# More than Meets the Eye: Reconsidering Variability in Iroquoian Ceramics

Kostalena Michelaki†

**Abstract.** This paper presents an approach to the analysis of Iroquoian ceramics that goes beyond the traditional normative creation of ethno-chronological typologies to consider pottery as a dynamic material shaped by, and in turn shaping, complex webs of human and material interactions. To accomplish this goal I consider how the shell-tempered pots that appeared in some Neutral Iroquoian villages in the late 16th and 17th centuries AD have been interpreted. I discuss both the hypothesis that they had been made by Fire Nation captives—a typical interpretation in Ontario archaeological writings—and the possibility that they were better suited for cooking maize—an interpretation appearing in archaeometric considerations of northeastern North American shell-tempered pottery. I argue that both interpretations are limited and offer instead an approach inspired by recent writings in ethnoarchaeological ceramic studies, social theory, and the social nature of technology.

**Résumé.** Cet article présente une nouvelle approche analytique de la poterie iroquoienne. Cette approche va au-delà des modèles normatifs traditionnels basés sur les typologies ethno-chronologiques. Je considère la poterie comme un matériel dynamique formé par, et formant en retour, des réseaux complexes d'interactions humaines et matérielles. Je réexamine à cette fin les interprétations proposées concernant l'apparition des vases dégraissés au coquillage dans les villages iroquoiens Neutres datant du 16e et du 17e siècle. Je fais d'abord état de l'hypothèse, traditionnelle en archéologie ontarienne, selon laquelle ces vases auraient été faits par des captives de la Nation du Feu, ensuite je considère l'hypothèse, récemment suggérée dans le cadre d'études archéométriques, selon laquelle ces vases auraient été adoptés parce qu'ils étaient plus appropriés pour la cuisson du maïs. Ces deux interprétations semblent trop limitées. Conséquemment, j'avance une approche alternative, inspirée par des publications ethnoarchéologiques récentes, par la théorie sociale et tenant compte de la nature sociale de la technologie.

Ceramics vary in seemingly endless ways: in ways that are visible (e.g., shape, size, colour or decoration), invisible (e.g., raw materials or forming methods), tactile (e.g., surface texture) or even audible (e.g., the high pitch sound produced by highly fired vessels when tapped with the fingernail—a common test ceramic pot buyers perform at markets). The interesting questions are "Why? What does this variation mean?," and, at a more practical level, "How can we record this variation accurately and systematically, so that we understand its meaning?"

Using the example of shell-tempered pottery that appeared in Neutral Iroquoian villages in the late 16th and 17th centuries AD, I examine here how our answers and methodologies change depending on whether we consider

† Department of Anthropology, CNH 509, McMaster University, 1280 Main Street West Hamilton, ON L8S 4L9 [michela@mcmaster.ca]

ceramics as passive objectified ideas, as functional tools, or as dynamic parts of wider social projects and active agents in social life. I also argue that through a combination of social theory and archaeological science we can ask ceramics new questions and find more nuanced answers to existing ones.

## CERAMICS AS OBJECTIFIED IDEAS

Culture historians have argued, or rather assumed, that ceramics, like all material culture, vary in direct correlation to the ethnic groups who create them. If *culture* refers to a homogeneous set of ideas shared by a "people" (Taylor 1948: 101–110), then ceramics are those ideas objectified and should be equally homogeneous in their characteristics. According to this line of thinking, ceramics vary because the ideas of different ethnic groups vary in time and space. To capture this orderly variation, all we need to do is record traits, make lists of the ones that co-vary, and then organize them into types.

Culture history has been a very influential approach in Ontario archaeology in the last sixty years (Watts 2006: 9). Ceramics have been used to answer two main questions: what the origins of the Iroquoian speakers are, and what the timing of their becoming the ethnographically known people we read about in the Jesuit Relations is. The arguments about whether one should study "types" (Emerson 1968; MacNeish 1952) or "attributes" (Ramsden 1977; Watts 1999; Wright 1966, 1980), and whether developments occurred in-situ (MacNeish 1952, 1976; Ritchie 1969) or via migration (Snow 1995, 1996) or a combination of both[1], have often been heated, but the discussion has always remained about shared traits of pots and the origins and movements of ethnic groups. In most reports, ceramics are used to build chronologies, situate a site in an existing ethno-chronological taxonomy, or track the movements of particular ethnic groups in space and time. As Latta wrote, "culture history remains the dominant approach in Canadian archaeology" (1999: 21; for an example, see Wright 2006).

More often than not, decorative designs have absorbed the energy of researchers who study Iroquoian ceramics.[2] My focus here is on an oddity (from an archaeological practice point of view): the shell-tempered ceramics found in Neutral Iroquoian villages. They are the only case in Ontario ceramic studies where a type has been defined by raw materials rather than decoration. My intention is to provide neither a comprehensive review of Iroquoian ceramics, nor a re-analysis of any particular ceramic assemblage. My aim is to introduce some of the wider ceramic studies literature into the analysis of Ontario Iroquoian pottery and show the wealth of socially relevant information we can gain from their study, much beyond the narrow creation of taxonomies.

### Shell-Tempered Ceramics in Ontario

Lennox and Fitzgerald point out that the shell-tempered ceramics are of western influence, originating from the Algonquian Western Basin peoples of the Toledo-Detroit-Chatham region (1990: 418). Jamieson refers to them as "Upper Mississippian influenced, but nonetheless indigenously made" (1992: 79). They appear throughout the Neutral sequence, but a temporal and spatial pattern is discernible in their distribution (Table 1, Figure 1). Lennox and Fitzgerald argue that from the 15th and very early 16th centuries we find traces in western Ontario sites, such as Lawson

Table 1. Known historic Neutral Iroquoian sites, their chronology and percentage of total sherd-tempered pottery discovered during their excavations.

| Site | Chronology | Shell-Tempered pottery % | References |
|---|---|---|---|
| ***North: Spencer-Bronte Drainage Cluster*** | | | |
| Christianson | ca. AD 1615 | 14.63 | Fitzgerald 1982 |
| Bogle I | ca. AD 1630–1641 | 16.3 | Lennox 1984b |
| Hood | ca. AD 1630–1641 | 26.2 | Lennox 1984a |
| Bogle II | ca. AD 1638–1651 | 64 | Lennox 1984b |
| Hamilton | ca. AD 1638–1651 | 61 | Lennox 1981 |
| ***Centre: Grand River Cluster*** | | | |
| Fonger | ca. AD 1580–1600 & 1600–1610 | 3 | Warrick 1984 |
| Walker | ca. AD 1626–1640 | 4 | Wright 1981 |
| ***South: Niagara Escarpment*** | | | |
| Thorold | ca. AD 1615–1630 | 1.1 | Noble 1980 |

