottery attached to it. The left and the right slope were seen to be barren and attached to mud brick. A large concentration of pottery was seen in the upper slope and the down slope, especially imported pottery. Remnants of a kiln structure can be clearly seen in the southern part of the inner circle. There is kiln-lining scatter on both the eastern and western parts of the 10 m diameter. The slope is a little steep and slopes from north to south towards the sandy area. There is a clay outcrop in the southern part of the area.

<table>
<tr><td>Upper slope: kiln-lining scatter with one example of such lining attached with local type sherd attached. High density of sherds</td><td rowspan="2">Inner Circle: high density of sherds</td><td>Right side: high density of sherds</td></tr>
<tr><td>Down slope: kiln lining and sherd scatter</td><td>Left side: sherd scatter</td></tr>
</table>

6.4.2.2 Finding local fabric type at Karanis:

The fabric type associated with local manufacture at Karanis can be discerned through:

1. Surface pottery kiln areas: body sherds
2. Surface pottery kiln areas: diagnostics
3. Surface pottery: non-kiln areas
4. Excavated kiln pottery: body sherds
5. Excavated kiln pottery: diagnostics

Surface pottery kiln areas: body sherds

Having identified the fabric types in *chapter 1,* a survey of probable kiln areas at the site allowed analysis of types used in pottery manufacture at Karanis. Surface collection was made of body sherds at each kiln site, identified by the presence of kiln lining and vitrified shreds. The collected surface sherds were quantified by clay or fabric type. Surface ceramics were collected in the kiln areas using the dog leash method discussed earlier in *section 6.6.1.2*.

Figure 6-18
Mohammad at the probable center point of kiln

The center of the circle was positioned in what appeared to be the top or center of the kiln (*figure 6-18*), and included the kiln and its immediate vicinity.

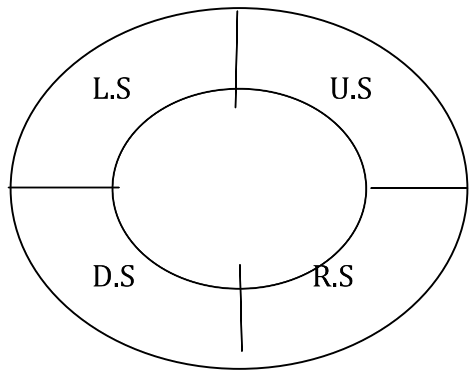
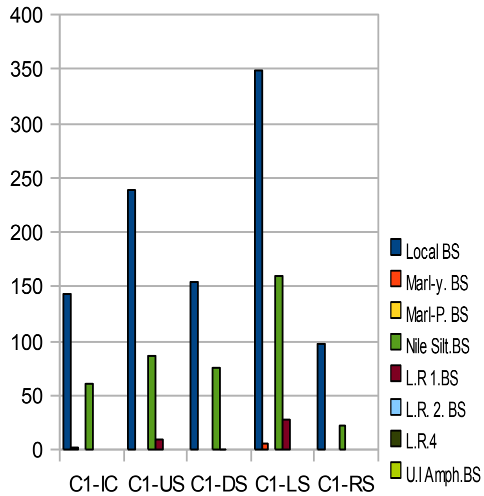


Figure 6-19
Transects using the dog leash method

A smaller circle of 5 m is drawn using a string with 2.5 m length, The outer circle is divided into four transects namely Up slope (US), Left side (LS), Down slope (DS) and Right side (RS) (see *figure 6-19* above). All the sherds that are found in the inner circle are collected and analyzed separately from those of the four segments of the outer circle. The upper slope and down slope indications help to account for post-depositional processes.

Processing: Each transect was separately bagged. The diagnostics and body sherds within these transects were also separately bagged and subsequently separated by fabric type, analyzed, weighed and counted. Further, the imported amphorae were also bagged and weighed to keep consistency in the processing methodology at Karanis, and to have a comprehensive database for future research. The accompanying histograms (two for each kiln area) for each kiln (*see figures 6-15 to 6- 26 below*) show the 1) fabric count of various fabrics found at Karanis (the unidentified amphorae are labeled U.I. in the figures*)* and, 2) the division of the local fabric types into local plain and local organic types (*discussed in chapter 1*). It has already been explained in *chapter 1* why it is relevant to discern these local types. The overall results and interpretation of the kiln and non- kiln survey areas are presented under *analysis*.

C1-Kiln area 1:



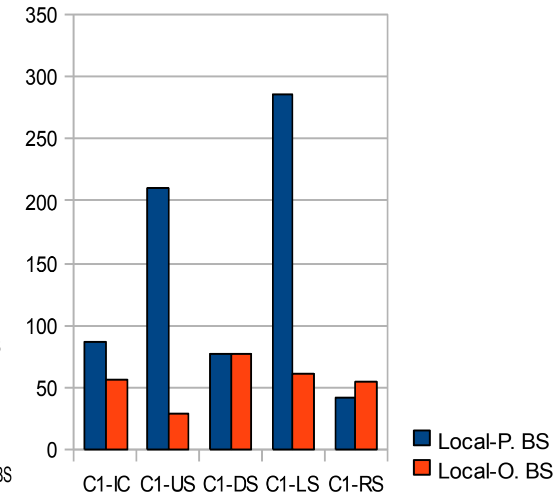
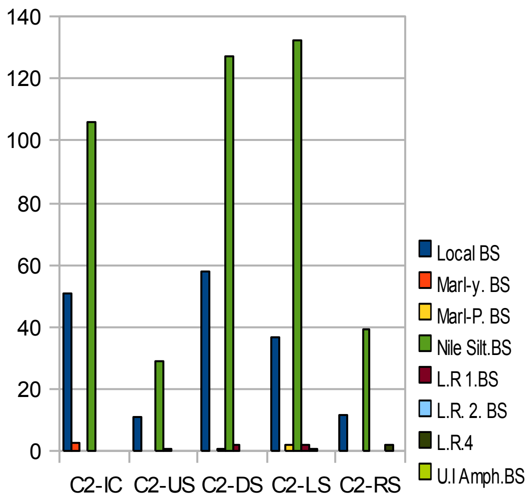


Figure 6-20.1 *Figure 6.20.2*

Distribution of surface pottery (body sherds) in kiln area C1

From *figure 6-20.1* above it is evident that the local body sherds dominate the corpus followed by Nile silt clay fabrics and LR1. F*igure 6-20.2* represents local production at Karanis. Here, it is evident that the local plain fabrics dominate over the local organic fabrics.

C2-Kiln area 2:



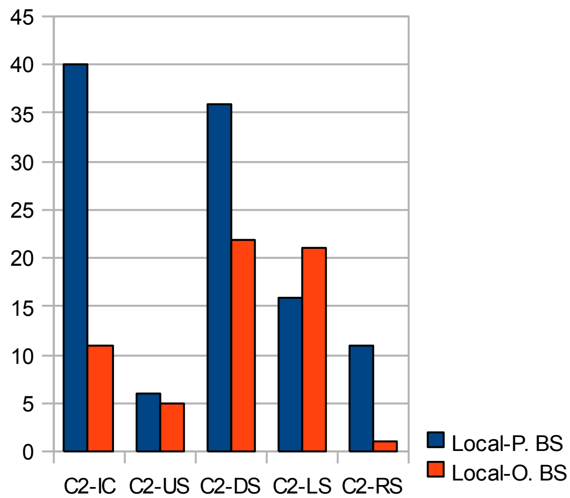
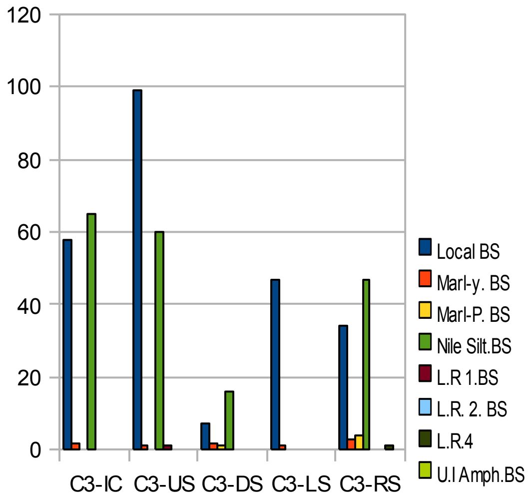


Figure 6-21.1) *Figure 6-21.2*

Distribution of surface pottery (body sherds) in kiln area C2

From *figure 6-21.1* above it is evident that the Nile silt clay fabrics dominate the corpus followed by local fabrics. From *figure 6-21.2* it is evident that the local plain fabrics dominate over the local organic fabrics.

C 3-Kiln area 3:



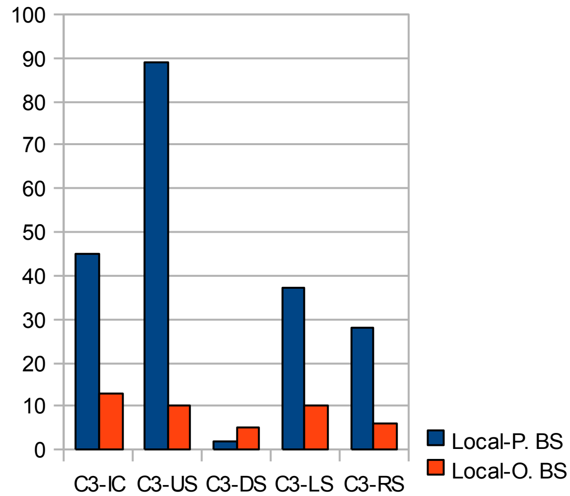
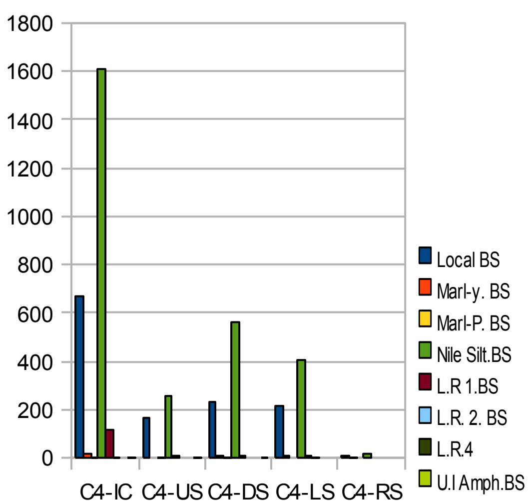


Figure 6-22.1 *Figure 6-22.2*

Distribution of surface pottery (body sherds) in kiln area C3

From *figure 6-22.1* above it is evident that the local body sherds dominate the corpus followed by Nile silt clay fabrics. From *figure 6-22.2* it is evident that the local plain fabrics are represented well, while the local organic fabrics are less in number.

C4 -Kiln area 4:



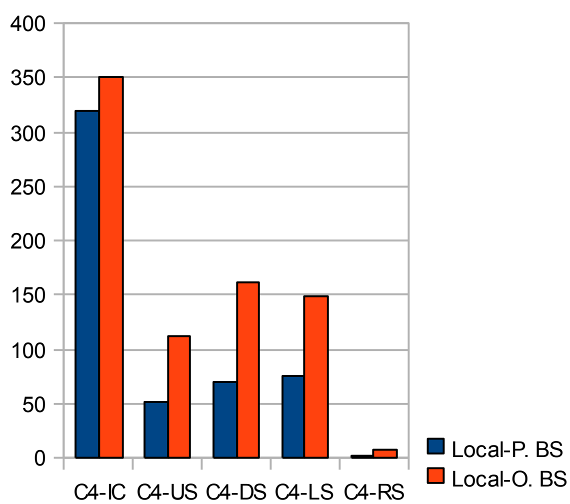
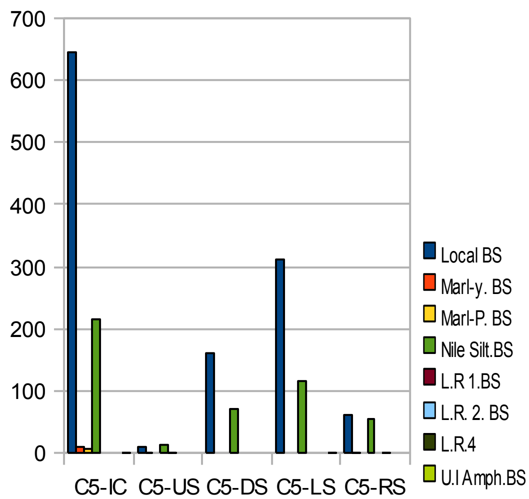


Figure 6-23.1 *Figure 6-23.2*

Distribution of surface pottery (body sherds) in kiln area C4

From *figure 6-23.1* above the Nile silt fabrics dominate the corpus followed by the local types. From *figure 6-23.2* it is seen tha't the local organic fabrics dominate over the local plain fabrics.

C5- Kiln area 5:



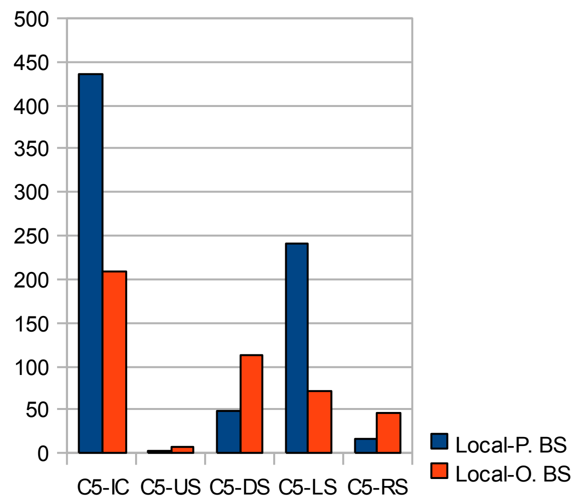
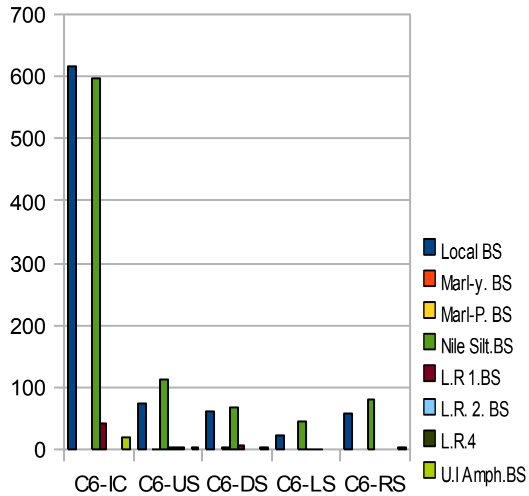


Figure 6-24.1 *Figure 6.24.2*

Distribution of surface pottery (body sherds) in kiln area C5

From *figure 6-24.1* above, the local fabrics dominate the corpus followed by Nile silt fabrics. From *figure 6-24.2*, it is evident that the local plain fabrics dominate over the local organic fabrics.

C6-Kiln area 6:



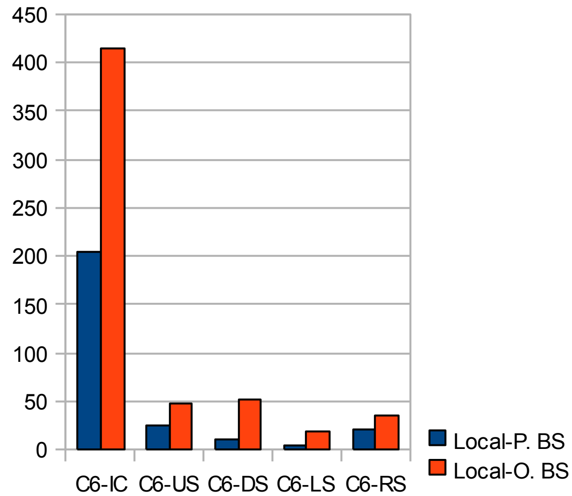
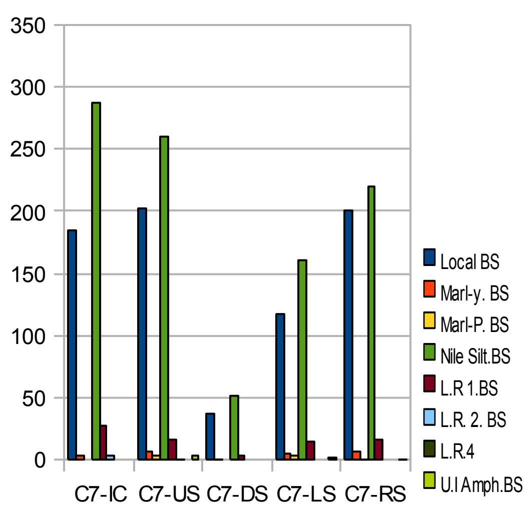


Figure 6-25.1 *Figure 6-25.2*

Distribution of surface pottery (body sherds) in kiln area C6

From *figure 6-25.1* above it is evident that the local body sherds and Nile silts are fairly close to each other. From *figure 6-25.2,* the local organics dominate the corpus.

C7- Kiln area 7:



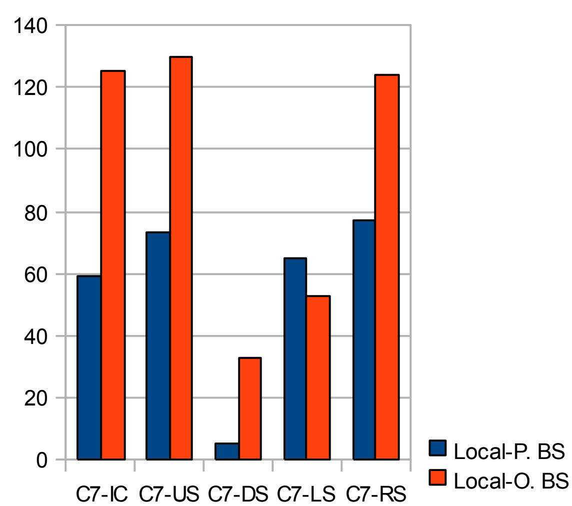


Figure 6-26.1 *Figure 6-26.2*

Distribution of surface pottery (body sherds) in kiln area C1

From *figure 6-26.1* above, the Nile silt clay fabrics dominate the local type. From *figure 6-26.2* it is seen that the local organic fabrics are dominant.

Analysis of kiln areas C1-C7:

Kiln area	**Local versus Nile Silt fabric type** *>= greater than* *< =less than*	**Local plain versus local organic fabric type** *>= greater than* *< =less than*
C1	Local > Nile silt amphora	Local plain> local organic
C2	Local < Nile silt amp	Local plain > local organic
C3	Local > Nile silt amp	Local plain > local organic
C4	Local < Nile silt amp	Local plain < local organic
C5	Local > Nile silt amp	Local plain > local organic
C6	Local= Nile silt amp	Local plain < local organic
C7	Local< Nile silt amp	Local plain < local organic

Table 6-11
Quantity of fabric types in kiln areas C1-C7 in relation to each other

Local plain versus local organic

The presence of higher quantities of local fabrics in the kilns indicates local production. These vessels were brittle, their use lives were short but the costs of replacing the vessels would be low due to ready availability of raw material (see *chapter 1*). The potters were adding chaff and carbonate temper (see *chapter 5* which was very economical and helped to produce a watertight body for low-fired ceramics. It seems that the potters at Karanis were aiming at efficiency and optimal use of resources.

Local (plan and organic) versus Nile silt

It is evident from the results above that the local body sherds dominate the corpus in the surface collection of the probable kiln areas. Nile silt amphora sherds rank second. Though kilns C2, C4 and C7 show higher quantities of Nile silt clay body sherds, we find no evidence of wasters or vitrified sherds associated with Nile silt amphora fabrics in the kiln zone. Also, according to Donald Bailey (2007:228),

> the nile silt amphorae were made in their thousands for the storage and transport of wine by potters leasing their work to vineyard owners in all areas where wine was produced.

In my opinion, the Nile silt amphorae found at Karanis were used for storing olive oil. We have evidence of olive oil production at the site (Wendrich *et al*. 2006)

According to Bailey (2007: 228),

> these amphorae were moved around Egypt frequently and a find-spot does not necessarily indicate place of manufacture.

Therefore at Karanis, the presence of Nile silt in the surveyed kiln zones do not indicate manufacture. Bailey (2007:228), also states that the products manufactured in a kiln can be known when the examples are accompanied with wasters. The distribution of the kiln lining and vitrified/overfired and misfired sherd occurrences in kiln and non- kiln areas indicate their association with the local fabric in the kiln area rather than Nile silt clay fabrics. The high presence of Nile silt amphora ware and absence of Nile silt wasters at Karanis is thus indicative of only the supply of vessels to olive oil producing setllements such as Karanis from amphora workshops around Egypt.

Further, I have already discussed in *chapter 1* about the influences of quality, abundance and distance of clay to firmly situate the facilitation of local vessel production. The potters at Karanis were using local Nile silt clays mixed with local sediments, desert marl, chaff and carbonates for local manufacture, A combination of all of these gives off a reddish color, distinct from the dark brown Nile silt alluvium.

In conclusion, the surface survey of body sherds (incorporating the role of vitrified material occurring with a fabric) indicates that the locally manufactured pottery at Karanis were of local and local organic fabric types (described in *chapter 1*).

Surface pottery kiln areas: diagnostics:

The results from the surface survey of kiln area C1-C7 indicate that the diagnostics of the local fabrics are more in number than other types *(see table 6-12 below)*. The results corroborate the findings in figures *6-20 to 6-26* above (*see analysis section)*.

Fabric type	Frequency for open forms	%	Frequency for closed forms	%
Local	222	72.3	193	70.7
Local organic	59	19.2	70	25.6
Nile silt	2	.7	2	.7
Marl yellow	15	4.9	5	1.8
Marl pink	5	1.6	3	1.1
Aswan pink	1	.3	-	-
African Red slip	3	1.0	-	-
Total	307	100	273	100

Table 6-12

Fabric frequency for open and closed form diagnostics from surface survey of kiln areas

Surface pottery: non-kiln areas:

Two non-kiln areas were surveyed in the same general region to evaluate how much of a difference in sherd types occurs when compared to a surveyed kiln area.

C8 or non-kiln area 8:

Collection area	Location	N	E
C8	468	*29 31' 124''*	*030 54'24.2"*

Description of area:

This non-kiln area was surveyed in the northeastern part of Karanis. It lies away from the Fayum road and the Michigan dump area. It seems to be a courtyard with a street on one side.

Up slope: wall & fired brick remnants. Low density of sherds.	**Inner Circle:** remnants of part of wall from upper slope. High density of sherds	**Right side:** sherd scatter
Down slope: high density of sherds		**Left side:** high density of sherds

C9 or non-kiln area 9:

Collection area	Location	N	E
C9	471	29 31'00.9"	*030 54'06.7"*

Description of area:

This is a domestic area that lies to the south of the south temple. It is bounded by a street on one side and overlooks the modern fields of Fayum. The southeast part yielded a considerable quantity of pottery while the southwest was sloping. The northwest was further bounded by remnants of a wall.