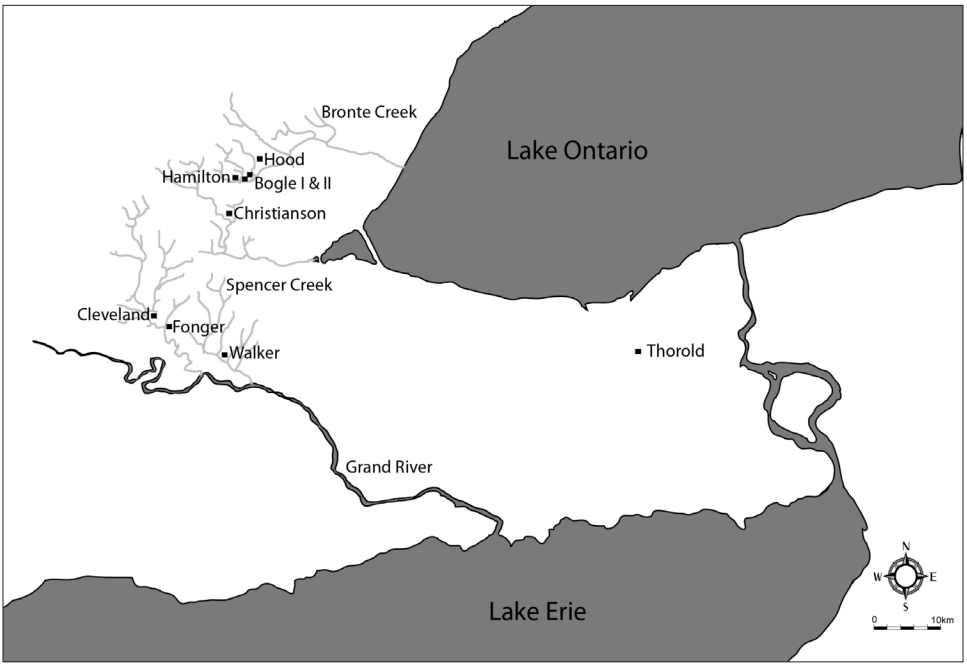


Figure 1. Late 16th and 17th-century Neutral Iroquoian sites in Southwestern Ontario.

and Pound[3], as their inhabitants initiated or continued hostilities with a group further west. With time this conflict intensified, as the Neutral expanded westwards, and thus in the Wolfe Creek and McGeachy sites 17% of the body sherds are shell-tempered. The people at most westerly sites likely joined in late prehistoric migration into Historic Neutralia to become inhabitants of the Spencer/Bronte Creeks site cluster (Figure 1), continuing their western forays (Lennox and Fitzgerald 1990: 418–419).

Fitzgerald (1982: 96–101) considers in parallel ethnohistoric sources and the percentages of shell-tempered ceramics in excavated Neutral settlements. Based on the accounts of Champlain (Biggar 1922–1936 iii: 97), the Neutral were at war with the Fire Nation by *ca.* 1616. Jerome Lalemant also reported hostilities with the Fire Nation, resulting in the capture of more than 1,000 men, women, and children between 1640 and 1643 (Thwaites 1898a: 195; 1898b: 25). Fitzgerald argues that the increase in shell-tempered ceramics in the Spencer-Bronte sites from *ca.* 1615 mirrors the influx of prisoners, among whom there must have been women potters. Since the ceramic assemblage at the protohistoric Indian Hills site (*ca.* 1610) in northeastern Ohio, considered a Fire Nation site (Fitzgerald 1982: 97), is thought to consist "exclusively of shell tempered ceramics with decorative motifs and techniques identical to those observed in the shell-tempered assemblages from Spencer-Bronte drainage sites" (1982: 101), the conclusion is reached that the increasing number of shell-tempered ceramics on the northern cluster of Neutral sites after *ca.* 1615 is due to the increasing numbers of hostages that arrived in Neutralia as a result of attacks against the Fire Nation.[4] Since contemporary nearby sites have very small amounts of shell-tempered pots (Table 1, Figure 1), the idea is that the majority of hostages were restricted to a few sites (Fitzgerald 1982: 98; Lennox and Fitzgerald 1990: 418).

The issues addressed through the presence of shell-tempered ceramics are large-scale, important questions of interaction, enculturation, and culture change. However, large-scale processes (whether one sees them as "Mississippification" [Jamieson 1992: 70], as "peer-polity interactions" [Williamson and Robertson 1994], or as any other kind of interactions) happen on the ground through the rather small-scale decisions and actions of individuals who go about their everyday lives. We must ask then how it is that these shell-tempered pots came to be in Neutral villages.

According to our current understanding, for at least two centuries—and thus, for at least six generations of people—shell-tempered pots were known to Neutral groups. They were not known only as foreign pots that arrived complete in their villages, since empirical evidence suggests they were locally made in Neutral villages (e.g., Holterman 2007: 72–73; Jamieson 1992: 79). This means that they were not trade items and that Neutral men did not bring them back from their raids as symbols of bravery. It is also hard to imagine that captive women carried along their household pots. It seems that six generations of Neutral women at least would have witnessed Fire Nation women making shell-tempered pots in their villages, quite possibly in their own longhouses. Is it conceivable that for two centuries not even one Neutral potter made a shell-tempered pot, or that not a single Fire Nation captive made a grit pot? Can we assume that the percentage of shell-tempered sherds reflects which

sites had more captives and which ones had less?

Even if shell-tempered pots were indeed made exclusively by captives during the first generation, what happened to those women down the line? As villages moved and initial captives were integrated into village life, they must have taught their daughters and granddaughters to make pots too. If they taught them to only use shell temper, then higher percentages of shell-tempered pots in later villages would not necessarily mean increased hostilities and captives. For example, at the Hood site (*ca.* 1630–1641), where the quantity of shell-tempered sherds has grown more than 10% in comparison to the earlier Christianson site (Table 1), Lennox (1981: 135) argues that "… the Hood ceramics are the result of the partial adoption of shell tempering by Neutral potters. This occurrence of shell tempering at Hood may also be the result of a foreign influence or an influx of foreign potters but if so such an event occurred long before the Hood site was occupied such that other distinguishing attributes of the industry have since been abandoned or assimilated." Alternatively, if they taught them to make grit-tempered pots, then shell-tempered sherd percentages and the presence of Fire Nation women in Neutral villages would not have an evident one-to-one relationship.

At the moment, the way in which data are reported makes it very difficult to understand the nature of the introduction/adoption of this temper choice in Neutral villages. It seems that in some villages there are at least three categories of ceramic pastes: grit-tempered, shell-tempered, and grit-and-shell-tempered. In the analysis of some sites, sherds that include both shell and grit are subsumed under the shell-tempered category (e.g., Hood [Lennox 1984a: 76], Bogle I [Lennox 1984b: 213], Bogle II [Lennox 1984b: 244]). In other sites, no definition is provided as to what the shell-tempered category includes (e.g., Walker [Wright 1981:71, 79], Hamilton [Lennox 1981: 256–8], Thorold [Noble 1980: 52]). Thus, it is not clear whether all the sites that have shell-tempered pots also have grit-and-shell-tempered ones, and whether there is a pattern, chronological, spatial, or otherwise, in the distribution of the grit-and-shell paste.

Returning to the question of "why pots vary," it seems that a culture-historical definition of ethnicity, and its homogeneous and bounded manifestation in time and space, do not provide an adequate answer. Iroquoianists are becoming increasingly vocal about the theoretical and methodological problems of such an approach. Empirical studies (Chapdelaine and Kennedy 1990; Crepeau and Kennedy 1990; Hawkins 2001; Kuhn 1986; Schulenberg 2002; Trigger *et al.* 1980, 1984) have provided hard evidence that both the cultural landscape and the timing of interactions were far more complicated than the picture culture history assumed. Methodological studies point out that it is counterproductive, if not impossible, to fit ceramics or any kind of material culture into clearly defined, bounded and homogeneous taxa that orderly change characteristics in space and time. There are always the "intermediate" or "hybrid" ones (Watts 1999: 221) and, as a result, archaeologists keep creating more types and arguing whether the they are real and what their relation is to other types, all of which remain archaeological constructs. Theoretical studies show that social groups do not act as bounded, and homogeneous enti-

ties that can be described by labels such as "Seneca" or "Iroquois" (Cunningham 2001; Engelbrecht 1999: 51). In other words, the assumption that bounded and homogeneous ceramic taxa can explain the actions of bounded and homogeneous ethnic groups suffers from the fact that neither material culture nor human groups seem to behave like this.

## CERAMICS AS TOOLS

Another way to approach ceramics is to examine them not as objectified ideas, but as tools. If culture is " man's extrasomatic means of adaptation" (White 1959: 8), then people use ceramics as tools to adapt to their natural and social environments (Binford 1965). According to this logic, pots vary because they fulfil different utilitarian and social functions. We record that variation by identifying the attributes that are utilitarian and technical in character, responsible for the functional and mechanical variation of pots, and those that are unrelated to function and mechanics and, thus, bear the burden of social variation.

The question becomes thus, "Which attributes are functional, and which ones are social?" Physical properties of the ceramic material affect a vessel's suitability for various uses. Such variables as the raw materials and their characteristics, wall thickness, and surface finish can affect a vessel's permeability (important for storage containers), thermal conductivity (central in cooking), or strength and thermal stress resistance, which in turn affect ceramic longevity. Such variables then are functional, unlike colour, or decorative design, for example, which are thought of as social.

If raw materials are related to the function of vessels, then we should consider the functional story of the shell-tempered pots. The Ontario Iroquoian literature is surprisingly quiet, unlike the extensive studies that have considered the function of Mississippian pots.[5] It is worth examining that literature, especially if that is supposed to be the origin of this temper choice.

### Mississippian Insights

Steponaitis (1984: 110–111) considered the entire prehistoric ceramic chronological sequence in west-central Alabama, leading up to and including Mississippian ceramics from Moundville. He focused on how the paste composition of cooking vessels changed through time and showed three major shifts: from coarse sand to fine sand; from fine sand to coarse grog (i.e., crushed pottery); and from coarse grog to coarse shell. He argued that these shifts represent increased resistance of cooking vessels to thermal stress. Grog, unlike sand, expands at the same rate as clay. As the vessel is subjected to repeated cycles of heating and cooling, expanding and contracting, grog reduces the risk of cracking and thus prolongs the pot's successful life. Pre-fired shell particles not only have the same expansion rate as the clay, but also get easily oriented within the pot's wall, being platy in shape. Using finishing techniques such as paddle and anvil, the particles can become more compacted than those of grog. This makes the walls stronger and thinner, and as Braun has shown: "Other things being equal, the thinner a wall, the higher its thermal conductivity" (1983: 118).

In other words, shell-tempered pots are supposed to be superior cooking pots, especially for starchy foods, such as maize. Braun argues that the palatability and digestibility of starchy seeds can be enhanced by cooking them to the point of gelatinization in a liquid broth,

which requires long cooking times and high temperatures, making boiling the most efficient form of cooking (1983: 118). Shell-tempered pots, being thinner and stronger, are best for boiling. Thus, by AD 1000, Mississippian groups had established the best pottery making technology for their cooking technology, in which boiling maize was central.

If Mississippians were the source of Iroquoian maize, then this makes one wonder why the Iroquoians would choose to adopt maize, but not the "superior" pottery technology required for it to be cooked. Even if maize had been adopted for reasons other than eating initially (see Martin [2006, *in press*] for discussion), by the 15th century the Neutral had been eating it for centuries (Crawford *et al.* 2006; Crawford and Smith 2002; Katzenberg *et al.* 1995). By the 17th century, not only had they been eating maize, they had been familiar with the making of shell-tempered pots at their villages as well. Furthermore, if we judge from the Hamilton and the Walker sites where quantitative information is available, the shell-tempered ceramics were indeed notably thinner than the grit-tempered ones (Fitzgerald 1982: 110). One would expect that the Neutral would notice that shell-tempered pots cooked maize more efficiently and lasted longer and would adopt the practice of shell tempering wholeheartedly.[6]

This is the point where a strictly functional approach to ceramics falls apart. It assumes that functional constraints are strict, that the desire for efficiency is a given, and that a technical choice cannot also be symbolic and social. From a 21st-century point of view, the Mississippian shift from grog to shell may make perfect sense as a technologically/functionally inspired change. However, if we think of the time before anyone had ever thought of shell as a possible material to help achieve cooking efficiency, then the functional superiority of shell is not apparent.[7] At that point in time, shell must have had certain meanings and connotations that made it relevant as a material for a potter to even consider.

**Other Considerations**

Choices must already make sense in an existing realm of appropriate options. Materials do not only have mechanical properties. They have symbolic properties too. For example, the daughters of the famous potter Lucy Lewis at the Acoma Pueblo in the American southwest, send children to the Anasazi ruins nearby to bring back sherds that they crush and add to their paste so that their pot can get "spirit" from their ancestors (Anthony 1990). In Africa, among the Gurensi, grog from the eating bowl of a deceased woman is incorporated into new bowls to preserve a link between the woman, her family, and the earth (Smith 1989: 61). In Indonesia, this recycling of pots and souls continues today: in a lament we hear: "If you had broken like an earthern dish, I would dig you up again and bake you …" (Hoskins 1998: 169).

Thus, explaining the shift from grog to anything else as *simply* the desire to get a more thermally resistant pot is insufficient. The connection between shell and cooking is undeniable, but shell must also have fit in other ways too in the symbolically appropriate options of the Moundville potters. Maybe it did not do so for the Neutral. We know that marine shell was very important for them, and that in order to acquire it they engaged in extensive trade with the Atlantic coast. It is believed that marine shell was a powerful medicine, effective in hunting and warfare, connoting "social, physical, and

spiritual well-being and success in addition to wealth and/or status" (Jamieson 1992: 78). Interestingly enough, Fitzgerald mentions a relatively sudden increase in marine shell around *ca.* 1615, shown at the Christianson site, which corresponds with the pattern of increase in shell-tempered ceramics observed at the same site (Table 1). He attributes the increase of marine shell to "…attempts by the French, Huron, and perhaps *Cheveux relevés* around 1615 to get the Neutral to participate in the developing southern Ontario fur trade" (Fitzgerald 1982: 306–307), while the increase in shell-tempered ceramics to the influx of Fire Nation captives (1982: 101). Given the co-occurrence of the two patterns and the fact that shell-tempering remained a restricted choice in Neutral villages, when all around them in northeastern North America it was the favoured, if not the only choice, it becomes critical to understand where the shell in Neutral shell-tempered ceramics came from. If Stimmell's argument that salt was present in the thin-section analyses of shell-tempered ceramics from the Hood site (Lennox 1984a: 76, citing Stimmell 1978) is correct, then the hypothesis that marine shell was used in shell-tempered ceramics deserves to be examined.[8]

In Mississippian vessels, shell came most often from freshwater mussels (Feathers 2006: 92). Even if this is the case in Ontario, to understand the function and meaning of shell-tempered pots we need to know a lot more about the shell that was used in their production. We need to know whether mussels were collected specifically to be used in pottery production or whether only the leftovers of other activities, such as eating or bead making, were used. We also need to know how shell was finally discarded. An examination of the uses of different kinds of shell and their discard patterns in Neutral sites will provide a better context for understanding why the choice of this material was ever made and then remained restricted.