Left side: sherd scatter	**Inner Circle:** sherd scatter	**Upper slope:** sherd scatter
Down slope: sherd scatter		**Right side:** high density of sherds

Result:

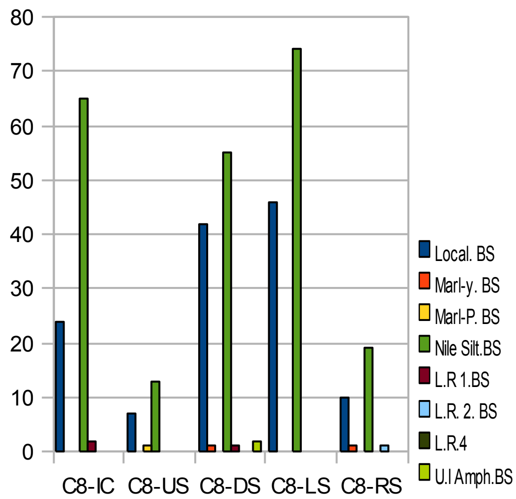


Figure 6-27.1

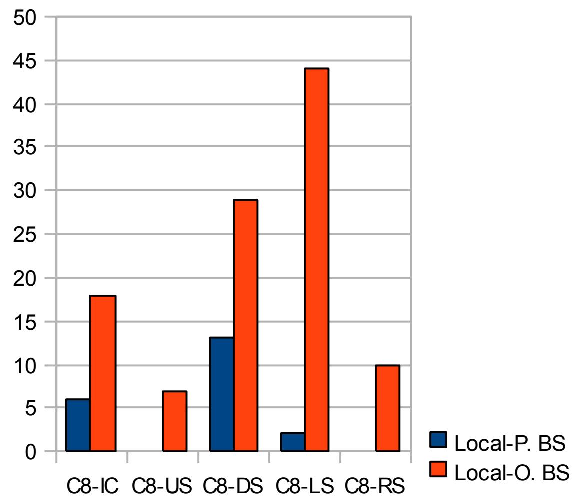
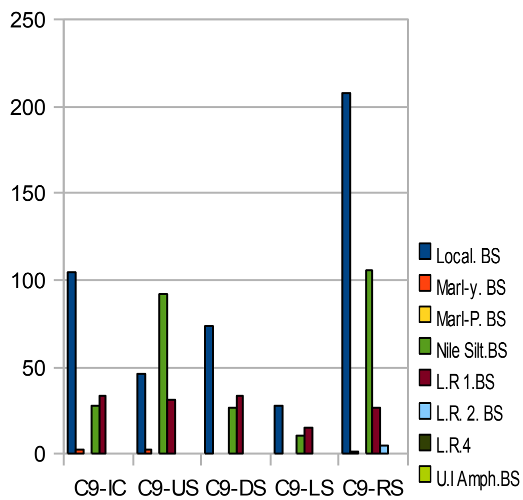


Figure 6-27.2

Distribution of surface pottery (body sherds) in non kiln area C8



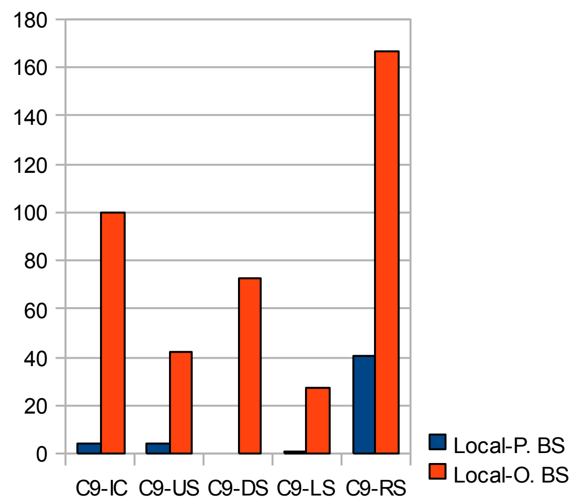


Figure 6-28.1 *Figure 6-28.2*

Distribution of surface pottery (body sherds) in non kiln area C9

Analysis of non- kiln areas :

Non-kiln areas	**Local versus Nile Silt clay**	**Local plain versus local organic** >= greater than < =less than
C8	Nile silt amp> local	Local plain < local organic
C9	Local> Nile silt amp	Local plain < local organic

Table 6-13
Quantity of fabric types from areas C8-C9 in relation to each other

From *figure 6-27.1 above*, the Nile silt fabrics dominate and *figure 6.27-2* indicates that the local organics are dominant (also see *table 6-13*). From *figure 6-28.1* above it is evident that the local body sherds dominate the corpus followed by Nile silt clay fabrics and a higher presence of

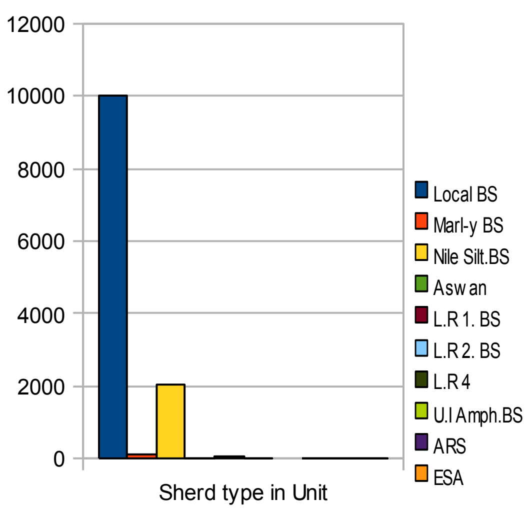
LR1 compared to previous kiln and collection areas. From *figure 6.28.2*, the local organics dominate while the local plain types are minimal.

Excavated kiln pottery: body sherds:

As surface collections are exposed and effected by post depositional processes, it becomes important to corroborate the results of the kiln survey. For this, the deposits of fabrics from an excavated kiln were analyzed for counts.

Method: One of the kilns C1 or Trench 8 was excavated by the UCLA/RUG project in 2007. The excavated kiln was included to compare the results of excavated and surface ceramics.

Results:



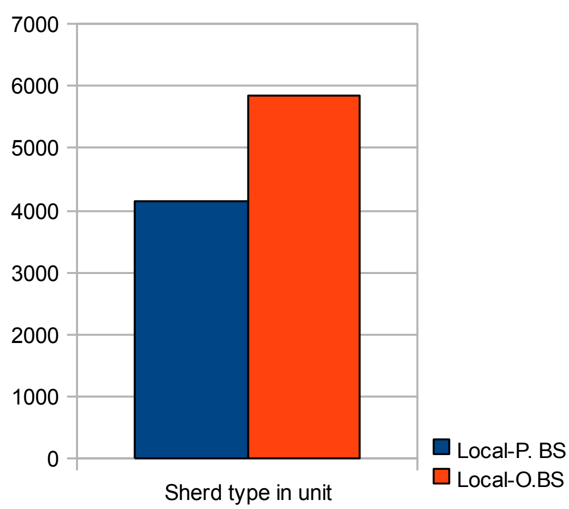


Figure 6-29.1 *Figure 6-29.2*

Distribution of body sherds in excavated kiln area C1

Analysis of excavated kiln areas: body sherds:

Kiln	**local versus Nile Silt**	**Local plain versus local organic** **>= greater than** **< =less than**
C1	Local > Nile silt amp	Local plain > local organic
C2	Local> Nile silt amp	Local plain < local organic

Table 6-14
Quantity of fabric types from excavated kilns C1-C2 in relation to each other

Figure 6-29.1 above shows that local body sherds dominate the corpus, with Nile silt amphorae intrusions coming in second. In *figure 6-29.2* when comparing the local plain sherds with local organic sherds, the latter dominate the corpus. This phenomenon is in line with the findings of the kiln areas as well as the non-kiln survey. The potter(s) of excavated Kiln C1 (trench 8) were manufacturing local ware using local resources. These clays and tempers could be easily procured. Functionally too, daily utilitarian ware such as cooking pots had a high breakage rate, and required the availability of replacements, best created locally, using locally available clay. The fabric type from excavated kilns matches the fabric type of survey as well. The results are proof that what was interpreted as local was indeed local.

Excavated Kiln pottery: diagnostics:

Fabric types	Frequency for open forms	%	Frequency for closed forms	%
Local	139	75.5	68	63.6
Local organic	34	18.5	36	33.6
Nile silt	4	2.2	1	.9
Marl yellow	4	2.2	2	1.9
Marl pink	3	1.6	-	-
Total	184	100	107	100

Table 6-15
Fabric frequency for open and closed form diagnostics from kiln C1

The fabric type counts of diagnostic sherds found in excavated kiln C1 (trench 8) indicate high counts for the local fabrics (See *table 6-15*). The results corroborate the findings from the kiln surface survey, non-kiln surface survey and the excavated kiln.

Analysis of excavated kiln areas: diagnostics:

From the excavated kiln, the Nile silt clay fabric types are minimal compared to the local sherd presence clearly indicating manufacture of local sherds in excavated kiln area 1 (C1 or trench 8). The results show high frequency of the local plain and organic fabrics types from the kiln survey surface collection and excavated kiln C1.

6.4.2.3. Evidence of common vessels through surface rim types from kiln areas C1-C7

Evidence of common vessels can be discerned though the surface collection of rim types from kiln areas C1 to C7. The surface diagnostics were first divided by rim types for open and closed forms using the rim type catalogue.[36] Most of the bowls, dishes, casseroles, open jars and basins

[36] I have developed the rim type catalogue for excavation years 2006 to 2012.

are open forms. Open forms are wide mouthed with an absence of necks. Cooking pots, water vessels and pots feature under closed forms. These are not wide mouthed as the open forms and have necks. A count of the forms occurring in each fabric type was taken. The count of diagnostics of open forms from kilns areas C1 to C7 suggested that 15% of the total diagnostic assemblage was composed of casseroles. A count of diagnostics for closed forms from kiln areas C1 to C7 suggested that 37% of the total diagnostic assemblage was composed of cooking pots.[37]

Conclusion:

In summation, the scale of production at Karanis was intensive given the number of kilns. These kilns were mostly located around the southwestern periphery of the site, an area where activities relating to potter manufacture were carried out by different group of potters. There were two local pottery fabric types at Karanis: local plain and local organic. The manufacture of local ceramics at the site is shown by the use of these fabrics and can be quantified by counting the rim types from the kiln, non-kiln and excavated kilns. The potters of Karanis had no direct access to the river Nile. The clay was collected from the local canal. They had access to the canal from the south of the site, which was linked to the Bahr-Youssef canal fed by the Nile. It appears that the potters procured clay from the banks of the canal. This was silt mixed with marl of the Fayum desert, thereby giving the local type its mixed fabric characteristics. This is the reason that the distinct Nile alluvium brown color is absent in the local vessels at Karanis. The test for carbonates with HCL (Hydrochloric acid) presented earlier in *chapter 5* indicates the mixing of Nile silt clays from the canal with carbonates emanating from the Fayum desert marl. This local

---

[37] Late Roman cooking pots from Karanis are closed forms with ribbed bodies and necks. Casseroles are open cooking vessels. See photographs in appendix E.

type was heavily used in manufacturing everyday utilitarian ware as suggested by the kiln survey.

The range of pottery can suggest the duration of the kiln (Hasaki 2002: 76). At Karanis, the range of utilitarian ware from the excavated kilns relates to the Late Roman period. Only a homogeneous body of pottery can represent what the kiln originally produced (Hasaki 2002: 299). At Karanis, I have firmly established the production of utilitarian ware at the kilns.

6.4.3 Kilns as workshop areas

Kilns are focal points for production and are of significance for the purposes of discerning communities of potters. Kilns were built to last as building these were a considerable economic investment (Hasaki 2002: 75). Ethnographic data suggests that kilns have a lifetime of two or three generations (Hasaki 2002: 299). The lifetime of a kiln is then perfect for understanding transmission of skill and knowledge at Karanis. From the Late Roman kilns at Karanis, I have established the presence of wasters, misfired ceramics, vitrified mudbrick and other debitage, which are all reliable indicators of local production (see *sections 6.4.1* above).

Kilns are also the strongest criterion for identifying a ceramic workshop (Hasaki 2002: 22). The main criteria for selecting a site for a kiln explained earlier (*section 6.4.1*) are similar to those for establishing a ceramic workshop. A workshop is "a room, apartment, or building in which manual or industrial work is carried on (Tournavitou 1986: 447; Hasaki 2002: 252). Tournavitous (1986; Hasaki 2002) enumerated six major criteria for the secure identification of a work place namely architecture, pottery, facilities, tools, material worked and connection with central administration. Hasaki (2002: 259) proposes a new list adapted from Tournavitou's where she divides the criteria into two groups: movable objects and permanent features. The former includes large quantities of raw material, pottery along with wasters, technical equipment, potter's wheel, jars for applying slips, molds, forming tools and kiln props. The permanent features include architectural structures for processing clay such as clay settling basins, forming, and firing vessels. According to Hasaki (2002: 260), the values of some criteria from these groups differ when considered individually than when considered collectively. According to her, quantitative values may allot each criterion more importance. If viewed collectively, the criteria then could indicate a workshop, or point to a workshop in the vicinity (261). She concludes that only the remains of the kiln of a ceramic workshop should be called a "workshop" in its fullest sense. At Karanis, production activities were noticed in kiln areas C1 to C7 and the UCLA team excavated physical remains of two kilns C1 and C2 (trenches 8 and 30 respectively). As mentioned above, Hasaki (2011: 14) is of the view that a kiln is "undoubtedly the strongest criterion for the location of a ceramic workshop, being most resilient to post abandonment processes." Cuomo Di Caprio (2007: 258) in her assessment of traditional Italian workshops suggests three workshop space categories: 100-500 square meters, 300-400 square meters and 500-1000 square meters (the last one is applicable to potteries for tile works). Similar trends are noticed in a survey conducted by Papadopoulos (1995) where small workshops extend over 200 square meters and the larger ones with two or more kilns cover between 300-400 square meter. According to Hasaki (2011: 25), other examples from workshops in both the ethnoarchaeological (Greece, Italy, Tunisia and India) and archaeological contexts (from the Hellenistic and Roman periods in both Greece and Italy) suggest a space range from 120 square meters to 750 square meters as a viable size for a family based workshop industry. Assuming that the area of the two kilns/workshops C1 and C2 was 750 square meters, the distance that separated the two is approximately 100 meters apart, far enough to ensure that no overlapping of areas took place.[38] Therefore, following Hasaki's (2002: 25) comprehensive assessment on size and spatial distance of workshops, I designated Kilns C1 and C2 as ceramic workshops C1 and C2.

The kiln can reveal economic aspects of the ceramic workshop and to a certain extent be correlated to the degree of craft specialization (Hasaki 2006: 225). Peacock (1982) divides pottery into eight modes of production: household production, household industry, individual workshops, nucleated workshops, the manufactory, the factory, estate production and military and other official production (Peacock 1982:10). Peacock ascertains these models through archaeological evidence by evaluating excavated workshops with patterning in pottery distribution, its trade and consumption. Peacock (1982) considers an aggregation of kilns as an independent workshop, in contrast with estate production. According to his criterion, the kiln areas in the southeastern section of Karanis indicate several independent workshops. Estate production is on a much larger scale and would be better suited for amphorae production, for storage and transport for agricultural produce and building materials and not for utilitarian wares. There is no evidence for Nile silt amphora production (*page 55*) and no written sources suggesting large-scale pottery works at Karanis.

Textual evidence also indicates that pottery production of basic earthenware took place in villages (Cockle 1981; CPR XVIIA 8 (Hermapolis: 317). Local pottery needs were met by local production and fine wares were mostly manufactured in the nome capital (Bagnall 1996: 129). Utilitarian vessels which were in high demand would have multiple potters /workshops producing the same form.

38 See map showing kilns/workshops C1 and C2 and distance between them in Appendix D.

While observing and interviewing the potters in Egypt and India, it was evident that each workshop manufacturing similar vessels had its own range of variability and recipes, which were carefully guarded. The different measurement standards were 'standardized' for each workshop but generated 'metric variability' at the site for similar vessels.

In *chapter 5*, I showed that in modern pottery workshops, when potters make similar vessels, the main stages of pottery manufacture may be similar but the associated actions are different as indicated by space usage, gesture and posture analysis, different ratios of clays during mixing and adding of temper. In the same chapter, I also demonstrated that similar rim sherds of cooking vessels from certain kiln areas in Karanis indicate different temper treatment perhaps pointing to different communities of potters. In the ethnoarchaeological context, most potters work together and use the kiln in or right next to their workshop. Therefore, the kiln area can be taken as a workshop area in view of all the indicators discerned in the earlier sections.

6.4.4. Discerning communities of potters at Karanis

Aim: In order to discern communities of potters and understand transmission of skill and knowledge at Karanis, there is a need to find a form common to all kiln areas. The common vessels allow an assessment of variability within standardization.

Method: Diagnostic rim types were collected from all the kiln areas. The most frequently occurring rim types common to all kiln areas were chosen to be the basis for selection of rim types from excavated kilns C1 and C2.

Casserole rim types	***Kilns***						
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**
B19	0	0	0	0	1	0	0
B31	0	0	0	0	1	0	0
B55	1	1	0	4	1	0	0
B59	0	0	0	0	1	0	0
B61	0	0	0	0	0	0	0
B64	1	0	0	0	0	0	0
B72	0	0	0	0	1	0	0
B77	0	0	0	1	2	0	0
B93	0	0	0	0	1	0	0
B105	0	0	0	0	0	1	0
B107	0	0	0	0	1	0	0
B109	1	1	1	0	10	1	0
B132	0	0	0	0	1	0	0
B150	0	0	0	0	4	1	0
B155	0	0	0	1	2	1	0
B157	0	0	0	0	1	0	1

Table 6-16
Distribution of casserole rim types in kiln areas C1-C7

The results show that forms B55, B109 and B155 are more common to most of the kiln areas. However, B109 is the only common type found in excavated kilns C1 and C2 that has a comparable sample size.

Cooking pot rim types	***Kilns***						
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**
R1	5	1	1	4	11	3	5
R6	0	1	0	2	10	1	0
R21	3	3	0	8	7	0	5
R23	2	1	1	0	10	2	1
R45	0	0	0	0	8	0	2

Table 6-17
Distribution of cooking pot rim types in kiln areas C1-C7

The results indicate that cooking pot rim types R1, R21 and R23 are common rim types occurring in kiln areas C1-C7. However, R1 and R21 are the only two common types in the excavated kilns C1 and C2 that have a comparable sample size for analysis.

The following rim types (*table 6-18*) representing a casserole and cooking pots were common to kilns C1 and C2. [39] The shallow lid seated rims are typical rim types dating to the Late Roman period.[40]

Rim type	*Form*	*Description*
B109	Casserole	shallow lid seat rim
R1	Cooking pot	angled rim
R21	Cooking pot	shallow lid seat rim

Table 6-18
Common rim types in kilns C1 and C2

Metric analysis for rim types at Karanis

Table 6-19 below highlights the measuring method I have used for testing variability within standardization for rim types of cooking vessels from excavated kilns C1 and C2. Recording biases were kept to a minimum by having only two people record the measurements. Individual observations were continually rechecked and verified to rule out errors.

[40] See photographs and drawings for these specific rim types in appendix F and G.

Measured dimension	*Comment*	*Method of measurement*
Rim diameter	Outer circumference of form at rim	Diameter chart
Rim thickness	Thickness of form at point of maximum thickness	Calipers
Neck thickness	Thickness at neck for cooking pots	Calipers
Wall thickness	Wall thickness for casseroles right below the rim.	Calipers

Table 6-19
Method used for quantitative measurement of vessels

Results for casserole rim type from kilns C1 and C2:

The analysis was conducted on rim type number B109 (the sample sizes for the other open form casserole types types were too small to facilitate a fair comparison between kilns C1 and C2).

Rim type B109

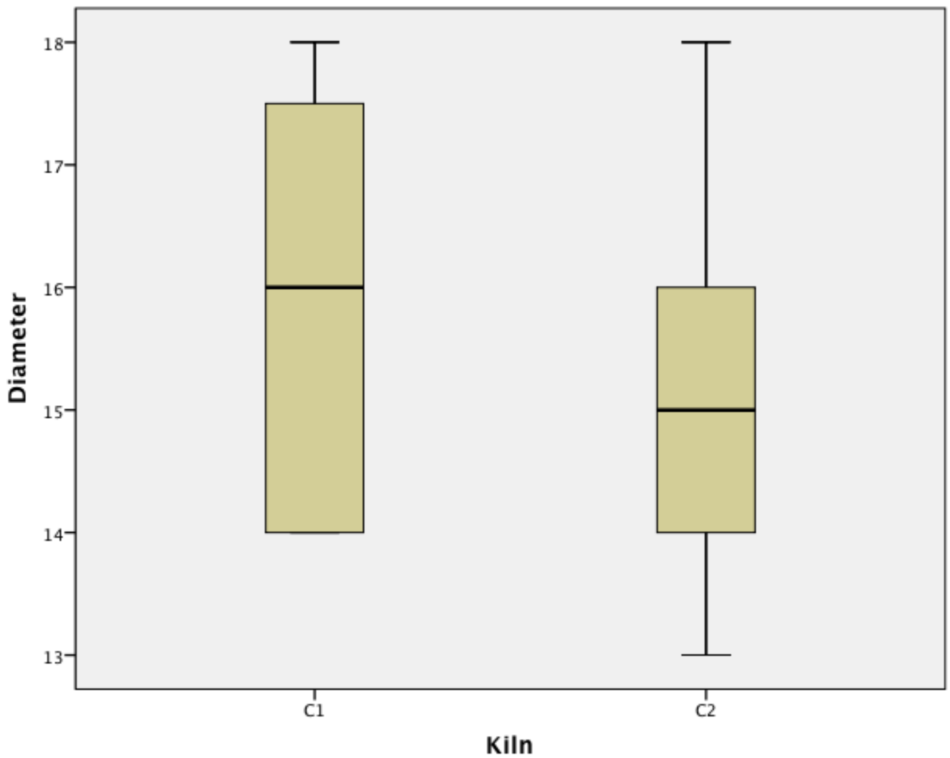


Figure 6-30
Box plots showing rim diameter of B109 from kilns C1 and C2

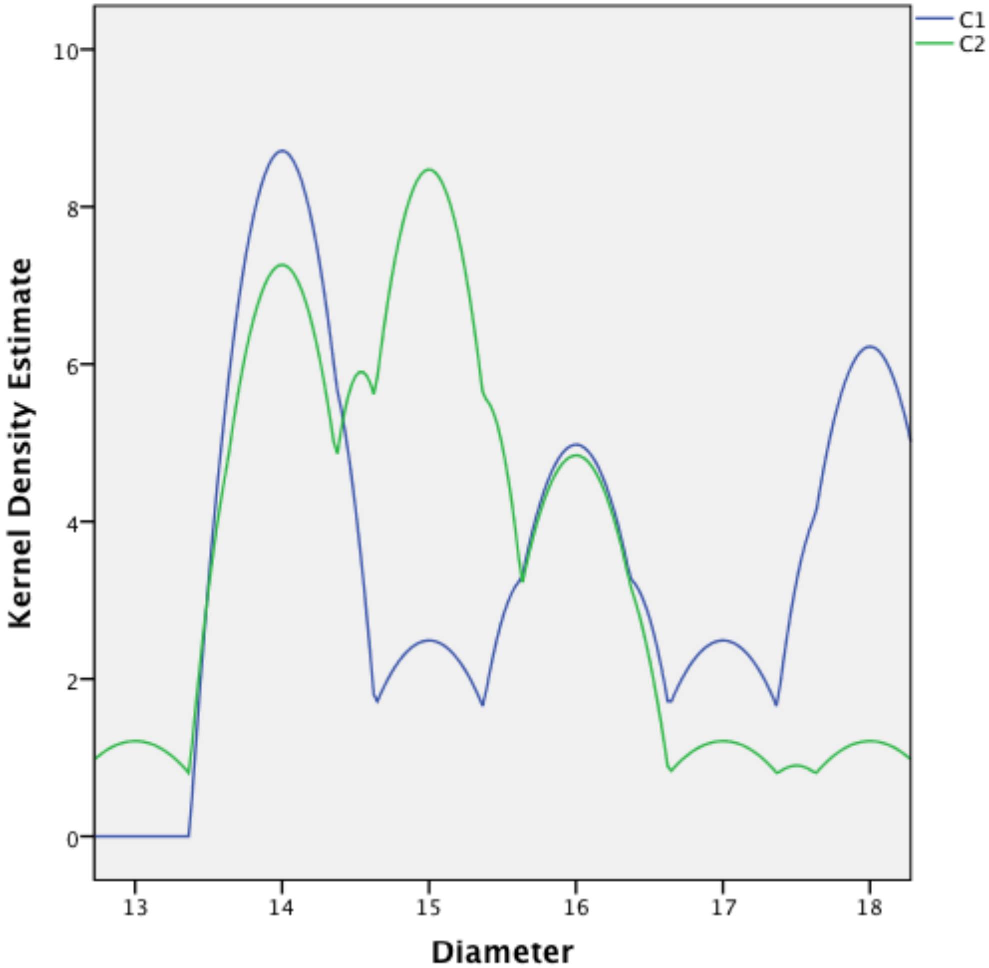


Figure 6-31
Density plot showing rim diameter for rim type B109 from kilns C1 and C2