What becomes evident very quickly is that we do not know how people in Neutral villages made and used ceramics and thus we cannot evaluate whether the shell-tempered pots represent a different group, a different function, or require a different interpretation altogether. If we do not know the logic according to which they made and used materials and objects, how then can we understand what objects, practices, or traits they chose to adopt and what to reject in their interactions with their neighbours? How can we understand what large-scale processes of culture change might have actually involved?

## CERAMICS AS THE PARTS OF A SOCIO-TECHNICAL WEB

Every person comes to life, grows, and learns how to make things in a community with pre-formed ideas about how the world works, how things should be made, and what resources, tools and techniques are "appropriate." Every act of production is social and exists in continuation with the past. However, in their everyday practice, people modify these rules even as they try to reproduce them, so that "rules" are never absolute and individual action is never random (Dobres 2000; Giddens 1984; Michelaki 2006).

There is now enough ethnographic, ethnoarchaeological, and archaeological evidence to demonstrate that mechanical and functional constraints in prehistoric or modern traditional pottery making contexts are never severe enough to dictate the choices of potters (Gosselain 1998: 90; van der Leeuw

1993: 239). This means that choices are seldom orderly. There is no predictable one-to-one correlation either with ethnic groups, or with different functions, yet not all options are equally good, nor are they ever random.

Ceramics vary for reasons that are mechanical *and* functional *and* social *and* economic *and* political *and* symbolic *and* traditional *and* personal. Such complex webs of factors cannot be adequately considered by examining finished objects and *a priori* deciding which attributes are mechanical, which are functional, and which are socially relevant. These qualities are indivisible and co-exist in the process of making and using ceramics. A methodology is needed that allows the examination of activities, of complete operational sequences, recognizing that at every step of the sequence there is a human being making a decision about how to proceed. These decisions are material. Potters have to meet real constraints to create successful pots. But for every constraint there is always more than one way of meeting the challenge. Thus, the point is the *choice*, not the *constraint*. Of all the possible solutions, which one does the potter choose? If the constraint is a weak ceramic vessel, or one that cannot handle thermal shock well, then the question is why potters choose to meet the challenge with shell and not with another equally appropriate solution.

## CONSIDERING COMPLETE OPERATIONAL SEQUENCES

There is a lot of exciting work that remains to be done with Neutral ceramics, since we currently do not understand what choices were made throughout their operational sequences. What raw materials did the potters collect and from where? How did they prepare them? How many different, yet equivalent, processing strategies did they have? How did they form and finish their vessels, using what methods and tools, achieving what shapes and sizes? How many variants of each technique can we discern, how many "technical styles" (Lechtman 1977; Lechtman and Steinberg 1979; Sillar and Tite 2000)? How did they fire their vessels? How did they use them? How did they discard them?

As we try to describe systematically the variability in Neutral Iroquoian ceramics to understand its meaning, it will be very important to consider complete operational sequences instead of isolated stages. Different sequences may lead to ceramics that superficially look very similar. Interpreting such ceramics as similar might be accurate, but it would not be precise.

To make this point clearer, we could assume for a second that indeed in some Neutral sites there are two very distinct assemblages: one characterized by grit-tempered pots and the other defined by shell-tempered ones. Consider the sequences outlined in Figure 2: for both assemblages the raw materials are local, yet all the activities related to their preparation and the subsequent forming, finishing, firing, and use of the pots are clearly different. If this was the relation between the two assemblages, we could argue that two distinct groups of people, with minimum interaction between them, made and used these pots.

In Figure 3, the local raw materials, their preparation and the pot-forming methods remain distinct, yet all the rest of the steps of the operational sequence are the same. In this case, we would have to admit that a rather close connection existed between the potters who made these pots. We could claim that they must have worked together, observing

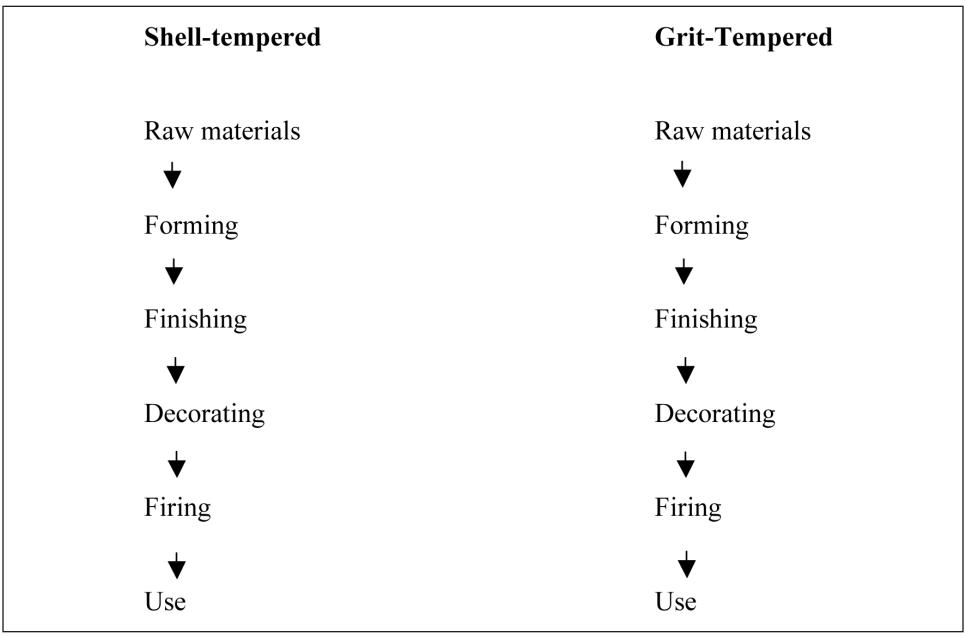


FIGURE 2. Distinct operational sequences: Shell- and grit-tempered pots made by different groups that did not interact with each other.

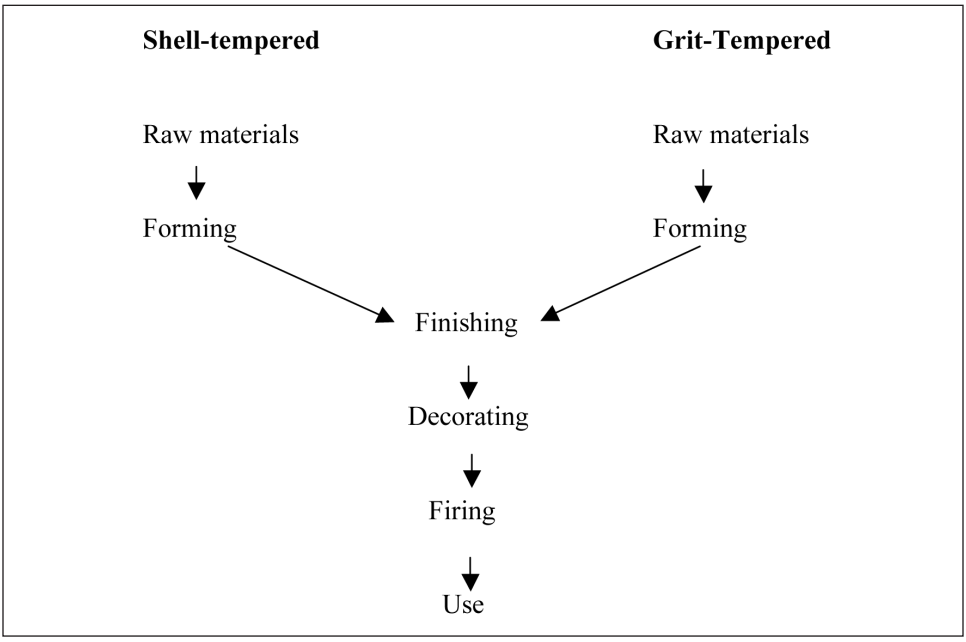


FIGURE 3. Blended operational sequences: Pattern could suggest distinct groups of potters working together.

and copying each other, during certain stages of the potting activity. However, the difference in the forming stage would suggest that we are possibly dealing with two distinct groups of potters who had learned how to form pots differently. Since Gosselain's work in Cameroon (1998: 92) has convincingly shown that the forming stage coincides generally with linguistic boundaries and might lead to the recognition of cultural boundaries, we could consider the differences in the forming stage, in association with the differences in the tempering material, and suggest that indeed potters from distinct traditions were working in proximity.

Finally, in Figure 4, the difference in raw materials seems to suggest yet a different interpretation. Given the similarity of forming and firing techniques, and the distinction in raw materials and surface finish, a group working together and producing two functionally distinct wares could be imagined. In all three scenarios, we start with the same grit-tempered and shell-tempered pastes. However, the meaning of the pots produced with these pastes changes dramatically, depending on what the rest of the sequence looks like.

The ethnoarchaeological literature on the factors that affect how potters make decisions throughout the manufacturing sequence, and how they learn and transfer their knowledge, is now extensive enough that we cannot afford to ignore it.[9] Ultimately, I believe that the nature of manufacturing sequences and the meaning they conveyed is an empirical question for the archaeologist to explore in individual case studies. Ethnoarchaeological information, however, can help us design richer research strategies and look for connections where we might have not otherwise. In the following sections I focus on the lessons ethnoarchaeology has taught us about the raw material selection and preparation, as well as the forming stages. These stages have been used by Iroquoianists to argue for interactions (as in the case of shell-tempered pots) or migrations (as in the case of changes in forming techniques between Early Iroquoian and earlier ceramics [Snow 1995: 68]), yet without acknowledging the

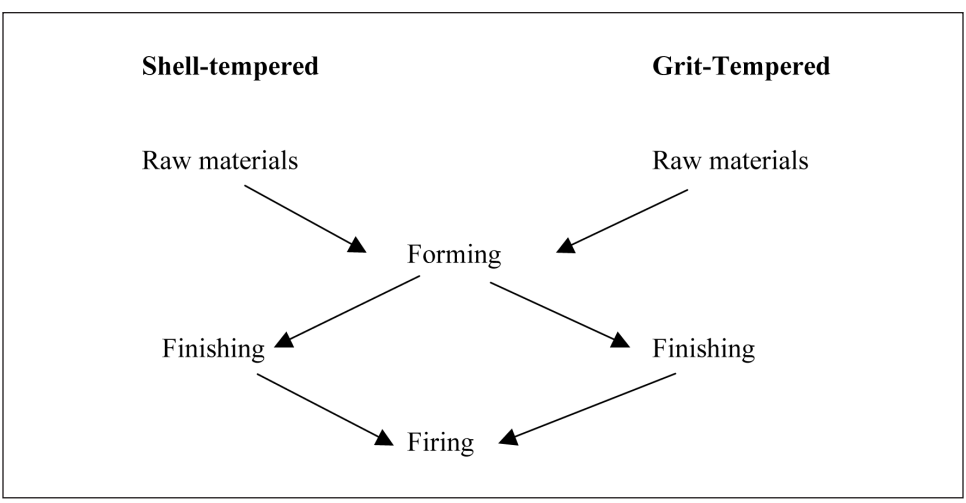


FIGURE 4. Blended operational sequences: Pattern could suggest distinct vessel functions.

richness of information that such steps hide within them. Although I will not refer to the firing stage, a lot of exciting work already exists on the subject (Gosselain 1992a; Livingstone Smith 2001; Sillar 2000)—in the case of Iroquoian ceramics this may turn out to be critical (Marti Latta, pers. comm. 2006).

## RAW MATERIAL SELECTION AND PREPARATION

### Raw Material Selection[10]

Often, when making pottery is not a full-time, specialized activity, the time and energy potters devote to it are limited. As one of many other housekeeping tasks, it remains secondary to the main economic activities of the household, such as the tending of fields. The consequences are many:

1) Potters never go out specifically to discover clays. They find them rather "accidentally," quite often in places where they already perform other activities, especially ones that require them to observe closely or dig the ground. At the same time, they do not believe that clays exist everywhere: "The habit of frequenting specific categories of sites seems to alter potters' perception of their environment, as they eventually consider some environments to be more likely than others to yield clay" (Gosselain and Livingstone Smith 2005: 39).

In a Neutral setting, we could expect that they discovered clays in and around their villages as they were tending their fields, digging post-holes for their longhouses, or ditches/palisades around them, or close to rivers, creeks or lakes as they were fetching water for their households, washing, or fishing.

2) Once clay is discovered, it is not necessarily exploited. Three factors appear to be equally important: First, the source must be close to where the potters live and/or work. In ethnographic settings, it is observed consistently that if potters move their homes or places of work, they move their clay sources as well. In Arnold's famous example from South America, 85% of the potters in his sample collected clays from within a seven-kilometer radius of their place of residence/work (Arnold 1985: 38–50, 227). In Gosselain's sample in Africa, the radius was three kilometers (Gosselain 2002: 40–41).

Archaeologically this means that as we try to understand how Neutral potters selected their raw materials and we organize raw material surveys, we must not expect that their sources were either distributed randomly in the landscape, or that their distribution had a logic that was clearly "ceramic" in nature. Selecting and collecting raw materials was only one of the many activities that potters and non-potters alike performed in their landscape. Thus, understanding how and where Neutral potters collected their raw materials will have a lot to tell us about how they perceived their landscape and its resources and possibly lead us to where some of their other activities were taking place.

A second factor determining whether a clay source is going to be exploited is whether potters are satisfied by the properties of the clay. Each potter judges a series of characteristics, such as the clay's colour, taste, smell, or plasticity. The criteria for assessing them are very clear and rather strict, yet they are also completely subjective, depending on the preferences of each potter.

Materials science and experimental projects will have a lot to tell us about the clays that were available around Neutral villages and their properties. Analyzing clays collected through raw

materials surveys will give us a basis against which we can begin to comprehend the choices potters actually made. We can evaluate how many different kinds of clays and aplastics were available close to Neutral villages and whether their properties differed in a way that is mineralogically, chemically or physically different. It is important to remember that such analyses will have neither predictive nor full explanatory power. However, they will provide a reference point for us to understand, when we compare them with the archaeometric analyses of ceramic sherds, whether potters were utilizing all available sources, or only targeting some, or whether their local clays were plastic or stiff, for example. Having such basic awareness of the locally available raw materials may help us understand how they moved in their landscape and later on, how they were preparing their raw materials to create clay pastes.

The final factor determining whether a source is going to be used or abandoned is the existence of rituals and taboos. Certain persons may be kept away from where clays are extracted or used, offerings may be left by the potters at the extraction sites, and rituals may be performed (see Krepela 1972). Unless potters perceive that the requirements of such taboos and rituals are met in a satisfactory way, they will not necessarily use a clay source, even if the clay has all the right properties.