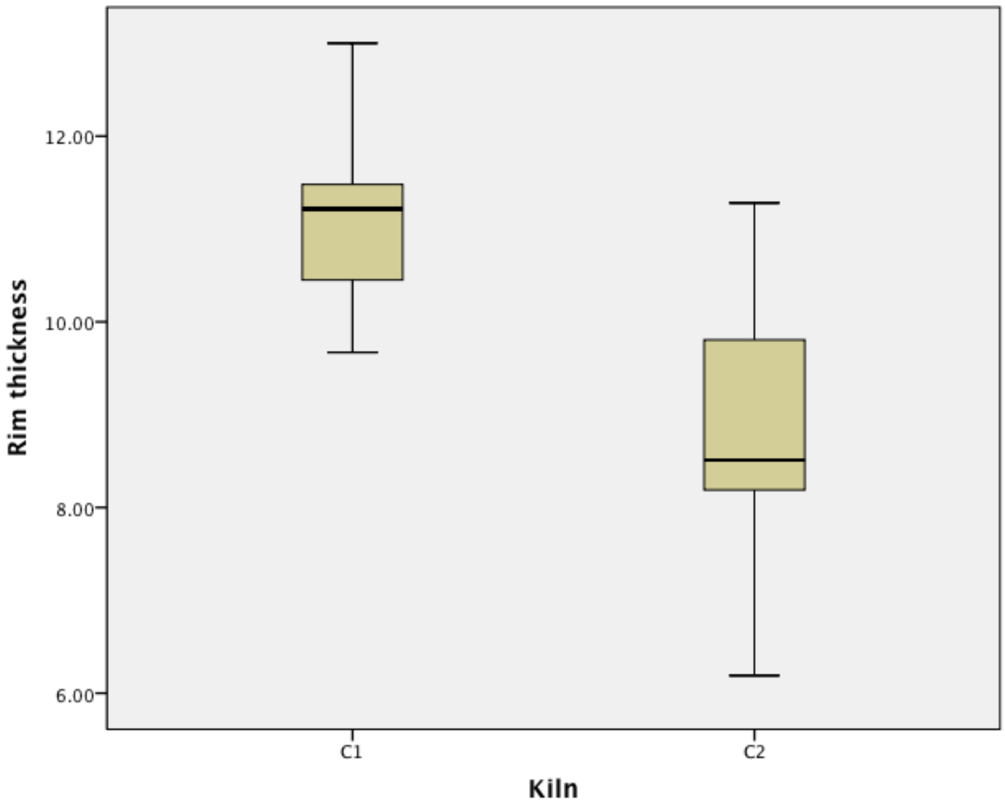


Figure 6-32
Box plots showing rim thickness of B109 from kilns C1 and C2

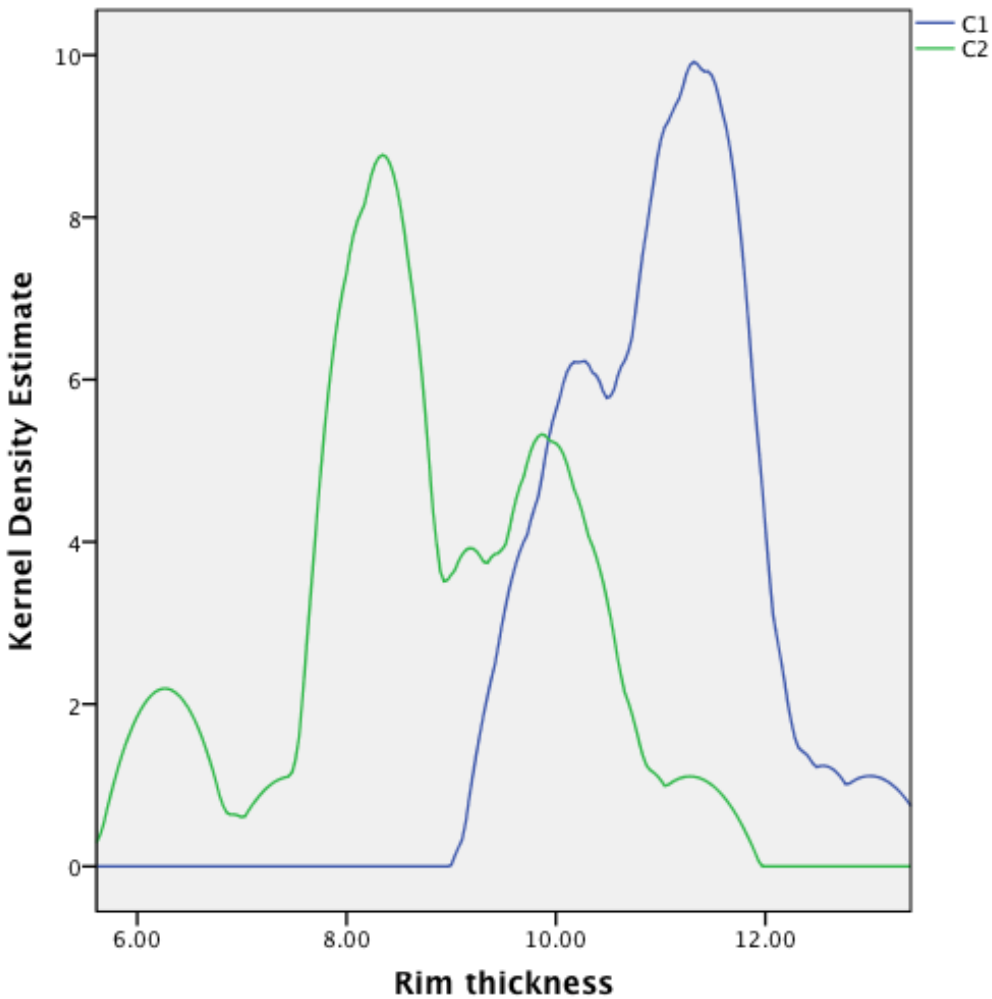


Figure 6-33
Density plot showing rim thickness of B109 from kilns C1 and C2

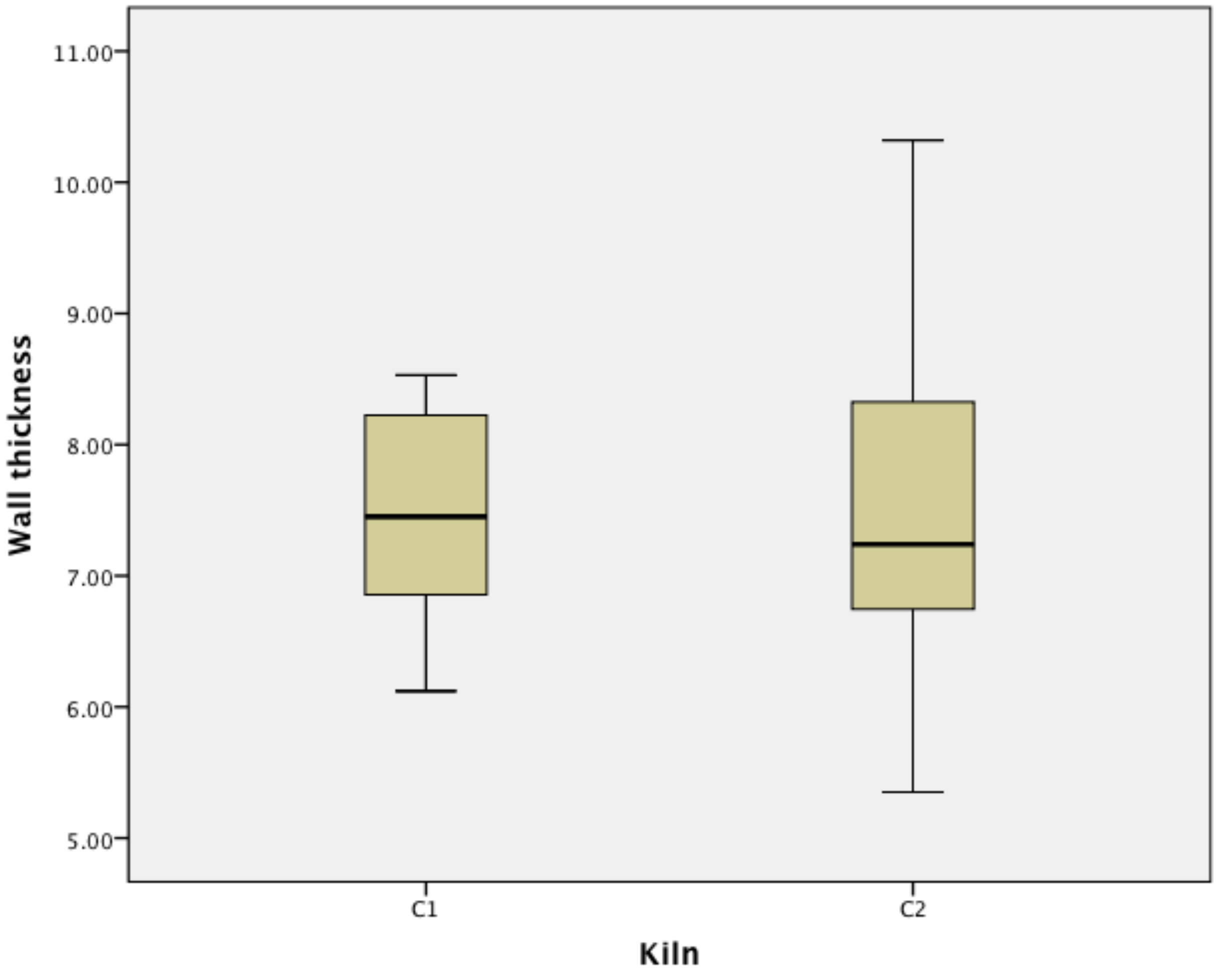


Figure 6-34
Box plots showing wall thickness of B109 from kilns C1 and C2

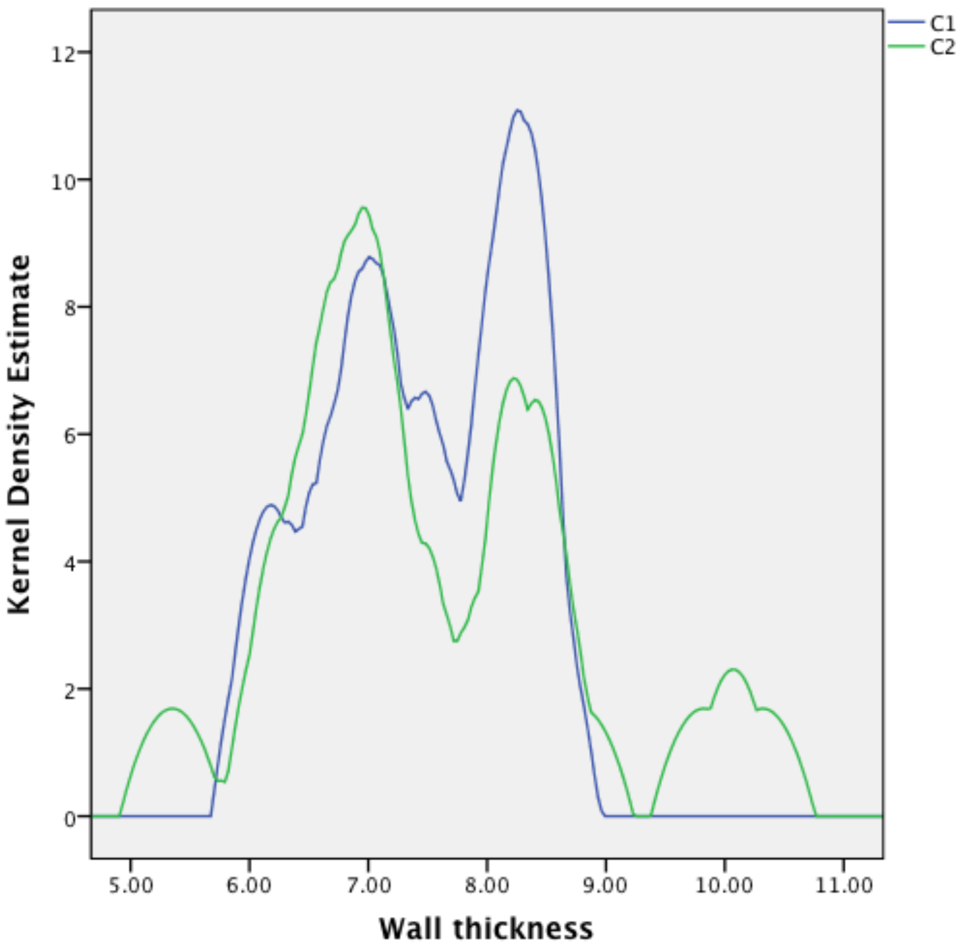


Figure 6-35
Density plot showing wall thickness of B109 from kilns C1 and C2

Kiln	*Dimension*	*Total no*	*Range*	*Minimum*	*Maximum*	*Mean*	*SD*	*Variance*	*CV %*
C1	Diameter	20	4	14	18	15.80	1.642	2.695	10.39
C2	Diameter	20	5	13	18	15.05	1.191	1.418	7.91
C1	Rim thickness	20	3.33	9.67	13.00	11.0200	.84602	.716	7.67
C2	Rim thickness	20	5.09	6.19	11.28	8.7730	1.30020	1.691	14.82
C1	Wall thickness	20	2.41	6.12	8.53	7.4475	.80074	.641	10.75
C2	Wall thickness	20	4.97	5.35	10.32	7.5250	1.23883	1.535	16.46

Table 6-20
Descriptive statistics for B109 from kilns C1 and C2

Rim diameter

The box plots in *figure 6-30* indicate a similar spread for rim diameter with overlapping rectangles but with a wide range of variability within each workshop.

The density curves for workshops C1 and C2 (*figure 6-31)* indicate that the variability of rim diameter is similar for both the kilns.

The range of variability for rim diameters in kiln C1 is between 14-18 cm, while for C2 it is between 13-18cm. It seems that the potters of both the workshops are aiming for similar sizes. However, the difference between the two workshops can be seen in the values of CV. The SD also shows similar trends (*table 6-20*).

Rim thickness

The box plots for rim thickness in *figure 6-32* indicates lower numbers for kiln C2. Both kilns C1 and C2 have overlaps in the spread. The two inter quartile ranges (the two rectangles) do not overlap along the vertical axis, suggesting that the means differ beyond just random variation.

The density curve in *figure 6-33* indicates a similar spread but the potters are aiming for different means.

The range of variability for the rim thickness in workshop C1 is between 9.67-12 cms, while for C2 it is 6.19-11.28 cms. The CV values indicate a difference between workshops C1 and C2 (see *table 6-20*).

Wall thickness

The wall thickness as shown in the box plots (*figure 6-34)* indicates similarities, though kiln C2 has a wider dispersion than C1. The rectangles also overlap each other suggesting similarities.

The density curve (*figure 6-35)* shows a very similar spread, where the mean is also similar.

The range of variability for wall thickness is between 6.12 to 8.53 cms for workshop C1 and 5.35 to 10.32 for workshop C2. The means for both the workshops are almost the same. The CV values indicate a difference between the two workshops (see *table 6-20*).