Although it is easy to disregard such a point as archaeologically invisible, we must not forget that it does affect the behaviour of potters as they decide which sources to use, and may help us understand particular choices. In Cuentepec, Mexico, for example, Lopez Varela (2005: 4) noticed that to make *comales* (the ceramic vessels on which tortillas are cooked), the potters collected clays from three different caves. Mineralogical and chemical analyses showed that the properties of all three different clays were the same and it made no difference whether only one source or all three were used. Yet, in those caves powerful forces of fertility were thought to reside and using clays from all of them transported the benefit to both the pots and their users.

Currently there is no systematic effort to understand in detail the raw materials Iroquoian potters used. In some exceptional and valuable cases (Braun 2003; Hawkins 2001; Kuhn 1986; Trigger *et al.* 1980, 1984), raw materials have been looked at in more detail than the usual division between grit and shell. The analyses have focused only on archaeological ceramics, however, and their purpose has been to determine whether the raw materials were local, or what their performance characteristics may have been. By adding the analysis of locally available geological clays into our research, we can tie pottery making to its landscape and begin to connect it with other activities, such as the tending of fields, and information we may have about those in the ethnohistoric record.

**Raw Material Preparation**

When it comes to the ways in which potters prepare their materials, it seems again that mechanical properties and performance characteristics are secondary side effects, rather than explanatory forces, and that the social context of learning and practicing the craft has more to do with what potters actually do. When potters are asked about their strategies of preparing raw materials, they identify diverse forces that guide them, including tradition, technical necessity, the interconnection between

pot making and other daily activities, as well as explicitly symbolic factors.

*Tradition*

Potters often use the recipes and tools their teachers had used and seldom change throughout their productive lives. They often consciously continue a "tradition" to assert actively their individual identity and social ties.

In Ontario, when it comes to ceramic raw materials, only a general division between "grit" and "shell" temper is typically recognized. However, neither all grit nor all shell is exactly the same. Braun (2003: 6–8) was able to identify at least six different ceramic paste groups based on the texture of granite, intermediate igneous rock, and calcite temper through his petrographic analysis of ceramic thin sections from the Antrex site, a pre-contact Iroquoian site in modern Mississauga. Normally, all these types would be subsumed under the "grit-tempered" heading.

Even using exactly the same raw materials does not presuppose that their preparation will also be the same. When Gosselain and Livingstone Smith (2005: 34) examined the strategies of potters in a 100-km$^2$ area in Africa, they realized that while everyone spoke the same language and used mainly one clay source, they prepared their raw materials according to six different recipes and variation existed both within and between villages. A casual macroscopic examination of the shell-tempered bodies from the Hamilton site, kept at McMaster University, suffices to show a clear division between those with few, larger pieces of shell, and those with more, smaller ones.

*Technical Necessity*

Potters usually insist that, unless they do things in a certain way, their pots will break. This makes them sometimes change their recipes to match the intended function of a vessel or certain parts of a vessel. For example, potters in Mali make two kinds of clay pastes: a "male" and a "female" one. The "male" is coarse and is used for the bottom, belly, and shoulder of a pot, while the "female" is fine and is used for the neck and the outer surface of a vessel, as well as for small pots used to prepare medications or to wash babies. They argue that the reason for such a division is apparent: fine clay looks prettier and using it on the outside of a pot makes the whole vessel look pretty, and it does not scratch the babies (Gosselain and Livingstone Smith 2005: 41). Just as often, however, potters use the same recipe, irrespective of whether they are making a pot for cooking, storing, serving, eating, or transporting.

When it comes to Iroquoian ceramics in general, other than Braun's (2003) and Martelle's (2002) work, there is rarely a systematic consideration of ceramic use. Cooking is often assumed to have been the only activity for which ceramics had been used. There is even less work on the relation between different raw material preparation strategies and vessel function or different vessel parts. Petrographic analyses would have a lot to teach us.

**Connections Between Pottery and Other Activities**

There are clear connections between pottery making and other activities, the most obvious of which are food processing and architectural practices. Food and pots are often prepared with the same tools, gestures, and processes and often at the same locations. At some Bariba villages in Africa, the best clay paste and the best millet porridge involve the same

processes (Gosselain and Livingstone Smith 2005: 41).

Researchers of Iroquoian pottery often mention the absence in ethnohistoric sources of observations related to pottery making (except for some scant information in the case of the Huron). Such lack of information has led archaeologists to implicitly assume that all Iroquoian groups produced pottery in ways similar to those of the Huron, an assumption that Latta (1991) has convincingly criticized. Ethnoarchaeological evidence suggests that we could take another look at ethnohistoric sources and instead of just seeking explicit information on pottery making, look for other activities with which pottery making may have been intimately related, such as food processing or architectural practices, as mentioned above.

Archaeologically, all students of small-scale handmade pottery complain about the lack of pottery-making tools. However, we often expect that those tools will be specialized for pottery making, just as in some cases of large-scale, full-time production, when it is possible that they were not and we should instead take another look at tools and features related with other activities, such as the processing of corn, in the case of the Neutral (Lopez Varela *et al.* 2002).

*Symbolic Connections*

Finally, as mentioned earlier, raw materials have both performance and symbolic characteristics. For example, potters in certain areas in India (those in the black cotton soil area, but also Madhya-Pradesh and some Orissan groups) argue that, whenever they use black cotton soil, they must use dung as a temper, otherwise their pots will crack. Although some claim that donkey dung is the only option, others are equally adamant about the use of cow dung. Ultimately, both options provide an efficient source of finely chopped straw, which does indeed create more pores in the clay paste and helps the vessel to dry without cracking. However, using donkey dung hinders access to a higher status, since donkeys and their products are considered impure and degrade those who use them, unlike cows and their products, which are thought of as sacred and pure (Mahias 1993: 164–165).

In the context of Neutral ceramics, we must take a detailed and systematic look at the kinds of materials potters used, both clays and aplastics, and how they prepared them. It is important to know how shell, granite, or other rocks and minerals were used in Neutral villages, whether they came consistently from particular places, and whether they were local or came from further away. We need to know in what other operational sequences these materials were involved, besides ceramics, and how they were finally discarded.

## LEARNING AND PRACTICING CONTEXTS

If potters' choices have more to do with the social context in which they learn and practice their craft, rather than technical constraints, then it is important to understand how such knowledge, such "traditions," are acquired. Most of the knowledge (technical and symbolic alike) relating to raw materials and their preparation is acquired very early on, often in a very informal setting: "Individuals learn how to select and prepare raw materials by "impregnation," in a participation framework that involves specific social relationships and is part of the wider process of becoming a community member" (Gosselain and Livingstone-Smith 2005: 42).

The implications of such informal learning are many: First, pottery manufacturing knowledge is directly linked to the ways in which individuals interact with each other and, through those interactions, build a sense of self. In Cuentepec, Mexico, to be a *comalera*, a woman who makes *comales*, you must be married. Until then you can learn, you can help, you do indeed acquire the "know-how," but it is not until you are married that you can make *comales* yourself. Building your identity as a *comalera* comes hand-in-hand with becoming a woman (Lopez Varela 2005).

Second, since a number of the steps in the ceramic manufacturing sequence, such as the collection and preparation of raw materials, are often part of the normal housekeeping tasks, children are expected to help, whether they will later on become potters themselves or not. In this way, as they grow up, building their identity, they adopt gestures, postures, techniques and beliefs without questioning them. However, if later in life they move into other communities, or adopt a different identity, then they could indeed change their practices.