Rim type R1

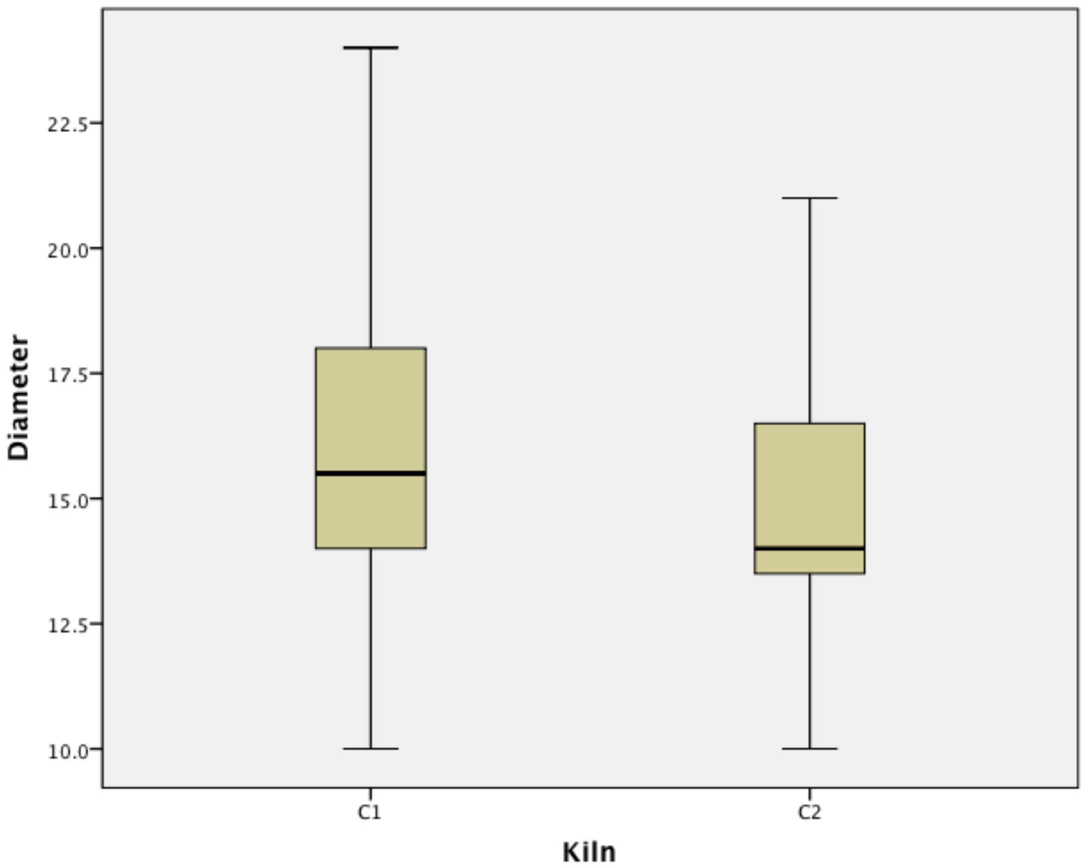


Figure 6-36
Box plots showing rim diameter of R1 from kilns C1 and C2

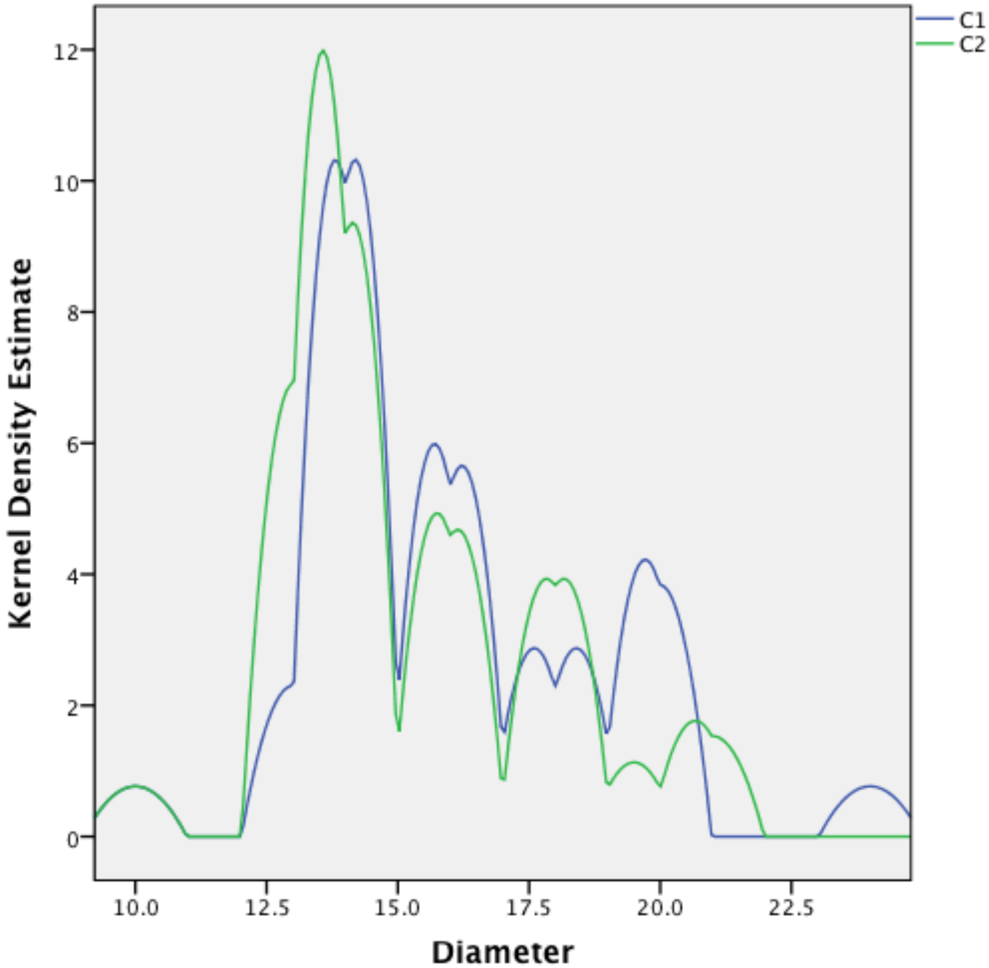


Figure 6-37
Density plot showing rim diameter of R1 from kilns C1 and C2

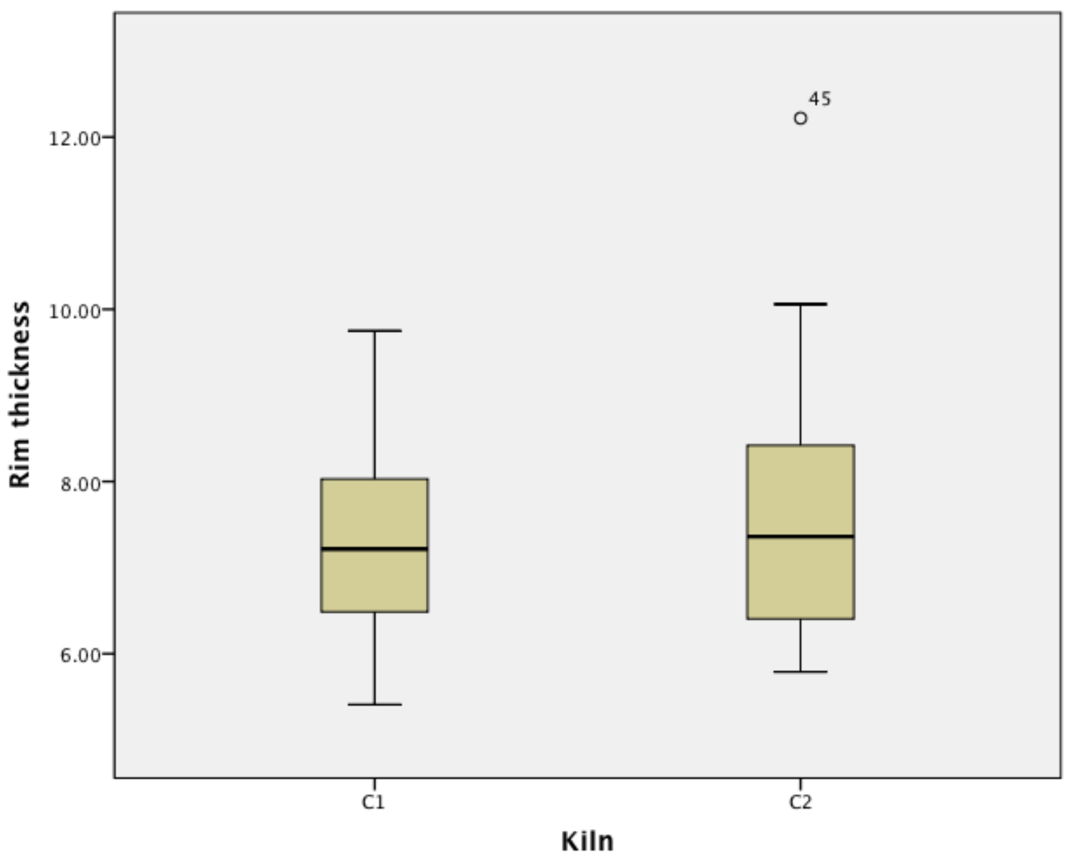


Figure 6-38
Box plots showing rim thickness of R1 from kilns C1 and C2

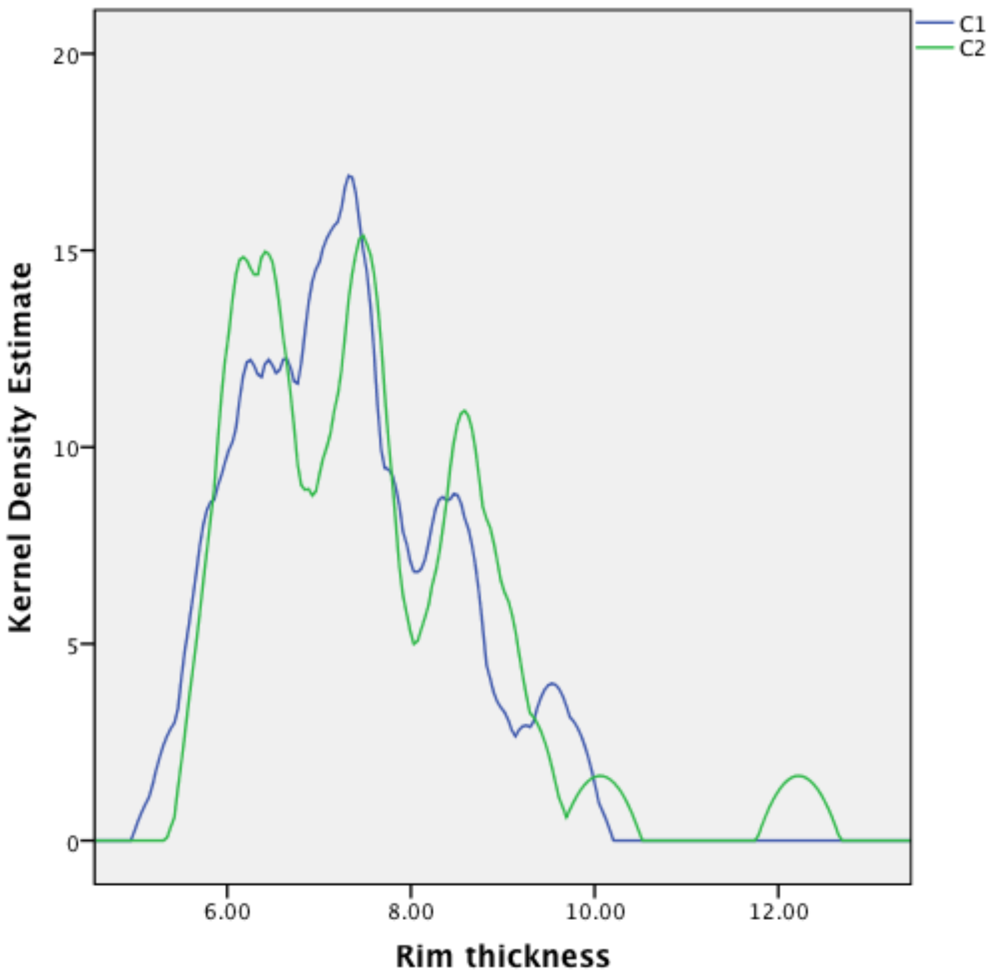


Figure 6-39
Density plot showing rim thickness of R1 from kilns C1 and C2

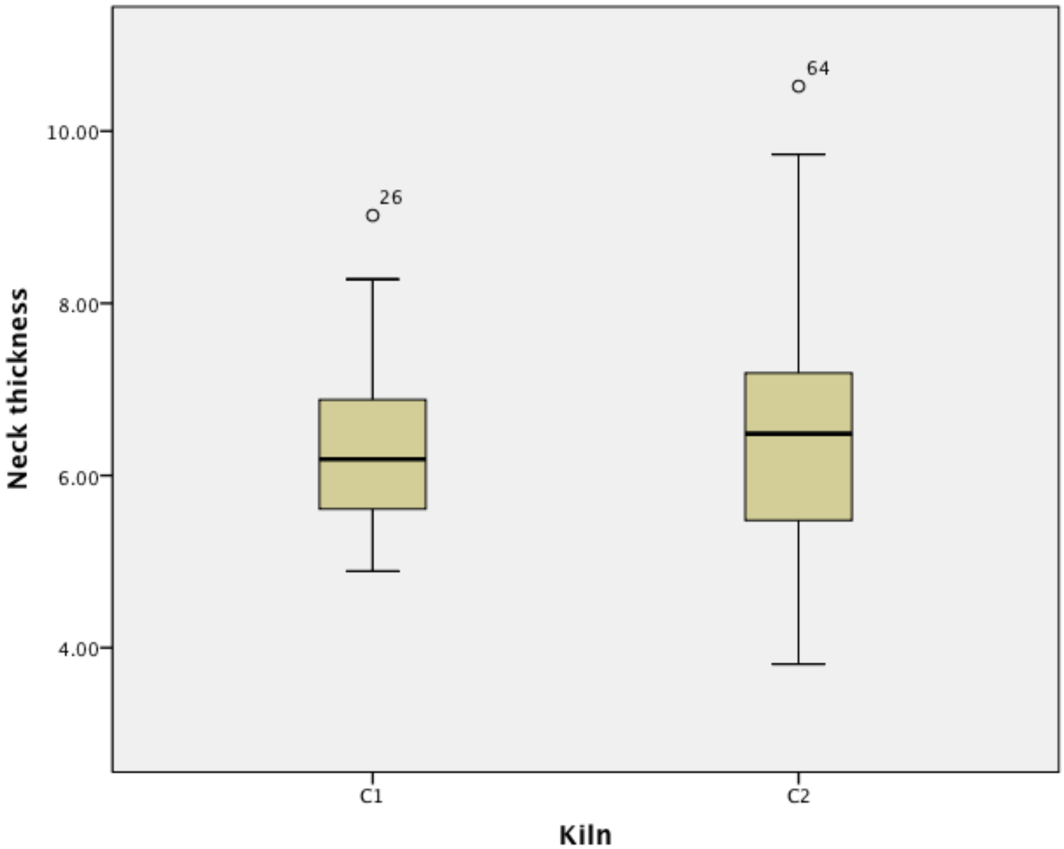


Figure 6-40
Box plots showing neck thickness of R1 from kilns C1 and C2

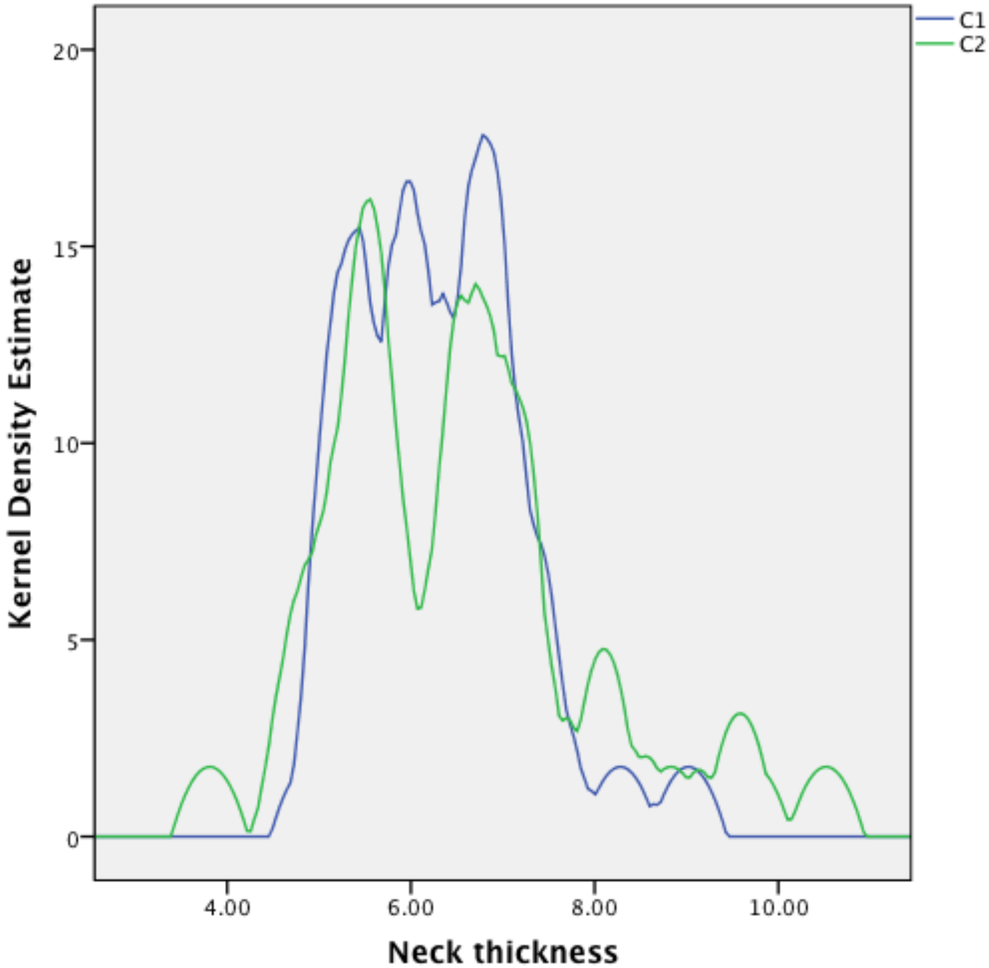


Figure 6-41
Density plot showing neck thickness of R1 from kilns C1 and C2

Kiln	Dimension	Total no	Range	Minimum	Maximum	Mean	SD	Variance	CV %
C1	Diameter	40	14	10	24	15.95	2.745	7.536	17.21
C2	Diameter	40	11.0	10.0	21.0	15.225	2.4754	6.128	16.25
C1	Rim thickness	40	4.34	5.41	9.75	7.2958	1.09045	1.189	14.94
C2	Rim thickness	40	6.43	5.79	12.22	7.4978	1.33432	1.780	17.79
C1	Neck thickness	40	4.13	4.89	9.02	6.3205	.91425	.836	14.46
C2	Neck thickness	40	6.71	3.81	10.52	6.5433	1.44760	2.096	22.12

Table 6-21
Descriptive statistics for R1 from kilns C1 and C2

<u>*Rim diameter*</u>

The box plots in *figure 6-36* indicate that the rim diameter for both the workshops follow a very similar pattern, though, kiln C1 has slightly higher numbers than C2.

The density curve for rim diameter (*figure 6-37*) is very similar for both of the kilns.

The range of variability for rim diameter for workshop C1 is between 10-24 cms, while it is between 10-21 cms for workshop C2. The CV values for rim diameters are quite similar for both of the workshops (see *table 6-21*).

<u>*Rim thickness*</u>

The box plots for rim thickness (*figure 6-38*) are very similar. The density curve for rim thickness (*figure 6-39*) are very similar.

The range of variability for rim thickness for workshops C1 is between 5.41 to 9.75 mm, while for workshop C2 it is between 5.79 to 12.22 mm. The means are almost the same. The real difference is seen in the CV values (see *table 6-21*).

Neck thickness

The box plots for neck thickness (*figure 6-40*) are similar. The density curves (*figure 6-41*) for neck thickness also shows a similar trend.

The range of variability for neck thickness for workshops C1 is between 4.89 to 9.02mm, and for C2 it is 3.81 to 10.52mm. The means are quite similar but a difference can be seen in the values of CV (*table 6-21*).

Rim type R21

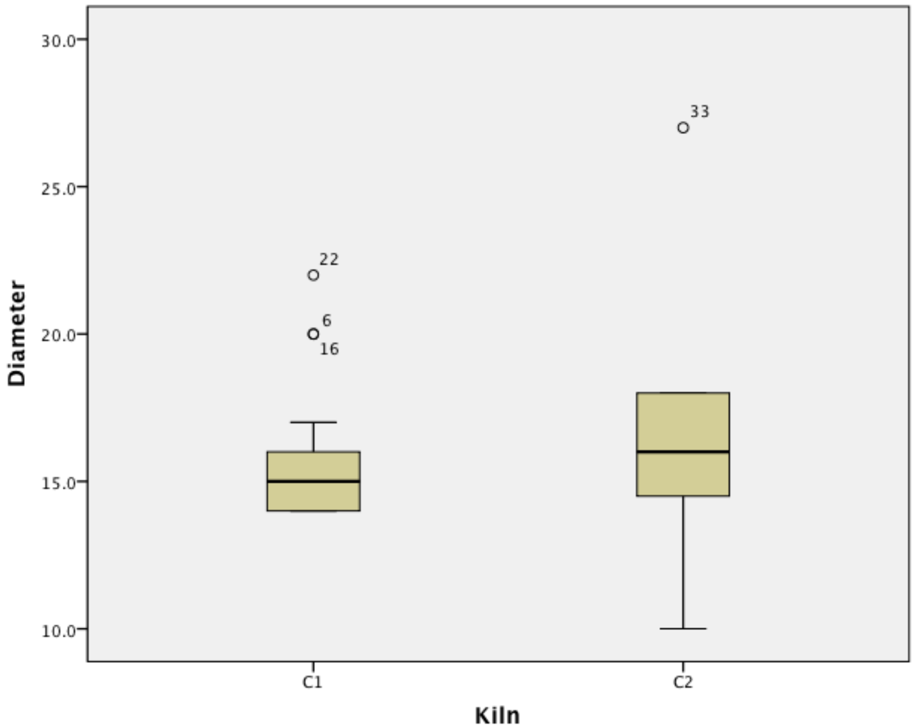


Figure 6-42
Box plots showing rim diameter of R21 from kilns C1 and C2

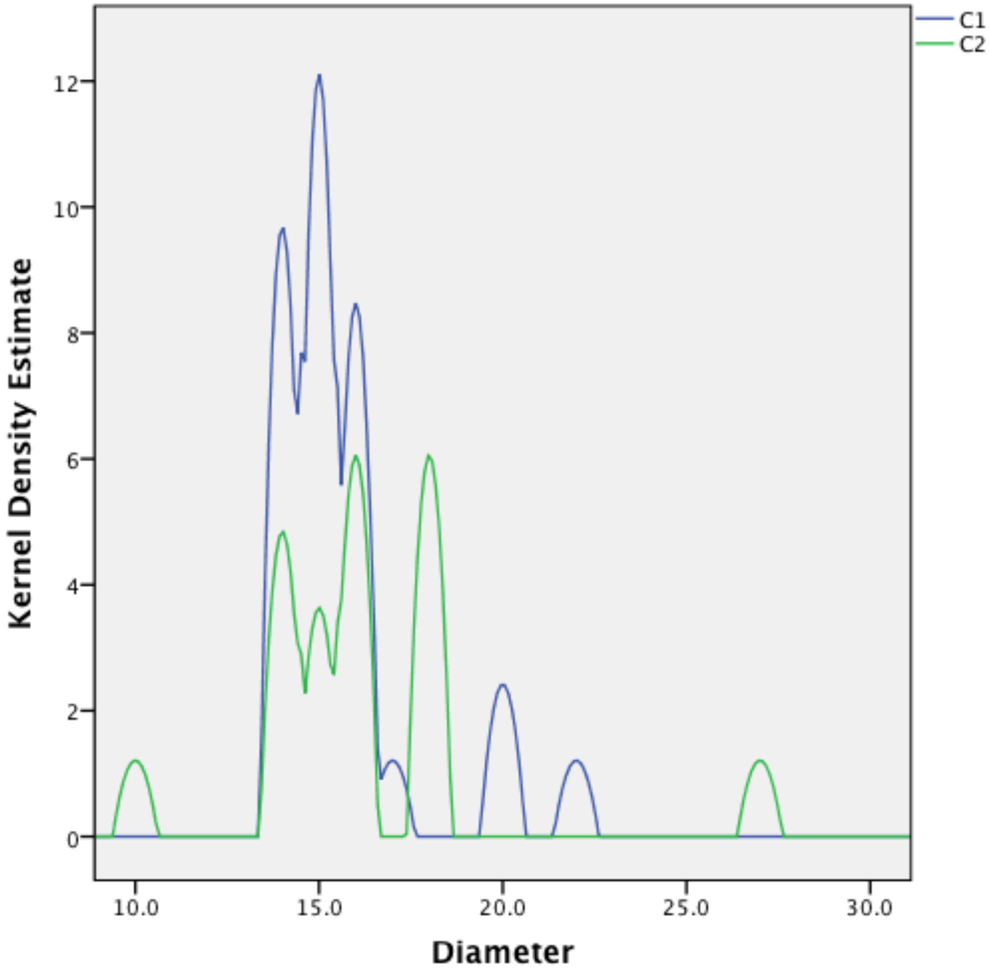


Figure 6-43
Density plot showing rim diameter of R21 from kilns C1 and C2

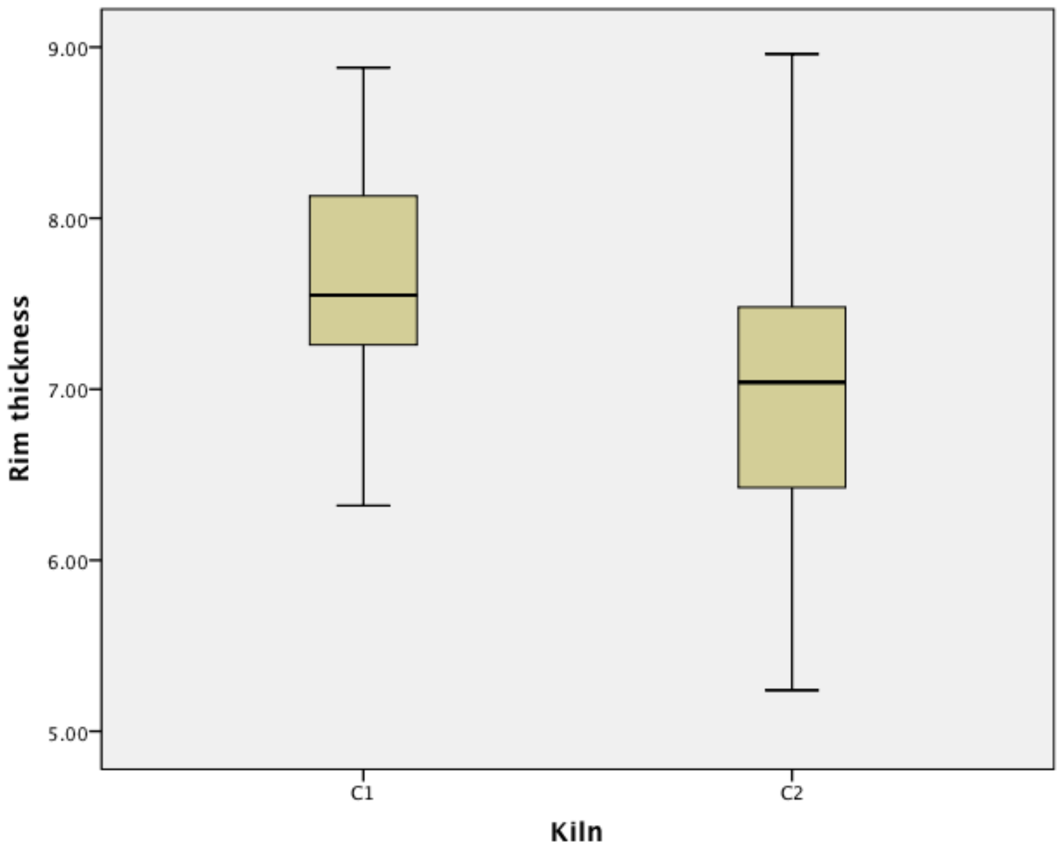


Figure 6-44

Box plots showing rim thickness of R21 from kilns C1 and C2

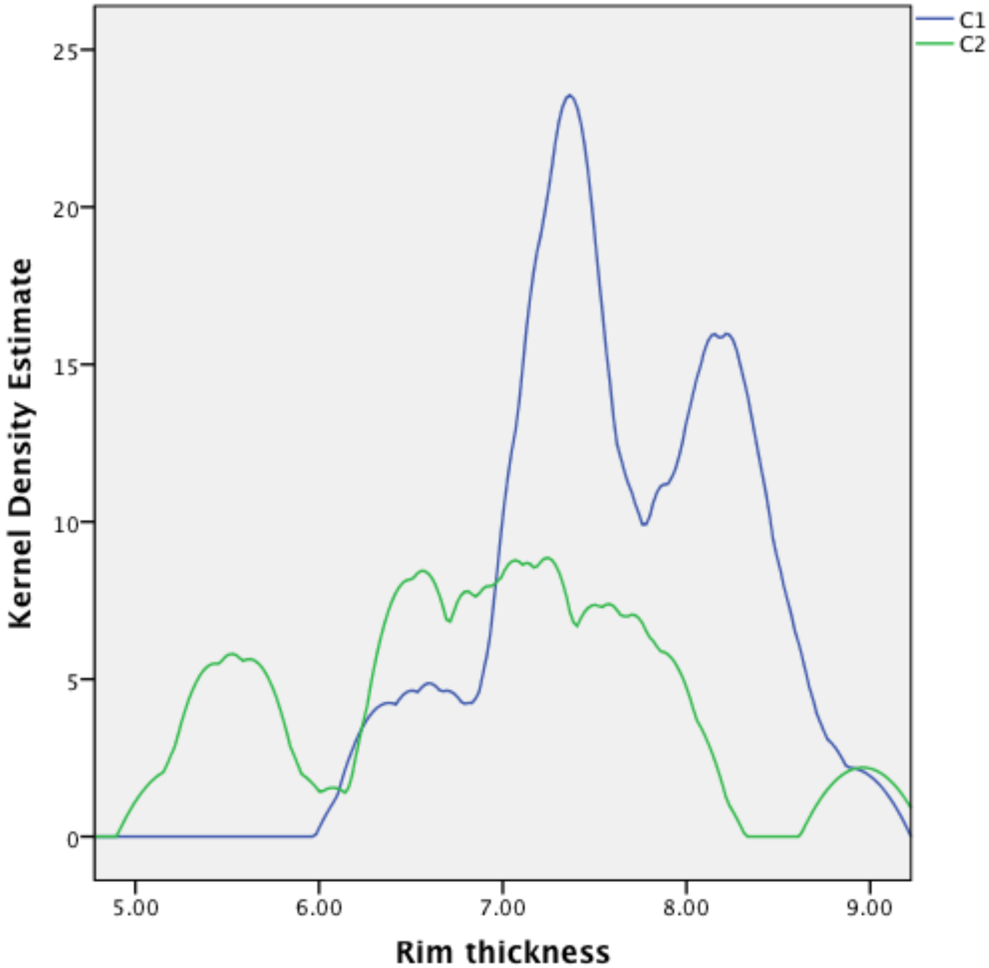


Figure 6-45
Density plot showing rim thickness of R21 from kilns C1 and C2

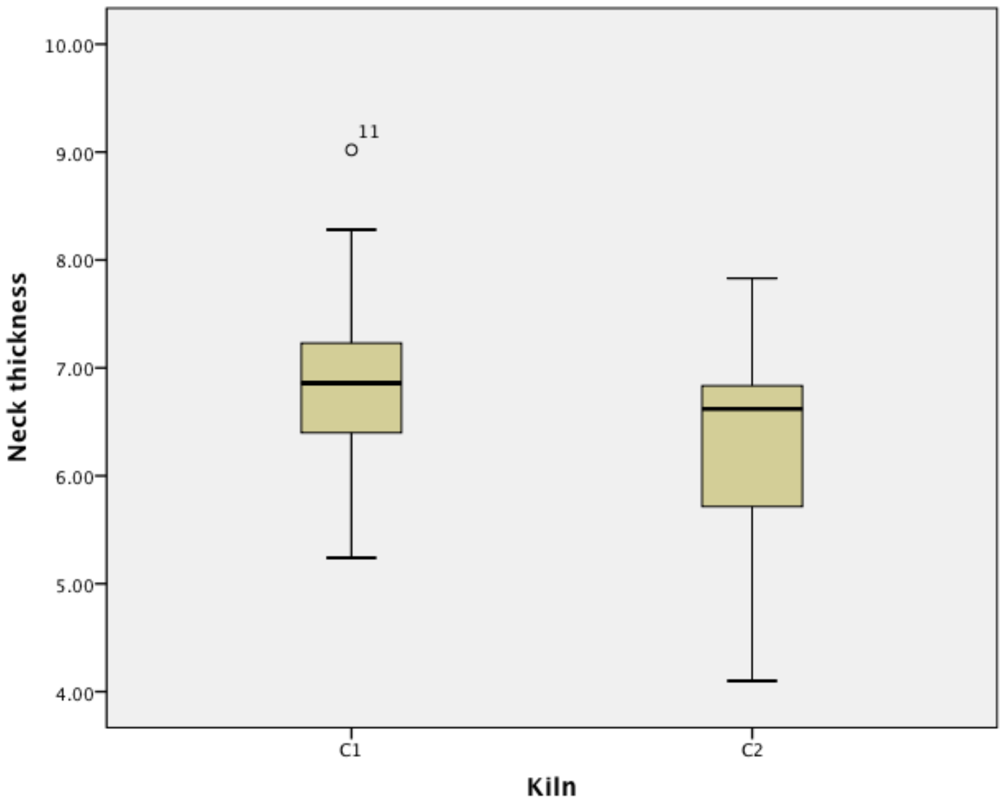


Figure 6-46
Box plots showing neck thickness of R21 from kilns C1 and C2

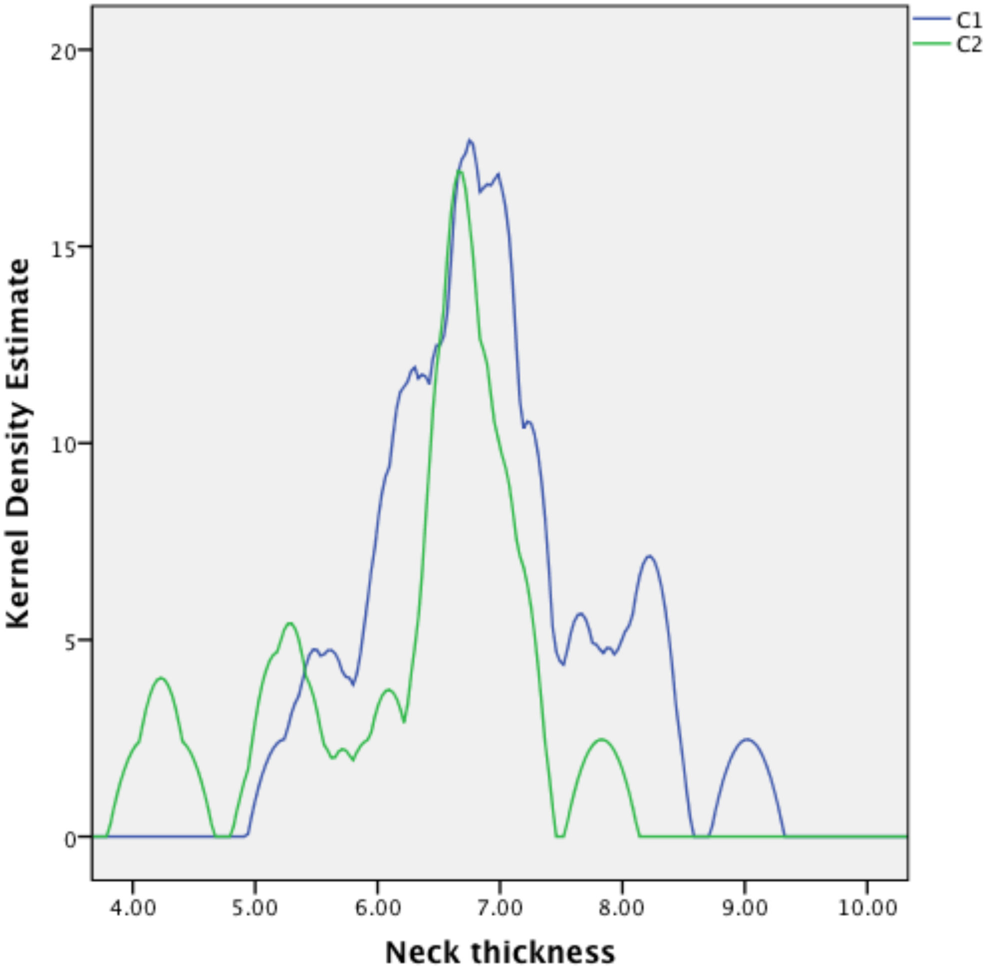


Figure 6-47
Density plot showing rim thickness of R21 from kilns C1 and C2

Kiln	*Dimension*	*Total no*	*Range*	*Minimum*	*Maximum*	*Mean*	*SD*	*Variance*	*CV %*
C1	Diameter	29	8	14	22	15.62	1.953	3.815	12.50
C2	Diameter	29	3.78	5.24	9.02	6.8934	.87074	.758	12.63
C1	Rim thickness	29	2.56	6.32	8.88	7.6228	.62776	.394	8.23
C2	Rim thickness	19	3.72	5.24	8.96	6.8895	.95380	.910	13.84
C1	Neck thickness	29	3.78	5.24	9.02	6.8934	.87074	.758	12.63
C2	Neck thickness	19	3.73	4.10	7.83	6.2658	.98490	.970	15.71

Table 6-22
Descriptive statistics for R21 from kilns C1 and C2

<u>*Rim diameter*</u>

The box plots in *figure 6-42* show a similar spread for rim diameters for both the workshops except that the values for C2 start low. The density curves (*figure 6-43*) show similar peaks with a similar spread.

The range of variability for rim diameter for workshop C1 is between 14 to 22 cms, while for C2 it is between 5.24 to 9.02 cms. It appears that the potters from the two workshops are aiming for different means. However, the CV values indicate a great degree of similarity between the two workshops in terms of rim diameter (*table 6-22*).

<u>*Rim thickness*</u>

The box plots for rim thickness (*figure 6-44*) show similar dispersion with C1 having higher numbers than C2. The density curves (*figure 6-45*) show a similar trend and similar spread. The density curve for C2 is almost trimodal, whereas the curve for C1 is essentially unimodal, suggesting that C2 has multiple rim thicknesses.

The range of variability for rim thickness for workshop C1 is between 6.32 to 8.88 mm, for C2 it is 5.24 to 8.96 mm. The mean values are quite near to each other. However the CV values indicate differences. The SD also exhibits a similar trend (*table 6-22*).

Neck thickness

The box plots show the neck thickness (*figure 6-46*) have similar dispersion. The density curves (*figure 6-47*) show a similar trend.

The range of variability for neck thickness for workshop C1 is between 5.24 to 9.02 mm, for C2 it is between 4.10 to 7.83 mm. The mean values are almost the same. The CV values indicate a difference (*table 6-22*).

6.5. Conclusion

From the analysis and discussion in the previous section:

There is overlap in the range of variability within standardization or cumulative blur in the case of rim thickness of workshops C1 and C2 as in the examples of modern pottery workshops. However, the overlaps are small and the means for the workshops appear to be different.

There is variability within morphological standardization (for casserole type B109 and cooking pots type R1 and R21) in workshops C1 and C2. The workshops are trying to achieve reduced variability by following a set ‘range of variability’ or ‘range of measurements’ for each of the three dimensions.

The distributions of rim thickness dimensions are approximately unimodal, reflecting the aims of the potters; i.e., to create a certain sized dimension with a resulting limited range of sizes around it.

I have already discussed the importance of the coefficient of variation in statistical analysis in *section 6.1.2* above. Here, I further elaborate on the reliability of the CV values for the purposes of my thesis. The CV is the best method to gauge differences between similar variables of different datasets, as extreme outliers tend to affect the means and standard deviations of a variable. The advantage of calculating the CV is that it is unitless and this property allows CVs to be compared to each other in ways that measures like the standard deviations cannot be compared. The coefficient of variation represents the ratio of the standard deviation to the mean. The standard deviation and mean of a variable are expressed in the same units, so taking the ratio of these two causes the units to cancel. Thus, the CV is a useful statistic for comparing the degree of variation between workshops C1 and C2, despite the means being different from each other in some dimensions. I rely on Eerkens and Bettinger’s (2001:494-497) standard on determining standardization where the upper baseline representing the maximum of standardization displays a CV of 1.7 %, and the lower baseline value, representing the minimum of standardization, displays a CV of 57.7 %. The baseline values can be used to evaluate the degree of standardization in artifacts (discussed earlier in *section 6.1.2*). The CV is also a better method than comparing the range of variability of metric dimensions, which may be affected by the cumulative blur if there is an absence of spatial and chronological control.

For rim type B109, there is clear difference in the CV values of rim diameter, rim thickness and wall thickness dimensions for kilns C1 and C2. The values for rim thickness dimensions for kiln C1 appear to be more standardized than kiln C2. Here, the CV value for rim type B109 for C1 is 7.67 %, which is closer to the upper baseline of 1.7% representing the maximum of standardization that humans can generate (see *section 6.1.2*). This indicates that the casserole with rim type B109 is less standardized in the casseroles made in workshop C2 than similar types in C1. The CV values for rim thickness between workshops C1 and C2 appear to be further apart than the values for the rim diameter and wall thickness. The rim thickness emerges as an important signifier for differences between two communities of practice, i.e. workshops C1 and C2.

For rim type R1, the CV values for the rim diameters for the two kilns are very similar (approx. 17% and 16% respectively) indicating that in terms of size of the vessels with rim type R1, both the workshops had similar aims. The CV values for rim thickness (approx. 15% for C1 and 18% for C2) and neck thickness (14% for C1 and 22% for C2) both show some differentiation. Again, the CV values for rim thickness and wall thickness for R1 cooking pots from workshop C1 indicate more standardization than those from C2.

For rim type R21, the CV values for rim diameter from both C1 and C2 are similar (the means are different as they are affected by extreme outliers, but would be the same without the outliers). This indicates that both of the workshops had similar aims in attaining a specific size. The CV values for rim thickness for workshop C1 indicate more standardization than the corresponding CV values from workshop C2 (approx. 8% for C1 an 14% for C2). The CV values for neck thickness from workshop C1 also indicate a difference when compared to the values in C2 (approx. 12% for C1 and 16% for C2). Further, the wall thickness dimensions appear to be more standardized in C1 than C2.

From the above analysis, it appears that modern potters are correct in asserting that they can isolate their work from others on the basis of rim thickness measurements. In all the three cases compared above, the rim thickness measurements have a greater difference than any of the other dimensions. Further, workshop C1 appears to be striving for more standardized products than workshop C2. Workshop C1 appears to be striving for reduced variability especially with regard to rim thickness than workshop C2.

The differences in dimensions are an effort by the workshops to assert their unique identity in Karanis, with other workshops manufacturing similar vessels. This would be a way to form stable buyer seller relationships with customers (discussed in detail in *chapter 7*). We could conjecture that the potters from workshops C1 and C2 (like potters SB and NB from Chattrikhera) were trained in the same workshop, due to the closeness of CV values for rim diameter for rim types R1 and R21. However, the differences in rim thickness and wall/neck thickness suggest that even if that was the case, they separated and worked in different workshops and adhered to new parameters (as did present day potters SB and NB). It is quite likely that the potters of workshops C1 and C2 catered to different sets of customers.

The next chapter is a discussion on the conclusions reached from the present thesis.

Chapter 7

Conclusions

The purpose of my research has been to delineate communities of practice in ancient Karanis through the analysis of utilitarian ware, such as cooking vessels, as part of a study of the material reflection of learning and transmission of skill in the past. I demonstrate by studying modern societies that the identification of communities of practice of potters can be done by analyzing the variability among vessels of the same type. Similarities and differences are considered the material reflection of the transmission of knowledge and skill during the learning process. The communities of practice affect long-term processes of continuity and change. Learning and the transmission of knowledge and skills in communities of practice have been evaluated by undertaking a combined ethnoarchaeological and archaeological study of actions and processes related to pottery manufacture manifested in the vessels produced.

In *chapter 1*, I discussed the importance of knowledge transfer within a community of practice in understanding the dynamics behind continuity and change. For this, the tension and interplay between tradition and innovation, the associated teaching and learning strategies, enculturation, daily practice within the groups and the influences of the customer were seen to be important elements in the final appearance of the vessels. I introduced the site of Karanis, its excavation background, the period in question and the ceramics, which form the primary material focus for the present thesis.

I have studied cultural transmission to understand *why* and *how* continuity and change in ceramic types occur and what it reveals about ancient societies (*chapter 2*). Following some scholars (Lave and Wenger 1991; Shennan and Steele 1999; Minar and Crown 2001; Wallaert-Pêtre

2001; David and Kramer 2001; Hegemon 2003; Stark et al 2008), I, too, propose a dynamic view of cultural transmission; one that is socially constituted. The role of the customer is important in influencing demand and thereby facilitates either continuity or change. Tacit or embodied knowledge passed on at a young age might be the key in understanding transmission of knowledge and skill in the context of a crafts.

In order to lay the foundation of *how* and *where* the transmission of a craft takes place I turn to the theory of practice with focus on the *habitus (*see *chapter 3*). Bourdieu's (1977) social perspective poses that to use both body and conceptual knowledge, one has to become a part of a structured group. The concept of communities of practice (Lave and Wenger 1991; Wenger 1998), where learning and teaching involve a process of engagement in a specific group achieved through daily practice, is a suitable approach to explore this further. The enculturation, continued interaction and active participation on a daily basis aids in the construction of identity and affiliation with a specific group. The traces of this identity are physically embedded in the material products manufactured by the members of this specific group and can be discerned using appropriate methods. I argue that *chaîne opératoire* provides a framework to trace these identities by an understanding the production processes for these products. This provides an effective method to determine the points in the process at which choices need to be made by the producers. By then looking at the actual production activities (rather than the schematized *chaîne opératoire*) we are able to link producers to specific groups and to discern communities of practice. Ethnoarchaeology allows for an approach tested in the present and applied to the past, which links the various theoretical concepts and can lend to our understanding of the ancient communities of potters at Karanis.

To illustrate the importance of learning and teaching and their role in cultural transmission, which cannot be done archaeologically, I conducted ethnoarchaeological fieldwork in 22 workshops where potters shared a common tradition of learning, teaching and interacting. Through observations and interviews, I concluded that from the potters' perspective, the consumer influences learning and teaching, and by implication, continuity and change are also affected by the consumer. I further concluded that enculturation and daily practice are part of group identity, which appears instrumental in enabling potters to identify their vessels from those produced by others. The potters unanimously pointed to the rim as the main identifier that allows them to discern their work from that of others.

My hypothesis was that potters who work together have more similar gestures and postures than those who do not; such similarities in actions stem from common enculturation, daily practice and similar *habitus*. To prove this, I used the *chaîne opératoire* as a framework through which I analyzed different actions relating to pottery manufacture to discern specific communities of practice (see *chapter 5*). Traces of the actions of pottery manufacture become embedded in the manufactured vessel. Space usage, gestures, postures, body and tool transitions, and other production actions relating to pottery manufacture of potters that work together show great similarity and, at the same time differ from the patterns exhibited by potters in other workshops. I was able to trace some of the similarities and differences within and between workshops through my analysis, outlined below in brief.

I first assessed the use of space by two sets of potters (potters K and S; S2 and ABS) from two different workshops at Fustat (Egypt) while manufacturing similar vessels. I learnt about the organization of workspace and space utility within and between workshops. I concluded that the potters from the same workshop have similar patterns in space usage and organization of workspace than those from other workshops when making similar vessels (*chapter 5*).

I then conducted the video analysis of all the potters to identify the following three phenomena: 1), similarity in actions but different frequencies of actions; 2), similarity in actions and similar frequencies of actions; and 3), whether an action was performed by one potter and not the other. For this, I first analyzed two potters from the same village who made similar vessels (SB and NB from Chattrikhera, India). The two potters had their own separate workshops, but were brothers who had learnt pottery manufacturing from their father. The similarities in their techniques are due to a similar enculturation and daily practice at a young age. The differences in action (where one action was performed by one and not the other) may be due to the fact that the potters have their own workshop.

I next analyzed two potters belonging to the same workshop (E and M2 from Kom Aushim, Egypt) where the outcomes demonstrated similarities (as in 1 and 2 above) and fewer differences.

I finally analyzed the actions of two potters Y and SR from Tathapilly, India and contrasted each of them with potter O from Chedamangalam, also in India, all manufacturing similar vessels. The comparison of these three potters enabled me to gauge the closeness of frequency of actions for each gesture and posture among the potters collectively. It turns out that as in 1 and 2 above, the 'closeness of frequency of actions' and not the 'frequency of actions' were the true markers for assessing similarities among potters. Potters Y and SR were closer to each other in frequency of actions than potter O. Further, there were more similarities between the potters of the Tathapilly workshop and more differences when compared to potter O from the Chedamangalam workshop. The analysis strengthened my hypothesis that potters who work together have more similar gestures and postures than those who do not.

My next analysis was based on the order of actions and tool usage based on transitional diagrams. The results indicated that both potters AH1 and AF1 (father and son from Ballas workshop 1) were similar in the order of their hand positions while making the *ballas* jar. Further, potters SR and SA from Tathapilly, India had a fairly similar order in using the hammer and anvil tools when compared to potter O from Chedamangalam, also in India. This too supports my argument that potters of the same workshop do not only use the same recipes for the clay, but that their gestures, work speed, posture are also fairly similar. The reasons for these similarities must be due to enculturation and practice at a young age.

With the help of observations of n=3, the manufacture of the *khashbooha (flower-pot), olla (water jug)* and the *mattam (pot for fermenting coconut sap)*, I highlighted the differences between workshops when making similar vessels on the basis of production actions. It was clear that each workshop appeared to follow similar stages of production (*chaîne opératoire)*, but had its own habits and ideas with regard to production activities and actions. The subtle differences (such as procuring clay and adding of temper in specific ways) were a deliberate effort on part of each of the workshops to differentiate themselves from others. This highlighted the role of identity within groups of potters making similar vessels.

Space usage, gestures and postures, transitional orders of body and tool usage and observation of production actions relating to pottery manufacture successfully provided insight into the various methods through which similarities and differences between various communities of practice could be discerned. The examples also demonstrated that repeated practices performed in a structured group get deeply engrained and are difficult to alter. These practices therefore reflect culturally and socially specific ideas of how certain actions relating to pottery manufacturing are to be carried out further adding to group identity.

I then transposed the action of adding the temper to the archaeological context. The action of adding temper and the knowledge of what and how much to add is an integral part of the knowledge and skill necessary to produce ceramic vessels. The continued practice of this action through daily repetition is visible in the produced vessel and forms a basis for identification of communities of practice based on body sherds. In the archaeological context, the result of the action of adding of temper is literally embedded in the matrix of the sherd. I therefore conducted visual analysis of sherds of similar cooking vessels collected from the kiln areas to test for similarities or differences in the presence of carbonate temper at Karanis. Some of these where findings where corroborated with spot chemical tests. I concluded that the sherds of cooking vessels collected from the different kiln areas indeed exhibited differences in temper, alluding to separate communities of practice at Karanis.

I demonstrated (see chapter 6) that communities of practice can be discerned by the measurements of the rim as the potters professed in their interviews in *chapter 4*. Based on experiments I showed that similarities and differences within and between workshops can be defined by measuring variables such as rim thickness and rim diameter. Each workshop follows a 'range of variability' in rim thickness measurements for morphologically standardized vessels. Due to the cumulative blur effect, where the range of measurements between workshops overlap (even though the means are different), I rely on the values of the coefficient of variation for metric dimensions because this proved to be a better indicator for discerning differences among workshops. A double blind experiment verified the statements of potters that they can identify their work from other potters by the rim of the vessel. The ability to identify the work of potters through rim measurements highlights the role of enculturation, daily practice and *habitus* in pottery workshops.