Finally, informal learning does not only come from the parents, as ceramic sociology had assumed, but also from peer groups. Thus, when we look at "traditions" we are not looking at families necessarily, but more at communities of practice. As a result, when potters relocate to a new community of practice, as captives, for example, or due to marriage, divorce, widowhood, or personal or economic reasons, the opportunities for change are high. Those are times when they come face to face with other ways of doing and, as a result, become aware of their own practices. Sometimes they adapt to their new community while at other times they insist on their own traditions as they link them to their identity, or believe that, if they alter them, their pots will break. While Luo women in Kenya, who are re-socialized in their husbands' villages by their mothers-in-law, are forced to abandon their own ways of doing (Herbich 1987), in Northern Cameroon Lame and Fulbe potters at the village of Bé stick to their own respective recipes, although they all collect clay from the same source.

It is also important to consider the social position of those among whom the other ways of doing are observed when examining how new practices are adopted. Borrowing from places and/or people that are considered important or renowned has important economic and social connotations. Given that potters often explicitly refer to the people from whom they learned their craft as a way to point out their relations and social ties with them, "borrowing" a choice (such as shell from western groups, if that was the case) would signify an active and explicit statement about desired connections and not just a passive spread of a trait: "The spread of clay processing recipes is not likely to proceed from an "unavoidable contagion" but from socially and culturally mediated relationships between potters" (Gosselain and Livingstone-Smith 2005: 43).

Traditions, then, are far from being stable. They are negotiated and must be actively maintained. Accordingly, their boundaries do not necessarily coincide with ethnic boundaries, whatever those may be, or with such tags as "the Neutral," or "the Huron." Traditions exist within communities that maintain them through practice, and communities of practice suppose actual and recurrent contact. This means that although ways of making pots are far less orderly than we had assumed, they have indeed a

lot to tell us about interactions, at least among potters.

## FORMING POTS

As Gosselain has shown, "… different types of technical knowledge that are acquired during the learning process do not necessarily evolve in the same way" (1998: 102). An interesting stage in the making of a pot and of a potter is that of *forming*. Learning how to form a pot and give it its basic shape seems to require a committed and focused effort from both the apprentice and the teacher. In the case of handmade pottery it often takes anywhere from two to three months all the way to a full year to become proficient in the craft. During that time, teachers must also show their apprentice a technique. They work next to them and intervene to correct mistakes, putting their hands on the hands of the apprentice to show them the right gestures and postures. By the time the apprenticeship is over, these gestures and postures have become motor habits and the new potters neither think about them nor are they aware of them, in a way that learning how to drive a car becomes second nature to our hands and feet.

The strength of muscle memory seems to be extraordinary, so that forming techniques are the most resistant to change of all the ceramic manufacturing stages and the probability that the potter will ever change them is very small (Gosselain 1998, van der Leeuw 1993). All the other stages, definitely the decoration process, but also the raw materials and firing, are far more prone to change through post-learning interactions. When potters find themselves within a new community of practice and wish to blend, when they consciously try to improve a recipe to achieve certain results, or when the social, political, economic, or symbolic context within which they work changes, it is far easier and commoner to alter parts of the sequence that do not involve any muscle memory—parts that are often performed publicly and involve collaboration with other potters or members of the community.

The forming stage, however, rarely imbued with any symbolism, is a stage where the hands take over and this may be the reason why it is the only one that ever seems to coincide with larger social groups, such as linguistic ones:

> It follows that the different stages of the manufacturing process do not all have the same stylistic significance. Being more sensitive to post-learning interactions some production steps could reflect a deliberate identification with or distinction from particular social groups. Without being necessarily concomitant, their evolution could parallel that of designs or vessels' morphological features. Other stages in the manufacturing process prove more resistant to change and could, in a passive or unconscious manner, reflect profound social relationships (Gosselain 1998: 102–103).

This is not to say that forming techniques unfailingly correspond to linguistic boundaries. In Southern Cameroon, for example, although the same forming techniques cross many villages, they do remain significantly smaller than linguistic groups. This restricted regional pattern is common in cases where learning the craft of pottery is informal and remains within the circles of family, friends, and neighbours. Either way,

discovering the distribution of similar forming techniques will certainly give us insights into communities that practiced and regularly interacted together.

It is important to point out here that understanding forming techniques involves more than just a casual examination of whether a pot was made by coils or with a paddle-and-anvil technique. There are many ways of preparing coils, just as there are many ways of adding them together when building a pot. In the case of the paddle-and-anvil technique, for example, which has been argued to be the main way of forming Neutral Iroquoian pots, Van der Leeuw (1993: 244–247), studying ceramics vessels in the Negros, Philippines, has identified at least five different ways of implementing the technique. His research supports Gosselain's argument about the resistance to change of forming techniques and adds to it, examining how different traditions conceptualize shape.

Van der Leeuw points out that there are three aspects of form and forming that are "fundamental conceptual "anchors" of any pottery-making tradition" (1993: 259): topology, partonomy, and sequence. *Topology* refers to the way in which the shape of a pot is perceived: is it horizontal, or vertical? Is it the result of stretching or compressing? Is it the outcome of transforming a sphere, a cylinder, or a cone? *Partonomy* refers to the units out of which a pot is made: is the whole pot perceived as one unit, with one smooth profile?; is it seen as two, or more, units put together?; a rim/collar part, and a body/base part stuck together, for example?; is the pot seen as a number of coils added together? Finally, *sequence* refers to the order in which the pot was made: was it built from the top to the bottom, from the rim downwards to the base?; from the bottom up?; from the shoulder to the top and then the bottom?; was it made out of vertical halves? (Van der Leeuw 1993: 258).

According to van der Leeuw (1993: 259), topology, partonomy, and sequence link pottery making to other techniques and aspects of a culture. They are related to the way particular groups perceive and explore the body, considering certain postures, gestures, and movements as "natural" and others as not. Such body attitudes are widely shared and their perception unconscious and thus very resistant to change.

There is no doubt that if we look in detail at Iroquoian ceramics and the ways in which they were formed, we will find that Iroquoian potters used more than one paddle-and-anvil techniques and, quite possibly, different forming methods for different parts of the vessel (see Holterman 2007: 98–99). Allen (2005), looking at ceramics from two contemporary Seneca villages (Factory Hollow and Dutch Hollow), compared vessel morphology, construction, and decorative techniques. The pattern she found, as expected, was complex. Certain aspects of forming techniques (the use of drawing and pinching a form from a ball of clay using a base support), as well as the general proportions of the vessels, were identical between the sites. However, more detailed characteristics, such as the shape of the bottom and shoulder differed both within and between the sites. In particular, shoulder shape suggested the use of distinct paddle and anvil techniques, while some modifications to the form at the base of the collar were more common in one village than the other (Allen 2005: 9–10). It is these different tendencies, she argued, that "may reflect variability in cultural identities between these villages" (p. 9). For

this paper, the particular interpretations that Allen provided are of no relevance. As she states herself, further contextual work is needed before she can differentiate between alternative interpretations. What is important is that her consideration of Iroquoian ceramics through the wider lens of ethnoarchaeological ceramic studies allowed her to recognize variables, such as the relative proportions of different parts of a vessel, as important, and thus look for the source of ceramic variability in the social relations and movements of women potters within and between villages, and the negotiation of their identities in the context of pottery consumption within each village.