Using the insights from my ethoarchaeological studies, I used rims as the identifying feature to discern communities of potters at Karanis. I evaluated the rim diameter, rim thickness and wall or neck thickness of three rim types on the basis of the coefficient of variation values. Out of all three metric dimensions, the rim thickness emerges as the main indicator for different communities of practice. This assessment further corroborates the ability of modern potters in identifying their own work from others.

The morphology of the cooking and casserole forms (B109, R1 and R21) from workshops C1 and C2 at Karanis, and the main stages of the *chaîne opératoire* for the production of these vessels, appear to be common and culturally salient (shared by all the potters at Karanis). However, the visual analysis and spot chemical tests of the traces of the production actions indicate differences between workshops in the mixing of the fabric. The metric analysis of dimensions also indicates differences between workshops C1 and C2. The differences are due to the influences of enculturation, daily practice and *habitus* specific to each workshop.

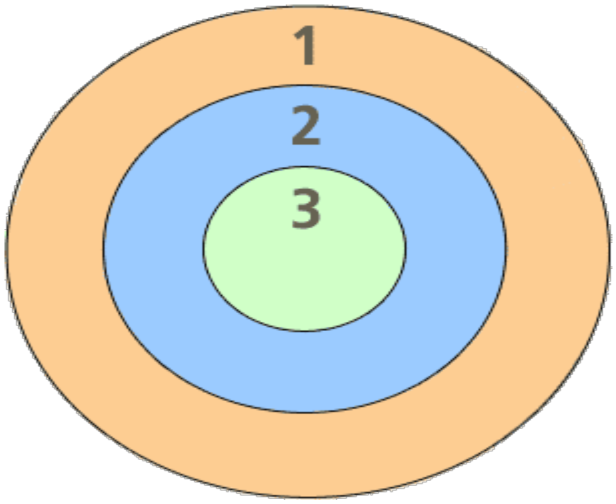


Figure 7-1
Concentric circles representing
1) Karanis 2) the pottery workshop and 3) the individual potter

Through this analysis what is it that I have learnt? The workshops at Karanis, represented by C1 and C2, are two different communities of practice. The understanding of continuity and change through transmission of knowledge and skills at Karanis can be analyzed as three concentric circles encompassing society, workshop and individual potter.

The first circle represents the common cultural concept of the form of cooking vessels in Karanis (and presumably the wider Fayum region). The particular cooking vessel shape is a tradition at Karanis that continues through the Late Roman period (390-641 CE). Both workshops share this common cultural concept of form. The cultural concept is also shared by the consumers at Karanis, who have a comparable mental template of the cooking vessels, represented by type B109, R1 and R21.

The second circle represents the workshop and shows a commonality, which defines certain parameters or range of measurements that an individual potter is to follow. Transgressing the parameters would not be accepted. Similarities within the group are possible because the individuals constituting the group are in agreement concerning the different actions in pottery manufacture. The similarities give the workshop an identity and uniqueness within the larger group of potters at Karanis. As an example, in a workshop, individual choices find expression by varying from the norm (metric variability) but these choices are within the parameters of the workshop (range of measurements). The fine balance between the individual and group is maintained through teaching, learning and inculcation of both social and technological knowledge. To illustrate, I demonstrated this balance in the workshop at Tathapilly, India (*chapter 5*), where potters O and T keep their vessels standardized, allowing for metric variability but not transgressing the overall measurement parameters of their workshop. The variability in measurements exercised by the individual potters is controlled by the workshop. Limiting the variability is only possible after years of experience in pottery manufacturing. The workshop constantly deals with the producer-consumer relationship. Past experiences facilitate the smooth functioning of the workshop and its sales. The individual potter does not have to deal with unforeseeable circumstances on his own and depends on the support of the workshop. Thus, the individual potter relates himself/herself to the group i.e., the workshop.

But why is this workshop identity so important and what do workshops gain from being different? To reiterate from *chapter 5*, to transgress the parameters set by the workshop would be to disrupt the uniqueness of, and affiliation with, a specific workshop. From an economic standpoint a subtle differentiation is desirable to enable potters to distinguish themselves in some way to help build their respective reputations and keep up long-term social alliances with customers. In Kerala (India), the workshops at Chedamangalam, Tathapilly and Korumuloor (see *chapter 4),* all make the morphologically standardized *mattam*. The differences, which stem from the production process and can be seen in their use of space, gestures, postures, production actions, and transitions, are manifested and expressed in the vessels they produce. In the entire region the differences are a conscious effort to differentiate oneself within a certain tradition and a group of craftspersons with common enculturation, daily practice and experiences. This identity of the individual potters with a specific workshop sets them apart from others and aids in building their relation with a set of customers. Thus, identity with a group helps in forming social relationships where economics play an important role. Transmission of craft skill and knowledge is regulated by these social alliances, where feedback from the consumers to the producers sets the pace for continuity or change.

At Karanis, workshops C1 and C2 represent two communities of practice. They both make morphologically standardized cooking vessels, B109, R1 and R21. These standardized cooking vessels have subtle differences in at least two aspects that can be investigated in the archaeological context, varying degrees of carbonate temper and metric dimensions. Workshop C1 and C2 follow their own range of measurements relating to rim diameter, rim thickness and wall/neck thickness (see *chapter 6, section 6.4)*. The defining signifier for the main differences between two communities of practice is seen in the 'range of measurements' relating to rim thickness. The range of measurements often overlaps, causing a cumulative blur as was demonstrated in the ethnoarchaeological examples. As explained earlier in chapter 6, according to Hasaki (2002: 14), a kiln is the strongest criterion for the location of a ceramic workshop being most resilient to post abandonment processes. I rely on the workshop space categories provided by Cuomo Di Caprio (2007: 258) and Hasaki (2002) who suggests three workshop space categories. In accordance to these space categories, the workshops C1 and C2 are located far apart spatially, do not overlap and can be regarded as separate workshop areas. Thus, the cumulative blur is curbed because of the spatial distance between the two workshops (see details in *chapter 6*).

The metric dimensions and traces of production actions, such as adding the temper, are the visible manifestations of the teaching and learning process, enculturation and daily practice of a specific group. Conforming to a specific range of measurements for certain variables in a workshop shows similarities. The coefficient of variation values for the metric dimensions of rim diameter, rim thickness and wall/neck thickness from workshops C1 and C2 indicate that the related workshops represent different communities of practice. It remains impossible to comment on whether through these differences, the workshops were trying to be distinct or if they were trying to achieve a degree of similarity.

The third and final circle represents the individual potter within the community of practice. The individual potter has the freedom to make a vessel with certain dimensions, but the workshop controls the variability of dimensions exercised by the individual potter. The workshop in return is regulated by the common cultural concept of the form of the vessel at the first level discerned above. Change in metric dimensions takes place when the 'range of variability' that defines a workshop extends to a point where the form of the vessel changes, leading to what archaeologists would call a new type of a vessel. This new form slowly permeates and becomes a new cultural concept for the entire community of inhabitants of Karanis, which includes consumers and producers.

The common element that exerts influence over all three levels is the customer. The demand of the customers impacts the continuity of a certain form and either the imitation/continuation of that form by the next generation or an often gradual change leading to discontinuity. The influence of the customer has a direct effect on the learning and teaching side of pottery manufacturing.

At Karanis, in the Late Roman period, we see the presence of the cooking casserole B 109 and cooking pots R1 and R21. These cooking vessels are not items that are used for social display. That in workshops C1 and C2, there is rim thickness variability at the level of the individual potters and a defined 'range of variability' for the rim thickness at the level of the workshop, indicates that the potters from both workshops were catering to two set of consumers who were exercising their specific choices relating to these cooking vessels. It could be that the two workshops were serving different neighborhoods. This could be verified by undertaking the visual and metric analysis of sherds found in habitation areas of the Late Roman Period at Karanis. In any case, the differences of the rim thickness, speak to affiliation to workshops of not only the potters but also the consumers.

The change in metric dimensions takes place at a certain pace in each of these workshops. It may be caused by drift over generations, and/or an independent mechanism, where individual potters make subtle changes to their vessels, either deliberate or unconsciously, leading to the slow evolution of forms that results in shapes that are different from older vessels.

Teaching and learning strategies are socially and culturally constituted. Knowledge and skill in pottery manufacturing is transmitted within groups of potters using both discursive and non-discursive knowledge specific to each group. Communities of practice ensure continuance of skills through the transference of this knowledge and in the process maintain group cohesion. The skills so transmitted within a group of potters are reflected in the produced vessels. The identification of specific communities of practice in workshops C1 and C2 at Karanis addresses how deep seated enculturation, daily practice and transmission are for the *habitus*. The similarity of the coefficient of variation values for rim diameter for rim types R1 and R21 allows us to conjecture that the potters from kilns C1 and C2 were trained in the same workshop, similar to potters SB and NB from Chattrikhera (see *chapter 5*). However, the differences in rim thickness and wall/neck thickness suggest that even if that was the case, they separated and worked in different workshops adhering to new parameters (as did potters SB and NB).

The data from Karanis offer insight into the dynamics relating to transmission of skills and knowledge at three different levels, where workshops and consumers could contribute to either continuity or change. I have used a theoretical and methodological approach inspired by the study of modern day potters and their workshops. This approach can be used for the examination of other craft-based artifacts for transmission of skills and knowledge. For Karanis, this approach has provided a means of understanding the transmission of socially constituted knowledge and skills, an understanding of enculturation, daily practice and some aspects of the *habitus* of potters, and finally the dynamics of the individual potter vis-à-vis the workshop; and the workshop vis-à-vis the customer.

APPENDICES

Appendix A:

<u>Satellite maps showing workshop locations</u>

Figure A-1
Satellite image of Egypt

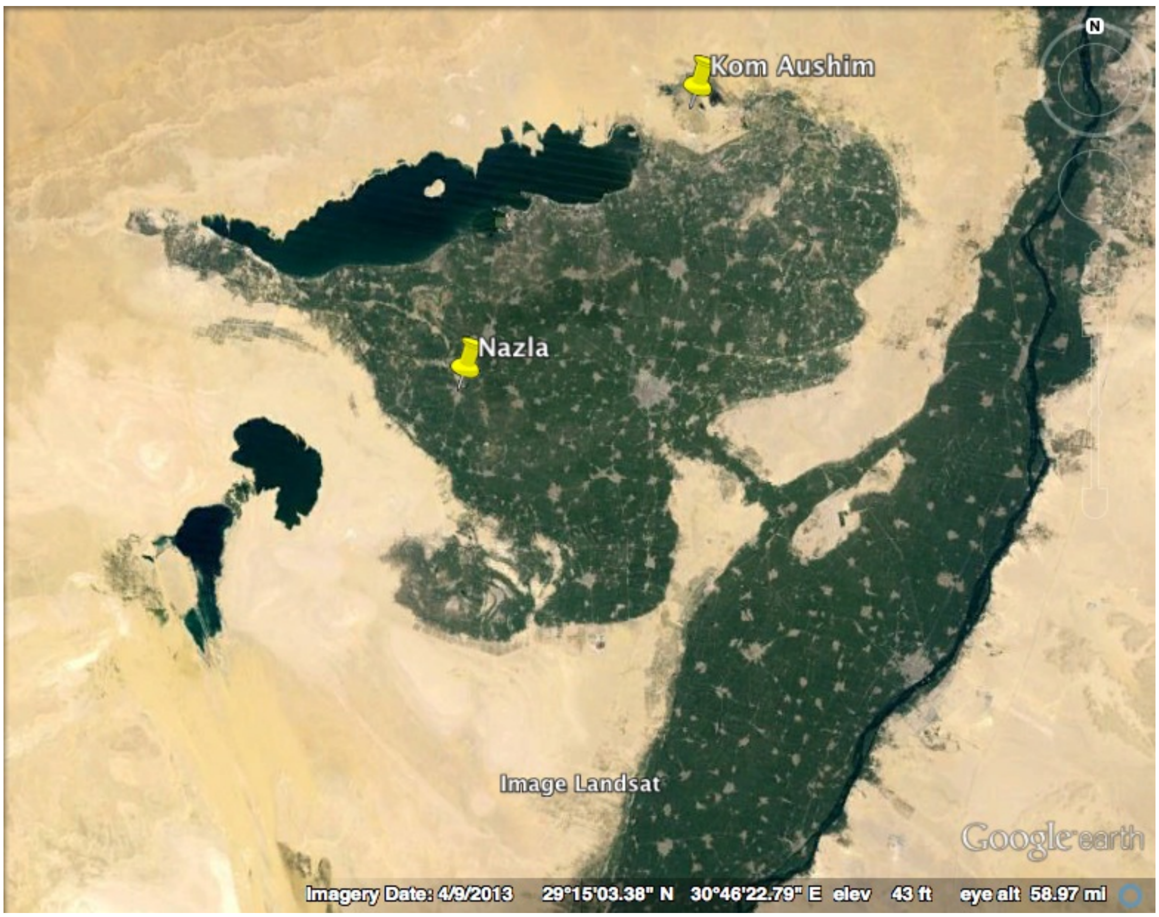


Figure A-2
Satellite image of Fayum

Figure A-3
Satellite image of Fustat

Figure A-4
Satellite image of Qena

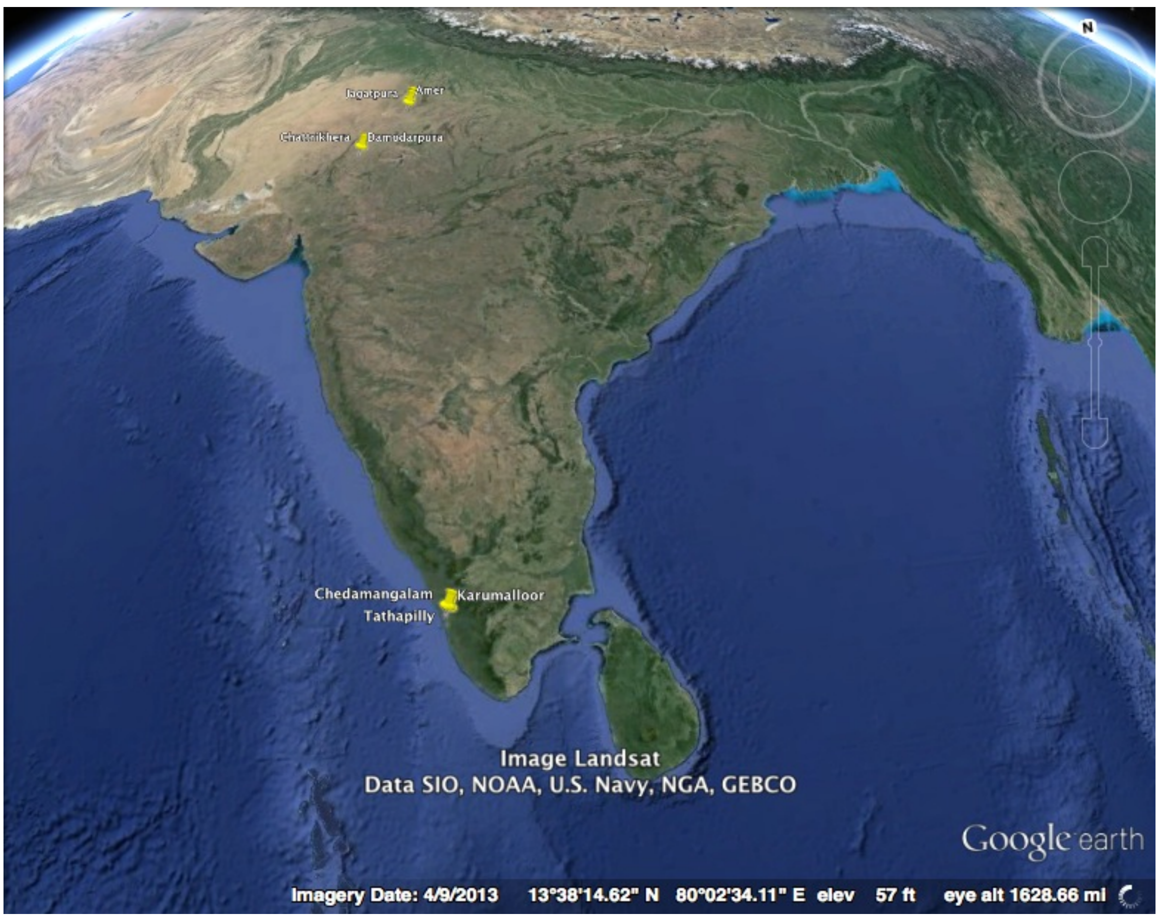


Figure A-5
Satellite image of India

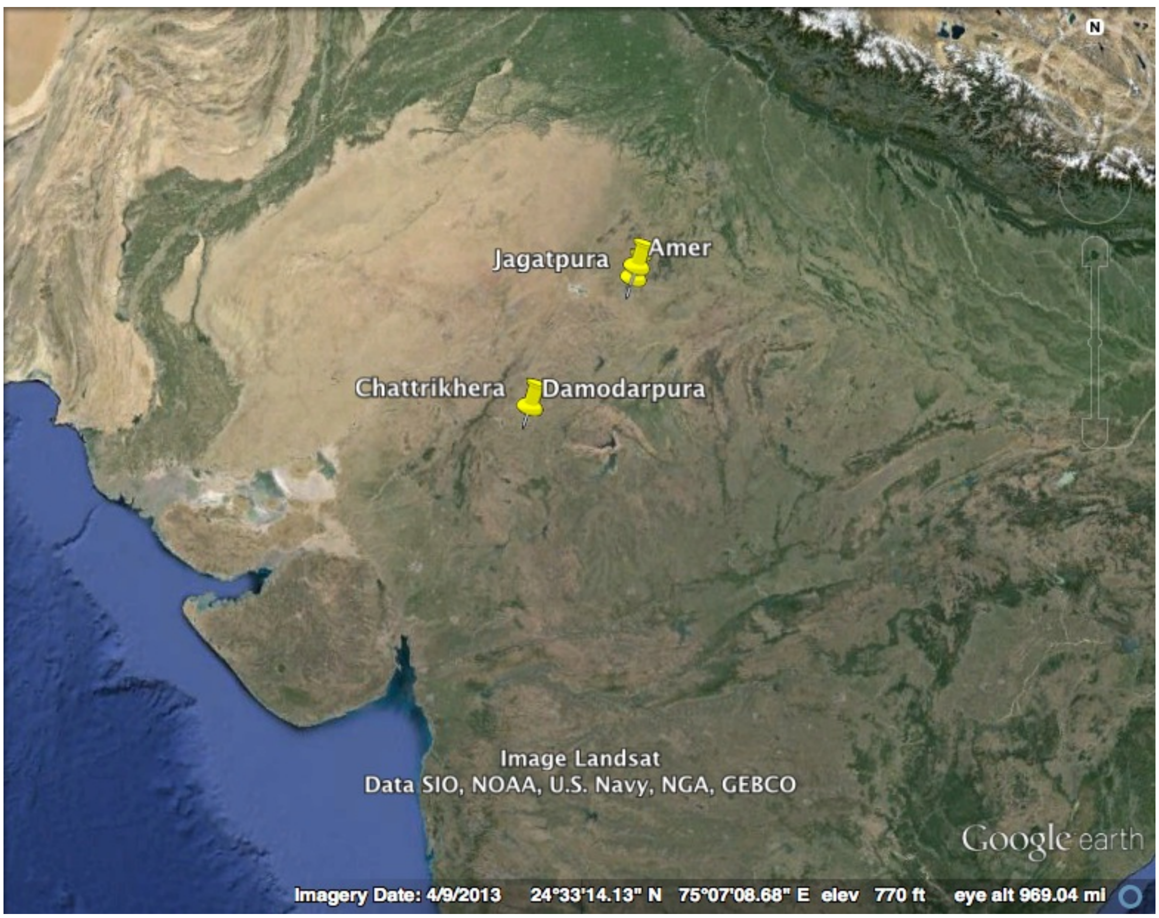


Figure A-6
Satellite image of Rajasthan

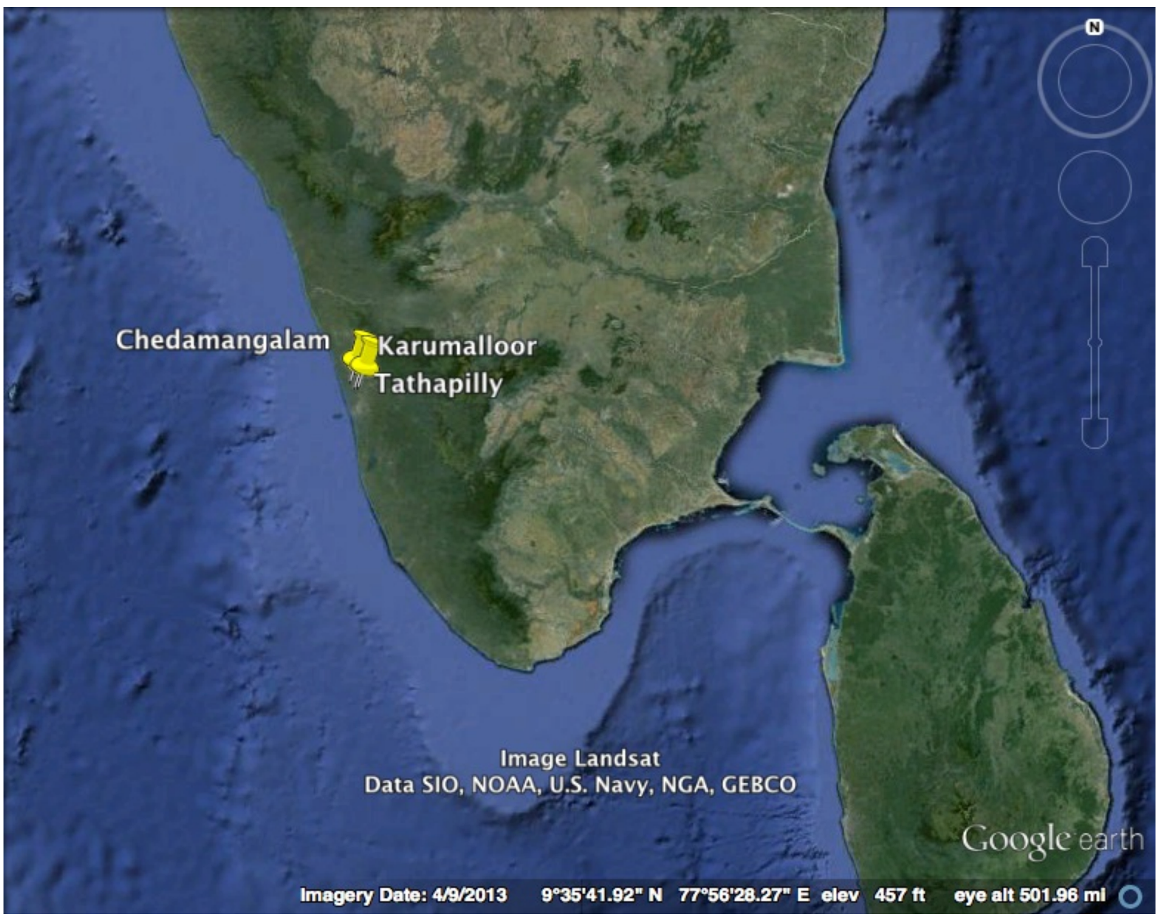


Figure A-7
Satellite image of Kerala

Appendix B:

Photographs of 22 workshops

Fayum

Kom Aushim workshop:

B-1
Workshop space

B-2
Potter using the hammer and anvil technique

B-3
Deffaya (heater) being dried in the ope

Nazla:

B-4
Potter showing the rim thickness of a vessel

B-5
Bokla being dried in the open

B-6
Potter making a large vessel

B-7
Pottery for sale

<u>*Cairo*</u>

Fustat 1:

B-8
Workshop space and kiln

B-9
Potter S at work with son A

B-10
Potter K at work

B-11
Son of S playing at the wheel

B-12
Workshop from exterior

B-13
Potters at work making the kursi

B-14
Potter at work

B-15
Helper kneading clay

B-16
Kursi being dried in the open

B-17
Workshop space from exterior and helper

B-18
Potter at work

B-19
Potter at work

B-20
Workshop space from interior

B-21
Vessels being dried in the open

<u>Qena</u>

Ballas 1

B-22
Ballas jars stored in the open

B-23
Kiln area

B-24
Potter getting ready to identify sherds

B-25
The master potter and I

Ballas 2:

B-26
Kiln area

B-27
Potter at work

B-28
Workshop space and kiln

Sheikh Ali 1:

B-29
Potter with son

B-30
Vessels being dried on the roadside

Sheikh Ali 2:

B-31
Young potter at work

B-32
Vessels being dried inside the courtyard

B-33
Measuring the Brahm (cooking pots) with calipers

B-34
Vessels being dried after application of slip

Rajasthan

Chattrikhera 1

B-34
Workshop and house from exterior

B-35
Bird's eye view of interior of workshop and house

B-36

Potter at the wheel

B-37
Potter using the hammer and anvil technique

B-38
Workshop and house from exterior

B-39
Potter at the wheel

B-40
Potter shaping the rim

B-41
Storage room for pots

Damodarpura:

B-42

Porch of the house with workspace

B-43
Potter with a complete pot

B-44
Workshop space in the interior of the house

Amer 1:

B-45
Potter using the hammer and anvil technique

B-46
Potter using the hammer and anvil technique

B-47
Clay being separated using a sari

B-48
Loaded kiln ready to be fired

B-49
Measuring the rim diameter of the matki

Amer 2:

B-50
Potter using the hammer and anvil technique

B-51
Recently fired kiln

Amer 3:

B-52
Potter using the hammer and anvil technique

Jagatpura:

B-53
Potter placing the pots for storage

B-54
Kiln in the courtyard interior

<u>*Kerala*</u>

Chedamangalam:

B-55
Workshop space exterior

B-56
Potter using the hammer and anvil technique

B-57
Potter shaping the rim of small pots

Tathapilly:

B-58
Side view of workshop exterior

B-59
Potters at work using the hammer and anvil technique

B-60
Mattam (pots for storing fermented coconut sap) being dried in the open

Karumaloor 1:

B-61
Potter at work using the hammer and anvil technique

B-62
Clay levigation and storage area in courtyard

Karumaloor 2:

B-63
Workshop space and house from exterior

B-64
Potter trampling the clay

Karumaloor 3:

B-65
Workshop exterior

B-66
Workshop interior showing kiln area

B-67
Potters at work using machinery

Appendix C:

Questionnaire for interview

1. Tell me about how you learnt pottery and at what age?
2. What do you remember about learning?
3. Did you start observing others in you family to make pottery?
4. When were you allowed/asked to start making pottery?
5. What are the steps associated with pottery making?
6. How do you identify pottery made by yourself and others?
7. What do you like about pottery making?
8. Do you have to follow rigid ruled of pottery making or can you bring in your own ideas?
9. With what pottery types do you have to follow strict rules of measurements/old ways that have been taught by your teacher/family?
10. What pottery types can you make with your own ideas?
11. Do customers buying pottery influence design or do they want the same type all the time?
12. Do customers buying pottery like tradition/old ways or do they like change?
13. Does the master potter introduce changes in a pottery type because of the customer or does he introduce change because he wishes to?
14. Which pottery type sells the most and why?
15. Who buys most of the pottery? Do the same people come again?
16. How much time does it take for you to make a certain type of pottery?
17. Do others of your age make it faster?

18. Do others older than you make it faster?
19. How much time do you spend making pottery?
20. Is there a time limit to how many pots you have to make in a day?
21. What happens if you make a similar pot but with different measurements? Are you told by your teacher or master potter to change it or repeat making the pot?
22. Do you hope to become a master potter?
23. When do you think it will happen and why?
24. Can you identify your pots from others? If yes how? What do you see? Thickness, shape or fingerprint?
25. Can you identify your pots from others by looking at the rim?
26. Can you identify your pots from other pots by looking at the base and handle?
27. Can you identify your pots from others by looking at the thickness of the pot? Or do you look at the weight of the pot?
28. When you make cooking pots, is there a way to tell which ones you have made?
29. How frequently do you make cooking pots?
30. What temper do you use for making cooking pots?
31. Is there a high demand for cooking pots? Why or why not?
32. Does local clay perform better in making pottery or do you prefer imported clay? Why or why not?
33. Do fingers have a role to play in understanding differences in pottery making?
34. Do small hands make better pots or large hands?
35. Does the master potter allow you to make metric variations (differences in measurements of same type of pots) to a great degree?

36. Is the master potter strict about metric standardization (similarity in measurements if dimensions of same type)
37. Do you measure dimensions of the rim, lip and thickness of the vessel? If yes, how?
38. If you do not measure dimensions, then how are you sure about the measurements of the vessel without measuring?
39. Does this ability to know about measurements without measuring come from experience, visual observation, and practice?
40. Does this ability of being sure about measurements come from training since childhood? Does your teacher explicitly explain it to you?
41. Does the master potter emphasize about form standardization (the form or shape should look alike?)
42. In which pottery type do you find more metric variation? Why?
43. In which pottery type do you find more of form standardization? Why?
44. Do standardized form types have metric standardization too? Examples?
45. Do standardized form types have metric variation? Examples?
46. How much does the consumer influence form standardization and metric standardization?
47. Does the consumer feel the pottery he/she wants to buy with the hand before purchasing?
48. Do you think 'metric variation' of a certain type of pottery which has been made for a long time in a 'metric standardized' way change the consumers mind to buy the particular pottery type? If yes, why? If not, why not?
49. Do you experiment with shapes of pottery and sizes to gauge whether the consumer will prefer a certain type?
50. Does a new innovation of pottery type influence the consumer into purchasing the same?

51. What kind of consumer prefers new types? Why what age group?
52. What kind of consumer does not prefer new types but prefers old traditional pottery? Why? What age group?
53. Do you manufacture your pottery types based on the demand of the consumer?
54. What other factors do you take into account in manufacturing pottery types?
55. Does the consumer demand influence the way you teach pottery to your students?
56. Do you think if it was not for the consumer demand you would have taught pottery differently to your students?
57. What do you think would have been different?
58. Do you think it would have been more of a leisurely activity with more ideas?
59. Would you be strict with your students or allow flexibility and ideas?
60. Do you think this would lead to many styles and rapid change or do you think there would be slow change?
61. What do you remember about learning from your master potter/father/relative?
62. Does being related and working together help in learning faster or does it make you learn slower?
63. For how many hours each day did you practice pottery making while you learnt? Do you practice now?
64. When did you feel you were ready to make pottery for the market/consumers? Did someone tell you, you are now ready?
65. Do you think you could understand these interactions between potter and students/learners from pottery of the past?

Appendix D:

Satellite maps showing location and distance of kilns C1 and C2 at Karanis

Figure D-1
Map showing kilns/workshops C1 and C2

Figure D-2
Map showing distance between kilns/workshops C1 and C2

Appendix E:

Photographs of cooking vessels at Karanis

Figure E-1
Casserole

Figure E-2
Cooking pots

Appendix F:

Photographs of rim types B109, R1 and R21.

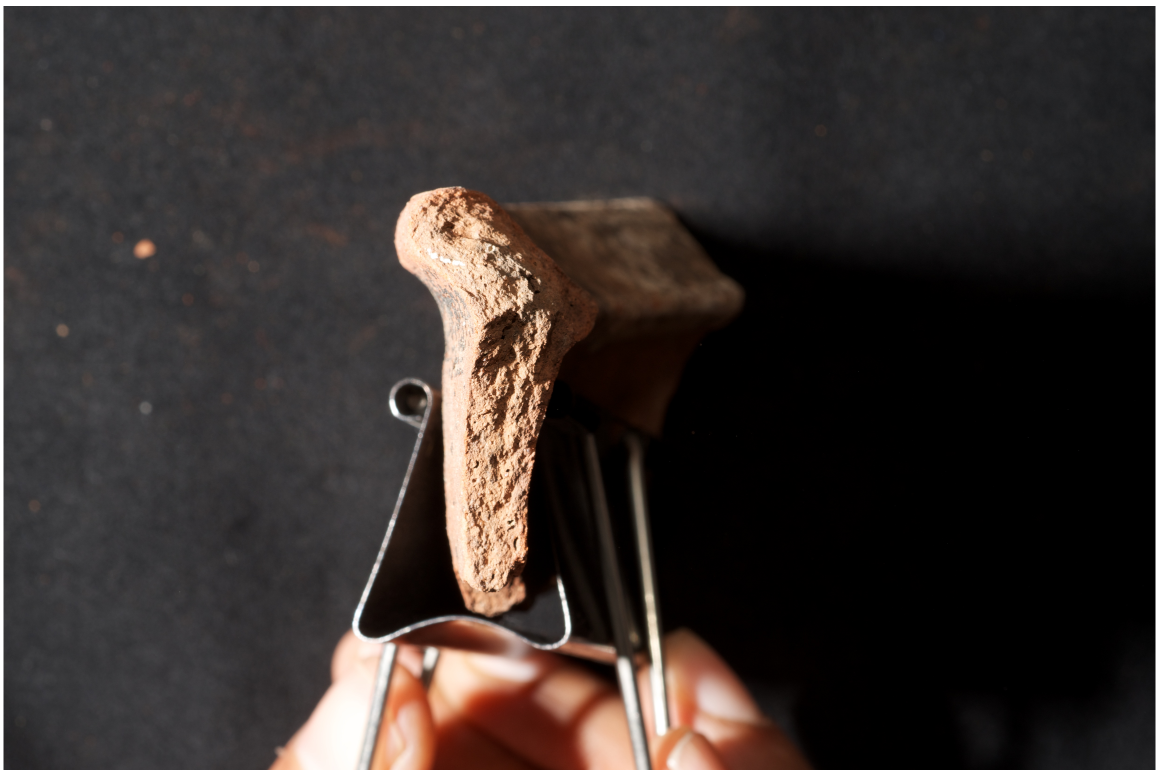


Figure F-1
Rim type B109
Kilns C2 Unit 3669
FY12: 2390-ai

Figure F-2
Rim type R1
Kiln C2 Unit 3784
FY2012: 23651-ai

Figure F-3
Rim type R21
Kiln C1 Unit 33
FY12: 8746-ai

Appendix G:

Drawings of cooking vessels B109, R1 and R21

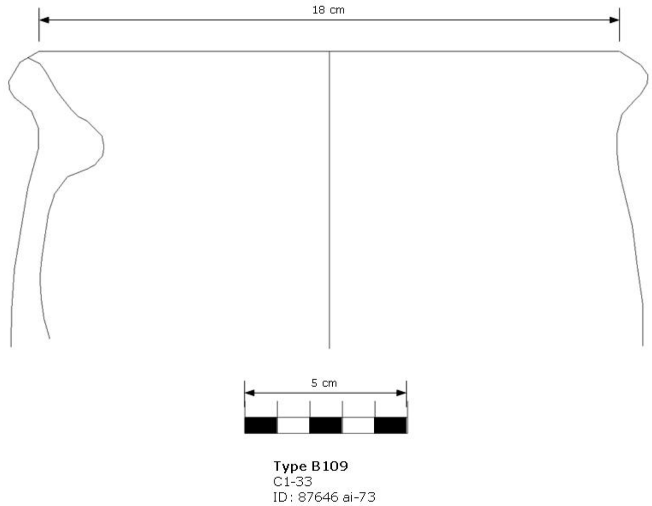


Figure G-1

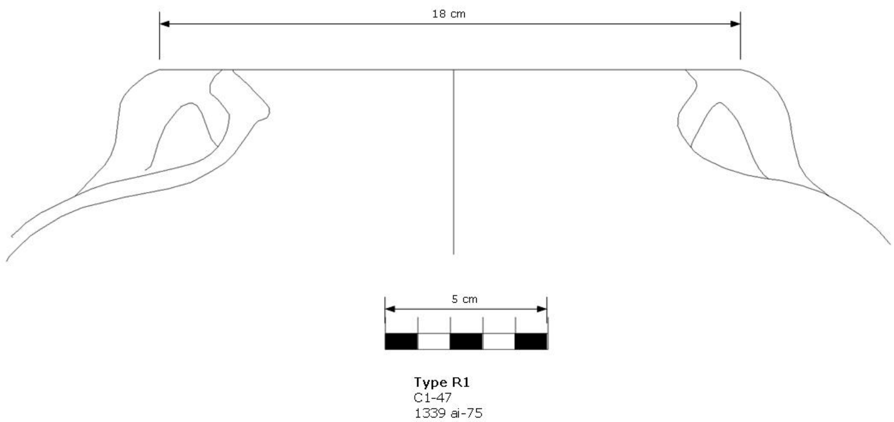


Figure G-2

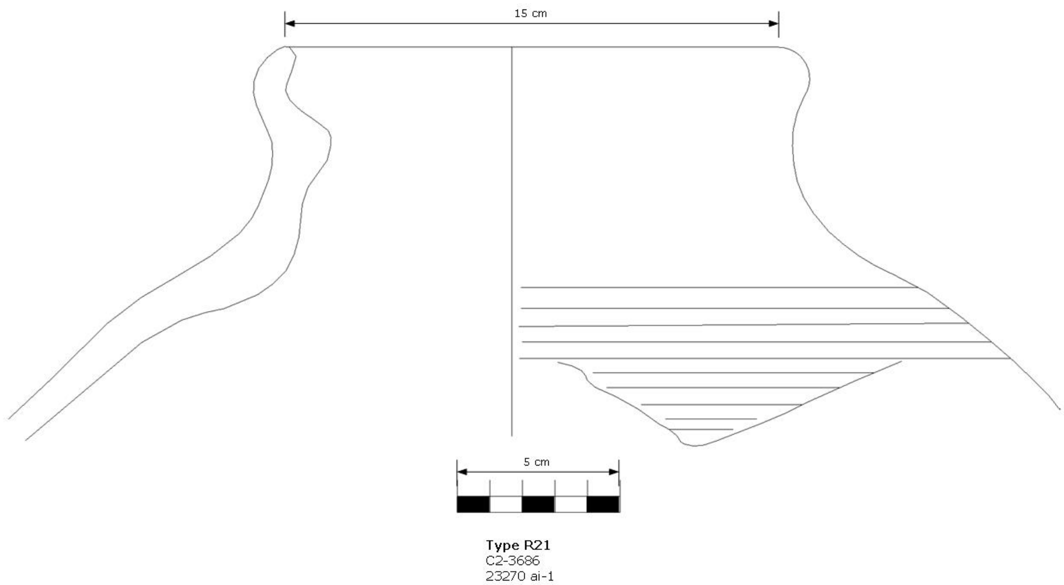


Figure G-3

Bibliography

Nassery-EL, S.A.A. "A New Roman Hoard from Karanis (Iiird C. A.D.)." *Bulletin de l'Institut Français d'Archéologie Orientale* 75 (1975): 183-202. Print.

Arnold, D. *Ecology and Ceramic Production in an Andean Community*. New Studies in Archaeology. Cambridge, UK.: Cambridge University Press, 2003. Print.

Arnold, Dean. "Ethnoarchaeology and Investigations of Ceramic Production and Exchange: Can We Go Beyond Cautionary Tales? ." *The Legacy of Anna. O Shepard*. Eds. Bishop, Ronald L. and Frederick W. Lange. Boulder: University Press of Colorado, 1991. 321-45. Print.

Arnold, P.J. III "Dimensional Standardization and Pro-Duction Scale in Mesoamerican Ceramics." *Latin American Antiquity* 2 (1991): 363-70. Print.

Bagnall, Roger S. *Egypt in Late Antiquity*. Princeton, 1993. Print.

Bagnall, Roger S. , ed. *Egypt in the Byzantine World, 300-700*. Cambridge, UK: Cambridge University Press, 1996. Print.

Bagnall, Roger S., and Dominic W. Rathbone, eds. *Egypt from Alexander to the Early Christians: An Archaeological and Historical Guide*. Los Angeles: Getty Publications, 2004. Print.

Bailey, Donald M. *A Form of Amphores Égyptiennes 3 from the South-West Fayum*. Amphores D' Égypte De La Basse Époque a L'époque Arabe. Eds. Marchand, Sylvie and Antigone Marangou. Vol. 1. 2 vols. Cairo: Institut Francais D'Archaéologie Orientale, 2007. Print.

Baines, John, and Jaromir Malek. *Cultural Atlas of Ancient Egypt*. Revised ed. Oxfordshire: Andromeda Oxford Limited,, 2000. Print.

Bateson, G., and M. Mead. *Balinese Character: A Photographic Analysis*. New York: New York Academy of Sciences, 1942. Print.

Bentley, R.A. "Fashion Versus Reason in the Creative Industries." *Innovation in Cultural Systems-Contributions from Evolutionary Anthropology*. Eds. O'Brien, Michael and Stephen J. Shennan. The Vienna Series in Theoretical Biology. Cambridge: The MIT Press, 2010. 121-36. Print.

Berg, I. "The Meanings of Standardisation: Conical Cups in the Late Bronze Age Aegean." *Antiquity* 78 (2004): 74-85. Print.

Bernard, Russel H. *Research Methods in Anthropology- Qualitative and Quantitative Approaches*. Fourth ed. Oxford: Altamira Press, 2006. Print.

Blackman, M.J., G.J. Stein, and P.B. Vandiver. " The Standardization Hypothesis and Ceramic Mass Production: Technological, Compositional and Metric Indexes of Craft Specialization at Tell Leilan, Syria." *American Antiquity* 58 (1993): 60-88. Print.

Bleed, Peter. "Skill Matters." *Journal of Archaeological Method and Theory* 15.1 (2008): 154-66. Print.

Boak, Arthur E.R, and Enoch E. Peterson. *Topographical and Architectural Report of Excavations During the Seasons 1924-28*. Ann Arbor: University of Michigan, 1931. Print.

Boas, Franz, ed. *Fieldwork for British Association*. New York: Basic Books, 1974. Print.

Bourdieu, P. *In Other Words: Essays Towards a Reflexive Sociology*. Choses dites. Trans. Adamson, M. Cambridge: Polity, 1994. Print.

---. *Le Sens Pratique*. Paris: Editions de Minuit, 1980. Print.

---. *Outline of a Theory of Practice, Cambridge Studies in Social and Cultural Anthropology.* Cambridge: Cambridge University Press, 1977. Print.

---. *Practical Reason: On the Theory of Action*. Stanford: Stanford University Press, 1998. Print.

---. "What Makes a Social Class? On the Theoretical and Practical Existence of Groups." *Berkeley Journal of Sociology* 32 (1987): 1-17. Print.

Bourriau Janine D., Paul T. Nicholson, and Pamela J. Rose. "Pottery." *Ancient Egyptian Materials and Technology*. Eds. Nicholson, Paul T. and Ian Shaw. Cambridge: Cambridge University Press, 2000. 702. Print.

Boyd, Robert., and Peter J.Richerson. *Culture and the Evolutionary Process*. Chicago: University of Chicago Press, 1985. Print.

Braudel, Fernand. *La Civilisation Matérielle, Économie Et Capitalisme, Xve-Xviiie Siècle.* Paris: Armand Colin, 1979. Print.

Brown, John Seely, Allan Collins, and Paul Duguid. "Situated Cognition and the Culture of Learning." *Educational Researcher.* 18 (1989). Web.

Buchanan, M. *The Social Atom: Why the Rich Get Richer, Cheaters Get Caught and Your Neighbor Usually Looks Like You*. New York: Bloomsbury, 2007. Print.

Cameron, C.M, ed. *Ethnoarchaeology and Contexual Studies*. Oxford: Oxbow, 2006. Print.

Cavalli-Sforza, L.L, and M.W Feldman. "Cultural Transmission and Evolution." (1981). Print.

Choksi, Archana. "Pottery Manufacturing Techniques: The Role of Technical Constraints and Personal Choices." *Man and Environment* 23.2 (1998): 108-18. Print.

Cockle, H. "Pottery Manufacture in Roman Egypt. A New Papyrus." *Journal of Roman Studies*.71 (1981): 87-97. Print.

Collier, J., and M. Collier. *Visual Anthropology: Photography as a Research Method*. New Mexico: University of New Mexico Press, 1986. Print.

Cook, J. "Landscapes of Irrigation in the Ptolemaic and Roman Fayum: Interdisciplinary Archaeological Survey and Excavation near Kom Aushim (Ancient Karanis), Egypt.". University of Michigan, 2011. Print.

Costin, C.L. "Craft Specilization: Issues in Defining, Documenting and Explaining the Organization of Production." *Archaeological Method and Theory* 3.1-56 (1991). Print.

David, N. & C. Kramer. *Ethnoarchaeology in Action*. Cambridge: Cambridge University Press, 2001. Print.

Dawkins, Marian Stamp. *Observing Animal Behaviour-Design and Analysis of Quantitative Data*. Oxford: Oxford University Press, 2007. Print.

Demesticha, S. "The Paphos Kiln: Manufacturing Techniques of Lr1 Amphoras." *ReiCretActa* 36 (2000): 549-54. Print.

Derex, M., B. Godelle, and M. Raymond. "Social Learners Require Process Information to Outperform Individual Learners." *Evolution* 67.3 (2012): 688-97. Print.

Dobres, M.-A, and C.R. Hoffman. "Social Agency and the Dynamics of Prehistoric Technology." *Journal of Archaeological Method and Theory* 1 (1994): 211-58. Print.

Duistermaat, K. "The Pots and Potters of Assyria: Technology and Organization of Production, Ceramics Sequence and Vessel Function at Late Bronze Age Tell Sabi Abyad,Syria." University of Leiden, 2007. Print.

Dunnel, R. *Aspects of the Application of Evolutionary Theory in Archaeology*. Archaeological Thought in America. Ed. Lamberg-Karlovsky, C. C. Cambridge: Cambridge University Press, 1989. Print.

Eerkens, J.W., and R.L. Bettinger. "Techniques for Assessing Standardization in Artifact Assemblages: Can We Scale Material Variability?" *American Antiquity* 66 (2001). Print.

Foucault, Michel. "L'hermeneutique Du Sujet. Cours Au Collège De France, 1981-1982." Gallimard Seuil, 2001. Print.

Frankel, D. . "Pottery Production in Prehistoric Bronze Age Cyprus: Assessing the Problem." *JMA* 1.2 (1988): 27-55. Print.

Gazda, Elaine K., ed. *Karanis: An Egyptian Town in Roman Times- Discoveries of the University of Michigan Expedition to Egypt (1924-1935)*. 1 ed. Vol. 1. Michigan: Kelsey Museum Publication, 2004. Print.

---. "Karanis: An Egyptian Town in Roman Times. Discoveries of the University of Michigan Expedition to Egypt (1924-1935)." Ann Arbor: Kelsey Museum of Archaeology, 1983. Print.

Gazio, Pierre. *The Fayoum-an Historical Exploration*. Alexandria, Egypt: Harpocrates Publishing, 2007. Print.

Goodwin, Charles. "Professional Vision." *American Anthropologist* 96.3 (1994): 606-33. Print.

Gould, R.A. *Living Archaeology*. New York: Cambridge University Press, 1980. Print.

Greenfield, P. M., and J. Lave. *Cognitive Aspects of Informal Education* Cultural Perspectives on Child Development Eds. D. Wagner. and H. Stevenson (Eds.). San Francisco: Freeman, 1982. Print.

Grenfell, Bernard P., et al. *Fayûm Towns and Their Papyri*. London: Egypt Exploration Fund, 1900. Print.

Grenfell, Michael, ed. *Pierre Bourdieu: Key Concepts*. Stocksfield: Acumen, 2008. Print.

Gross, D.R. . "Time Allocation: A Tool for the Study of Cultural Behavior." *Annual Review Anthropology* 13 (1984): 519-58. Print.

Gupta-Agarwal, Sonali. "Learning from Learning: Cultural Transmission and the Impetus Behind Consumer Demand Using Ceramics-Karanis: A Case Study." MA. UCLA, 2009.(n.d)

Harden, D.B. *Roman Glass from Karanis Found by the University of Michigan Archaeological Expedition in Egypt, 1924-29*. Ann Arbor: University of Michigan Press, 1936. Print.

Hasaki, E. "Ceramic Kilns in Ancient Greece: Technology and Organization of Ceramic Workshops. ." University of Cincinnati, 2002. Print.

---. *Crafting Spaces: Archaeological, Ethnographic and Ethnoarchaeological Studies on Spatial Organization in Pottery Workshops in Greece and Tunisia*. Pottery in the Archaeological Record: Greece and Beyond. Ed. (eds.), M. Lawall and J. Lund: Aarhus, 2011. Print.

---. *The Ethnoarchaeological Project of the Potters' at Moknine, Tunisia. Seasons 2000, 2002* Africa, Nouvelle Série Des Séances Scientifiques Iii. Ed. Kallala, N. Tunis: Institut National de Patrimoine, 2005. Print.

Hayes, J.W. *Late Roman Pottery*. Rome: The British School at Rome, 1972. Print.

Hegmon, Michelle. *Annual Review of Anthropology* 21 (1992): 517-36. Print.

---. "Setting Theoretical Egos Aside: Issues and Theory in North American Archaeology." *American Antiquity* 68.2 (2003): 213-43. Print.

Hewinson, R.N. *The Fayum: History and Guide*. Cairo: American University in Cairo, 2001. Print.

Hill, G. "Group Versus Individual Performance and N+1 Heads Better Than
One? ." *Psychological Bulletin* 91 (1982): 517-39. Print.

Hodder, I. *Pottery Distributions: Service and Tribal Areas*. Pottery and the Archaeologist. Ed. M.Millet. Vol. 4. London: Occasional Publication: Institute for Archaeology, 1979. Print.

Høgseth, Harald Bentz, ed. *Knowledge Transfer: The Craftmen's Abstraction*. Tucson: The University of Arizona Press, 2012. Print.

Ingold, T. *Perception of the Environment: Essays in Livelihood, Dwelling and Skill*. London: Routledge, 2000. Print.

J, Riley., ed. *The Coarse Pottery from Benghazi*. Vol. II. Tripoli1979. Print.

Johnson, Barbara. "Pottery from Karanis: Exacavtions of the University of Michigan." Ed. Michigan, University of. Ann Arbor: University of Michigan Press, 1981. Print.

Joyce, Rosemary A. *Thinking About Pottery Production as Community Practice. In Potters and Communities of Practice; Glaze Paint and Polychrome Pottery in the American Southwest. A.D. 1250-1700*.

Anthropological Papers of the University of Arizona. Ed. L. S. Cordell., J. A. Mauche (eds.). Vol. 75. Tucson: The University of Arizona Press, 2012. Print.

K. Rebay-Salisbury., and M.L.S. Sorensen, eds. *Embodied Knowledge*. Oxford: Oxbow books limited, 2012. Print.

Kamp, Kathyrn K. "Prehistoric Children Working and Playing: A Southwestern Case Study in Learning Ceramics." *Journal of Anthropological Research* 57 (2001). Print.

Keenan, James G. "On Village and Polis in Byzantine Egypt." *Proc. XVI International Congress of Papyrology* (1981): 479-85. Print.

---. "Pastoralism in Roman Egypt." *Bulletin of the American Society of Papyrlogists* 26 (1989): 175-200. Print.

Kent, S. *Domestic Architecture and the Use of Space-an Interdiscplinary Cross-Cultural Study*. New Directions in Archaeology. Cambridge: Cambridge University Press, 1993. Print.

---, ed. *Understanding the Usc of Space: An Ethnoarchaeological Approach*. New York: Columbia University Press, 1987. Print.

Kipp, Michael. *Multimedia Annotation, Querying and Analysis in Anvil. In , Editor, , Chapter 21.* . Multimedia Information Extraction: Advances in Video, Audio, and Imagery Extraction for Search, Data Mining, Surveillance, and Authoring. Ed. (ed.), Mark Maybury. Isotaro Kita, Ingeborg v: EEE Computer Society Press, 2012. Print.

Kohring, Sheila, ed. *Conceptual Knowledge as Technologically Materialised: A Case Study of Pottery Production, Consumption and Community Practice*. Oxford: Oxbow books, 2013. Print.

---, ed. *A Scalar Perspective to Social Complexity: Complex Relations and Complex Questions*. Vol. 215. Bonn: Ruhr-Universitat, 2012. Print.

Kostonas, A., ed. *Understanding Standardization and Variation in Mediterranean Ceramics: Mid 2nd to Late 1st Millennium Bc* Vol. 25. Leuven: Peeters, 2014. Print.

Kramer, Carol. "Ceramic Ethnoarchaeology." *Annual Review of Anthropology* 14 (1985): 77-102. Print.

---. "Ethnoarchaeology." *Encyclopedia of Cultural Anthropology*. Ed. Ember, D. Levinson and M. New York: Henry Holt and Co., 1996. Print.

Kuijpers, M.H.G., ed. *Sound of Fire, Smell of Copper, Feel of Bronze, Colours of the Cast - Sensory Aspects of Metalworking Technology.* Oxford: Oxbow, 2012. Print.

Lancy, David F. *Playing on the Mother-Ground: Cultural Routines for Children's Development*. New York: The Guilford Press, 1996. Print.

Last, Jonathan. *Potted Histories: Potsherds and Their Contexts*. Deconstructing Context- a Critical Approach to Archaeological Practice. Ed. Papaconstantinou, Demetra. Oxford: Oxbow Books, 2006. Print.

Lave, J., and Seth Chaiklin, eds. *Understanding Practice: Perspectives on Activity and Context*. Cambridge: Cambridge University press, 1993. Print.

Lave, Jean., and Etienne Wenger. *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press, 1991. Print.

Lemmonier, Pierre. "De La Culture Matérielle À La Culture? Ethnologie Des Techniques Et Préhistoire, ." *25 ans d' études technologiques en préhistoire*
(1991): 15-20. Print.

Lemmonier, Pierre. "The Study of Material Culture Today: Toward an Anthropology of Technical Systems." *Journal of Anthropological Archaeology* 5 (1986): 147-86. Print.

Lemonnier, Pierre. *Elements for an Anthropology of Technology*. Ann Arbor: University of Michigan, 1992. Print.

Leroi-Gourhan. *L'homme Et La Matière* Paris: Albin Michel, 1943. Print.

---. *Le Geste Et La Parole, Ii. La Mémoire Et Les Rythmes*. Paris: Albin Michel., 1965. Print.

---. "Le Geste Et La Parole, Tome 1 : Technique Et Langage." (1964). Print.

London, G.A. *Standardization and Variation in Thework of Craft Specialists*. Ceramic Ethnoarchaeology. Ed. (ed.), W.A. Longacre. Tucson1991. Print.

Longacre, William A, ed. *Why Did They Invent Pottery Anyway?* Washington DC: Smithsonian Institution Press, 1995. Print.

Longacre, William A. *Ceramic Ethnoarchaeology: An Introduction*. Ceramic Ethnoarchaeology. Ed. Longacre, William A. Tucson: University of Arizona Press, 1991. Print.

---. *Pottery Use-Life among the Kalinga, Northern Luzon, the Philippines.* Decoding Prehistoric Ceramics. Ed. (ed.), B.A. Nelson. Carbondale: Southern Illinois University Press, 1985. Print.

---. *Standardization and Specialization*. Pottery and People-a Dynamic Interaction. Eds. Skibo, James M. and Gary M. Feinman. Salt Lake City: The University of Utah Press, 1999. Print.

Luhrmann, Tanya. *Persuasions of the Witch's Craft: Ritual Magic in Contemporary England*. USA: Harvard University Press 1991. Print.

Lyman, R.L., and M.J. O'Brien. "The Goals of Evolutionary Archaeology: History and Explanation." *Current Anthropology* 39 (1998): 615-52. Print.

Malinowski, B. *Argonauts of the Western Pacific: An Account of Native Enterprise and Adventure in the Archipelagoes of Melanesian New Guinea*. London: Routledge and Kegan Paul, 1922. Print.

Marciniak, A., and Nurcan Yalman, eds. *Contesting Ethnoarchaeologies*. Vol. 7. USA: Springer, 2013. Print.

Martin, Archer. "Pottery from Schedia near Alexandria (Egypt)." http://www.schedia.de/. (2010). Web.

Mauss, Marcel. "Les Techniques Du Corps." *Journal de Psychologie* XXXII.32 (3-4) (1934). Print.

---. "Techniques of the Body." *Economy and society* 2.1 (1973): 70-88. Print.

McGrew, W.C. "The Cultured Chimpanzee: Reflections on Cultural Primatology." *Cambridge University Press* (2004): 284 pp. Print.

*Merriam-Webster's Advanced Learner's English Dictionary*2008. Print.

Miller, Daniel. *Artefacts as Categories- a Study of Ceramic Variability in Central India*. Cambridge: Cambridge University Press, 1985. Print.

Minar, Jill, and Patrician Crown. "Learning and Craft Production: An Introduction." *Journal of Anthropological Research* 4.57 (2001): 369-80. Print.

Moore, Jerry D. . *Franz Boas: Culture in Context: Visions of Culture: An Introduction to Anthropological Theories and Theorists. , California: Altamira.* . California: Altamira, 2009. Print.

Nasserry-EL (S.A.A.)., G. Wagner, and G. Castel. "Un Grand Bain Gréco-Romain À Karanis: Fouilles De L'université Du Caire (1972-75)." *Bulletin de l'Institut Français d'Archéologie Orientale* 76 (1976): 231-75. Print.

Navarro, Z. "In Search of Cultural Intepretation of Power." *IDS Bulletin* 37.6 (2006): 11-22. Print.

Nicholson, Paul T. *Deir Mawas and Deir El-Gharbi: Two Contrasting Ceramic Traditions*. Moving Matters: Ethnoarchaeology in the near East. Eds. Wendrich, Willeke and Gerrit van der kooij. Netherlands: Research School CNWS, Leiden University, 2002. Print.

Nieves, Arnold Dean E. and Alvar L. *Factors Affecting Ceramic Standardization*. Ceramic Production an Distribution: An Integrated Approach. Ed. Pool, George j. Bey III and Christopher A. Boulder, CO: Westview Press, 1992. Print.

Nordström, H-A., and J.Bourriau, eds. *Ceramic Technology: Clays and Fabrics*. Mainz von Zabern, 1993. Print.

O'Connell, J.F., K. Hawkes, and N.G. Blurton Jones, eds. *Distribution of Refuse Producing Activities at Hadza Residence Base Camps: Implications for Analyses of Archaeological Site Structure*. New York: Plenum Press, 1988. Print.

Ochs, E., et al., eds. *Video Ethnography and Ethnoarcheological Tracking*. Mahwah, NJ: Lawrence Erlbaum Associates, 2006. Print.

Olausson, Deborah J. "Does Practice Make Perfect? Craft Expertise as a Factor in Aggrandizer Strategies." *Journal of Archaeological Method and Theory* 15 (2008): 28-50. Print.

Peacock, D.P.S, ed. *Pottery and Early Commerce: Characterization and Trade in Roman and Later Ceramics*. London: Academic Press, 1977. Print.

---. *Pottery in the Roman World: An Ethnoarchaeological Approach*. London and New York 1982. Print.

Peacock, D.P.S, and D.F Williams. *Amphorae and the Roman Economy*. London and New York: Longman, 1986. Print.

Petrie, W.M.F. "Sequences in Prehistoric Remains." *Anthrpol. Inst. Gt. Br. Irel* 3(4) (1899): 295-301. Print.

Pink, S. *Doing Visual Ethnography*. 2nd. ed. London: Sage, 2007. Print.

Pollard, Nigel. "The Chronology and Economic Condition of Late Roman Karanis: An Archaeological Reassessment." *Journal of the American Research Center in Egypt* XXXV (1998): 147-62. Print.

Rea, John R. "P. Haun. Iii 58: Caranis in the Fifth Century." *zeitschrift fur papyrologie und epigraphie* 99 (1993): 88-95. Print.

Read, Dwight. *Artifact Classification: A Conceptual and Methodological Approach*. California: Walnut Creek, 2007. Print.

Redmount, Carol A., and Maury. M. Morgenstein. "Major and Trace Element Analysis of Modern Egyptian Pottery " *Journal of Archaeological Science* 23 (1996): 741-62. Print.

Renfrew, Colin, and Ezra B.W. Zubrow, eds. *The Ancient Mind: Elements of Cognitive Archaeology*. Cambridge: Cambridge University Press, 1994. Print.

Reynolds, Paul. "Levantine Amphorae from Cilicia to Gaza: A Typology and Analysis of Regional Production Trends from the 1st to the 7th Centuries." *LRCW I: Late Roman Coarse Ware, Cooking Wares and Amphorae in the Mediterranean. Archaeology and Archaeometry* 1 (2005): 563-611. Print.

Rice, Prudence. *Ceramic Diversity, Production, and Use*. Quantifying Diversity Inarchaeology. Ed. R.D. Leonard., G.T. Jones (eds.). Cambridge1989. Print.

---. "Evolution of Specialized Pottery Production:A Trial Model,." *Current Anthropology* 22 (1981): 219-40. Print.

---. *Pottery Analysis, a Sourcebook*. Chicago: University of Chicago Press, 1987. Print.

---. *Pottery Analysis: A Sourcebook*. Chicago The University of Chicago Press, 2007. Print.

Richerson, Peter J., and Robert Boyd. *Not by Genes Alone: How Culture Transformed Human Evolution*. Chicago: The University of Chicago Press, 2005. Print.

Roberts, John M., ed. *The Self-Management of Cultures*. New York: McGraw Hill, 1964. Print.

---. "Three Navajo Households." *Peabody Museum of Harvard University, papers* 40.3 (1951). Print.

Roe, P.G. *Style, Society, Myth and Structure*. Style, Society, and Person: Archaeological and Ethnological Perspectives. Eds. C.Carr and J.E. Neitzel. New York: Plenum Press, 1995. Print.

Rogoff, Barbara. *Developing Destinies: A Mayan Midwife and Town*. Oxford: Oxford University Press, 2011. Print.

Römer, C. , ed. *Why did the villages in the Themistou Meris die in the 4th Century AD?* Wiesbaden Harrossowitz Verlag, 2013. Print.

Rouse, Irving. "The Classification of Artifacts in Archaeology." *American Antiquity* 24.3 (1960): 313-23. Print.

---. *Prehistory in Haiti: A Study in Method*. Yale University Publications in Anthropology. Vol. 21. New Haven: Yale University Press, 1939. Print.

Roux, V. "Ceramic Standardization and Intensity of Production: Quantifying Degrees of Specialization." *American Antiquity* 68 (2003): 768-82. Print.

Roux, Valentine., and D. Corbetta. *The Potter's Wheel. Craft Specialization and Technical Competence*. New Delhi-Bombay-Calcutta1989. Print.

Sahlins, Marshall. *Culture and Practical Reason*. Chicago: University of Chicago Press, 1976. Print.

Sayers, Ken., and C. Owen Lovejoy. "The Chimpanzee Has No Clothes- a Critical Examination of Pan Troglodytes in Models of Human Evolution." *Current Anthropology* 49.1 (2008): 87-114. Print.

Schiffer, Michael B. "The Devil Is in the Details: The Cascade Model of Invention Processes." *American Antiquity* 70.3 (2005): 485-202. Print.

Schofield, A.J. *Understanding Early Medieval Pottery Distributions*. Landscapes from Antiquity. Ed. Stoddart, Simon. Cambridge: Antiquity Publications Limited, 2000. Print.

Schonpflug, Ute, ed. *Cultural Transmission: Psychological, Developmental, Social and Methodological Aspects*. Cambridge: Cambridge University Press, 2009. Print.

Sennett, Richard. *Craftsman*. 1st ed. New Haven CT: Yale University Press, 2009. Print.

Shennan, Stephen J., and J. Steele., eds. *Cultural Learning in Hominids: A Behaviorial Ecological Approach.* Cambridge University Press: Cambridge, 1999. Print.

Sigaut, François. "Learning, Teaching , and Apprenticeship." *New Literary History* 24.1 (1993): 105-14. Print.

---, ed. *Préface: Haudricourt Et La Technologie*. Paris: Editions de la Maison des Sciences de l'Homme, 1987. Print.

Sinopoli, Carla M. *Approaches to Archaeological Ceramics*. New York and London: Plenum Press, 1991. Print.

Sofaer, J. *The Body as Material Culture. A Theoretical Osteoarchaeology*. Cambridge: Cambridge University Press, 2006. Print.

Soressi , M., and Jean-Michel Geneste. " The History and Efficacy of the Chaîne Opératoire Approach to Lithic Analysis: Studying Techniques to Reveal Past Societies in an Evolutionary Perspective. Special Issue Edited by G. Tostevin Entitled Reduction Sequence, Chaîne Opératoire, and Other Methods: The Epistemologies of Different Approaches to Lithic Analysis." *Paleoanthropology* (2011): 344-50. Print.

Stark, M.T., R.L. Bishop, and E. Miksa. "Ceramic Technology and Social Boundaries: Cultural Practices in Kalinga Clay Selection and Use." *Journal of Archaeological Method and Theory* 7 (2000): 295-331. Print.

Stark, Miriam. "Current Issues in Ceramic Ethnoarchaeology." *Journal of Archaeological Research* 11.3 (2003). Print.

Stark, Miriam T., ed. *The Archaeology of Social Boundaries*. Washington: Smithsonian Institution Press, 1998. Print.

Stark, Miriam T., Brenda J. Bowser, and Lee Horne, eds. *Cultural Transmission and Material Culture: Breaking Down Boundaries*. Arizona: University of Arizona Press, 2008. Print.

Taylor, Edward B. *Primitive Culture-Researches into the Development of Mythology, Philosophy, Religion, Language, Art and Customs* 2nd ed. New York: H. Holt and Company, 1874. Print.

Taylor, Matthew J., and Candance A. Thoth. "Cultural Transmission." *Encyclopedia of Child Behavior and Development*. Eds. Sam Goldstein and Jack A. (Eds.) Naglieri. US: Springer, 2011. 448-51. Print.

Throop, J., and K.M. Murphy. "Bourdieu and Phenomenology- a Critical Assessment." *Anthropological Theory* 2(2) (2002): 185-207. Print.

Tomasello, Michael. "The Human Adaptation for Culture." *Annual Review Anthropology* 28 (1999): 509-29. Print.

Tomber, Roberta. *The Pottery from Mons Claudianus*. The Pottery and Ceramic Objects from Mons Claudianus. Ed. Peacock, V. Maxfield and D.P.S. Vol. 3. Cairo: FIFAO, 2006. Print.

Tournavitou, I. "Towards an Identification of a Workshop Space." *Problems in Greek Prehistory: Papers Presented at the Centenary Conference of British School at Athens*. Ed. (eds.), E.B. French. Athens-Manchester1986. Print.

Van Alfen, P.G. "New Light on the 7th-C. Yassi Ada Shipwreck: Capacities Ad Standard Sizes of Lra 1." *Journal of Roman Archaeology* 9 (1996): 189-213. Print.

Verdon, M. "Franz Boas: Cultural History for the Present, or Obsolete Natural History?" *Journal of the Royal Anthropological Institute* 13 (2007): 433-51. Print.

Vitelli, Karen D. *"Looking up" at Early Ceramics in Greece*. Pottery and People-a Dynamic Interaction. Eds. Skibo, James M. and Gary M. Feinman. Salt Lake City: The University of Utah Press, 1999. Print.

Vukovic, Jasna. "Late Neolithic Pottery Standardization: Application of Statistical Analysis." *CTAPHHAP LXI* (2011): 81-100. Print.

Wallaert-Petre, Helene. "Learning How to Make the Right Pots: Apprenticeship Strategies and Material Culture, a Case Study in Handmade Pottery from Cameroon." *Journal of Anthropological Research* 57 (2001): 471-93. Print.

Wendrich, Willeke, ed. *Archaeology and Apprenticeship: Acquiring Body Knowledge, Identity, and Communities of Practice*. Tucson: The University of Arizona Press, 2012. Print.

---. *The Relevance of Ethnoarchaeology: An Egyptian Perspective*. Contesting Ethnoarchaeologies- Traditions, Theories, Prospects Series: One World Archaeology. Eds. A. Marciniak and Nurcan Yalman. Vol. 7. USA: Springer, 2013. Print.

---. *The World According to Basketry: An Ethnoarchaeological Interpretation of Basketry Production in Egypt*. Leiden 1999. Print.

Wendrich, Willeke., J.E.M.F. Bos, and K.M. Pansire. "Vr Modeling in Research, Instruction, Presentation and Cultural Heritage Management: The Case of Karanis (Egypt)." *The 7th International Symposium on Virtual Reality, Archaeology and Cultural Heritage VAST*. Ed. M. Ioannides, D. Arnold, F. Niccolucci, K. Mania (eds.): 2006. Print.

Wenger, Etienne. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press, 1998. Print.

Wobst, Martin H. "The Archaeo-Ethnography of Hunter-Gatherers or the Tyranny of the Ethnographic Record in Archaeology." *American Antiquity* 43.303-309 (1978). Print.

Wylie, M.A. "The Reaction against Analogy." *Advances in Archaeological Method and Theory* 8 (1985): 63-111. Print.

Yeh Shi Tao. *Grapical Display of Data – a Nonparametric Approach, – Posters*. NESUG 2004 Proceedings. 2004. Print.