## CONCLUSIONS

The approach advocated in this paper is neither easy nor quick. It asks that we move beyond looking at pots as passive objects and attempt to discern the dynamic webs involved in their production and use. It makes apparent that pot making is rarely, if ever, isolated from other daily activities and projects. It requires the examination of complete operational sequences, all the way from the raw material selection and preparation, to vessel formation, finish, firing, use, and final discard, so that variability can be understood. It is not enough to describe attributes any more. We must start talking about the activities that brought those attributes about. Two vessels may be equally black on the surface, but one was carefully fired under consistently reducing conditions, the other was fired under mixed and uncontrolled conditions, only to be smudged at the very end of firing. The point is not only to show that the pot was black, but to reveal the many different ways in which the potters might have chosen to achieve that blackness, so that we can then ask "why? Why in so many or so few ways? Why in those ways and not in others?"

Thus, a student of ceramics can no longer be content to know only decorative types, or gross categories of attributes, such as the grog- vs. grit-temper options in raw materials. Choices are learned and practiced and they respond to a multitude of factors, from the most functional and mundane to the most spiritual and symbolic. It follows that some can be widely shared, while others can be rather individualistic, and we cannot know in advance which are going to be which. Traditions are fluid and actively maintained by people who learn and practice together and this is why they have a lot to teach us about human relations and interactions. However, to be able to access those choices, we need the observational and analytical power of methods that come to us from materials sciences, geology, or nuclear physics. Students of Iroquoian pottery must be as familiar with callipers and rim-diameter charts as they are with scanning electron and petrographic microscopes, X-ray diffraction machines, and neutron activation laboratories. Finally, no student of ceramics can study sherds and isolate pot making from other activities, ignoring other lines of evidence related to the landscape, or to food preparation or architecture, among others.

When we combine the analytical strength of techniques borrowed from geology, materials science, chemistry, and biology with the interpretive power of social theory, we can explore group and individual dynamics in the context of small-scale daily activities. When these activities are looked at over the long term, in a regional scale, they can reveal a far more nuanced picture of regional interactions than the one we currently have.

Such analysis can start with no delay. The infrastructure and expertise for the analytical techniques is at our fingertips in places like McMaster University, with facilities such as the newly created Centre for Interdisciplinary Research on Archaeological Ceramics, the well-established Brockhouse Institute for Materials Research, and the McMaster Nuclear Reactor. The holistic theoretical vision towards technology is becoming stronger as more applied examples are being published from around the world. The material awaits in museum, university, and cultural resource management collections requiring no new excavations.

I firmly believe that this small-scale approach can give a breath of fresh air to Iroquoian archaeology, providing new ways to answer old questions, adding new questions about the Iroquoian past and contributing significantly to international research on human technological behaviour and the adoption of innovation.

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## NOTES

1. See Hart (2001) and Schulenberg (2002) for reviews of competing models and the role of ceramics in testing them.
2. Until recently, there has been a difference in the typical way Canadian and American researchers have approached Iroquoian ceramics. While scholars such as Allen and Chilton have followed closely developments in the wider ceramic literature (see, for example, Allen and Zubrow [1989] for an analysis of Iroquoian ceramics influenced by ceramic ecology; Allen [1992] for an economic analysis of ceramic production; Allen [2005] and Chilton [1998] for approaches emphasizing the social nature of ceramic production), Canadian colleagues have often adhered to cultural historical approaches. This paper contributes to the work of Allen and Chilton and a number of young Canadian investigators (e.g., Braun [2003], Martelle [2002], Watts [2006]) who wish to see ceramics as more than markers of ethno-chronological typologies.
3. In 1982, Fitzgerald argued: "That the late prehistoric ancestral Neutral Lawson and Southwold sites in southwestern Ontario are devoid of shell-tempered ware (Robert Pearce and David Smith, pers. comm. 1980) lends credibility to the contention that shell tempering appears during the protohistoric, but reaches high concentration only on the more northerly historic Neutral sites after *ca.* 1615" (1982: 95). I have presented Lennox and Fitzgerald's claim that there are indeed traces of shell-tempered ceramic in prehistoric sites, assuming that, in the eight years between the two publications, the prehistoric material was better understood.
4. Another hypothesis about the origins of shell-tempered ceramics in particular Neutral sites considers the Wenro, who are known from ethnohistoric sources to have sought refuge in Neutralia and in Huronia in 1639 (see Lennox 1981: 356–358). Archaeologically, the problem with this hypothesis

is that there are no shell-tempered pots identified in Huronia, nor are the ceramic types identified there as "Wenro" similar to the material considered "foreign" at the Neutral sites (Lennox 1984: 358).

5. For the latest detailed discussion of the effects of shell tempering on the strength, toughness, and thermal shock resistance of ancient ceramics see Tite *et al.* (2001) and the comments and reply by Feathers, Schiffer *et al.* (2003). Feathers (2006) provides a comprehensive examination of the pattern of the adoption of shell-tempered pottery in prehistoric Eastern North America and an alternative interpretation for the reasons of this widely spread choice.
6. This scenario assumes that maize was indeed cooked in ceramic pots. Morton and Schwarcz (2004) have suggested that although maize formed indeed a large part of the Iroquoian diet, it was primarily the flesh of maize-fed animals, rather than maize itself, that was cooked in the pots. Their sample, comprising 137 residues from 45 sites (*ca.* 680 BC to AD 1725 cal.) for carbon isotopic analysis and residues from 32 sites for nitrogen isotope ratios includes two Neutral samples (*ca.* 1640–1650). It is not clear whether the samples are shell- or grit-tempered. It would be worth repeating the same analysis on grit- *vs.* shell- *vs.* grit-and-shell-tempered ceramics from Neutral sites to consider possible functional differences between the three ceramic pastes.
7. Vitelli (1999) has urged archaeologists to think in the same way regarding the time before the creation of the first pottery to avoid functionalist interpretations of the introduction of pottery as a technology.
8. When shell-tempered pots are fired at about 850°C, the calcite of the shell decomposes, forming lime and carbon dioxide. When that clay paste cools down, the lime absorbs moisture from the atmosphere, expanding in volume and causing cracking and spalling, which can crumble the vessel. The addition of salt is known to prevent severe crumbling (Rice 1987: 98). It is highly unlikely, however, that the Neutral Iroquoian shell-tempered pots had been fired at temperatures around $850^0$ C. Although the issue needs to be researched systematically, one can imagine the left-over marine shell from bead-making being used in the production of ceramics.
9. For Africa, see Barley 1994; Da Silva 2003; Dietler and Herbich 1998; Gosselain 1992a, b, 1994, 1998, 2000; Gosselain and Livingstone Smith 2005; Herbich 1987; Livingstone Smith 2000, 2001; Sillar 2000; Smith 1989; For India, see Mahias 1993; Roux 1994, 1995, 1997, 2003a, b. From the Americas: Arnold 1985, 1989, 1993; Arnold 1991; Bowser 2002; Deal 1998; Hoskins 1998; Lopez Varela 2005; for the Philippines, see the vast literature from the Kalinga Ethnoarchaeology Project under the direction of William Longacre.
10. In this and the preparation section I draw heavily upon the work of Gosselain and his colleagues throughout Africa, and especially from Gosselain and Livingstone Smith (2005), where they expertly summarize observations of many years of ethnoarchaeological work. The section on forming discusses Gosselain's (1998) and van der Leeuw's work (1993) in detail.

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