TRACKING GENDER AND TECHNOLOGY IN PREHISTORY: A CASE STUDY FROM BRONZE AGE CYPRUS

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Introduction

This paper presents a brief case study based on the Chalcolithic/Early Bronze Age transition, which took place about 2400 BC, on the island of Cyprus in the eastern Mediterranean. This transition is characterised by an array of innovations in technology, economy and society (Table 1). These include the introduction of metallurgy (specifically the mining and processing of copper), of new species of animals (specifically cattle and donkeys) and other agricultural technologies, such as the sole-ard plough and backed sickle blades (replacing hoe-based agriculture), of a rectilinear architectural system (replacing a circular one) and of new domestic technologies, such as the vertical warp-weighted loom, low-whorl spinning, direct fireboiling vessels and new ceramic forms. These innovations were not the result of trade, diffusion or independent invention in Cyprus. Rather, the majority may be traced to an Anatolian source and it is now widely accepted that they signal the arrival of communities of Anatolian migrants to the island in about 2,400 BC.

	Chalcolithic	Early Bronze Age
Metallurgy	No significant use of copper	Ore extraction and production of copper for tools, weapons and ornaments
Agriculture	Hoe-based Sheep, goat, pig, deer used for pri- mary products	Plough-based; backed sickles Cattle, donkeys, sheep, goat, pig, deer, with greater use of secondary products
Architecture	Single-roomed circular houses Mud-wall construction	Multi-roomed rectilinear houses Mould-made mud-brick construction
Burial	Pit graves in settlement area	Rock-cut chambers in extramural cemeteries
Textile pro- duction	No evidence available	Low-whorl spinning Vertical warp-weighted looms
Cooking/ heating	No direct-fire boiling pots	Cooking pots; hearth surrounds; baking pans; braziers; ovens
Ceramics	Vessels without handles Painted decoration	Vessels with handles Incised decoration

Table 1. A summary of differences in technology, economy and society between the Cypriot Chalcolithic and Early Bronze Age

¹ For a more detailed discussion of these innovations see Webb (2002a); Webb and Frankel (1999, 2007); Webb, Frankel, Stos and Gale (2006); Frankel, Webb and Eslick (1996); Frankel (2000, 2005).

² Most scholars accept that southwestern Anatolia or/and Cilicia is the likely source of most of the innovations which mark the beginning of the Cypriot Early Bronze Age, but the process by which they reached Cyprus has long been a source of controversy. See, in particular, Knapp (1990, 1994, 2001). A mid-third millennium migration to Cyprus from southern Anatolia is now, however, broadly accepted. See Bolger (2003); Steel (2004); Keswani (2004). Peltenburg (2007) and Bolger (2007) have recently argued for a complex long-term process, whereby contacts between Cyprus and Anatolia began during the Late Chalcolithic and were followed by intensive interaction culminating in the arrival of settlers at the beginning of the Bronze Age.

Third millennium BC Cyprus therefore provides an opportunity to investigate a number of issues relating to technology across a relatively short time frame within a closed island environment. More specifically, it provides an opportunity to investigate the part played by embedded gender roles in technology transfer, adaptation and transmission.

A particular understanding of technological practice underlies the following discussion and is best made explicit at this point.

- 1. Technology transfer is rarely if ever achieved by the movement of objects alone. Rather, it requires the movement of people habitually engaged in the practice of that technology. Thus, in the case of Cyprus, the appearance of new technologies across an array of behaviours implies the movement of whole communities—of men, women and children, of farmers, shepherds, metal-smiths, cooks and potters.
- 2. Technologies are embedded in social agency.³ They involve explicit and implicit knowledge, normally achieved through intergenerational learning, the use of particular tools and motor skills and an array of social values, attitudes and beliefs.
- 3. The adoption, rejection or transmission of particular ways of making and using objects frequently becomes a means of reaffirming, contesting or negotiating social identity.

Within this conceptual framework I will look at three processes involved in the introduction and long-term success of new technologies:

- 1. *Technology transfer*. Ie the initial arrival in Cyprus of a whole array of new ways of doing things.
- 2. *Adaptation*. Ie the subsequent innovations required to adapt these new ways of doing things to a different physical and social setting.
- 3. *Transmission*. Ie processes of *enculturation*—as newly arrived practitioners passed on their knowledge and skills to subsequent generations within their own communities; and *acculturation*—as these same practitioners passed on their knowledge to indigenous inhabitants.

An initial problem: tracking women's work

Given that this paper is concerned with the visibility of gender, a prior question arises at this point. If technologies are transferred by people engaged in the practice of those technologies, we can only proceed if we know who was doing what. It is generally assumed that women in pre-state societies were engaged in domestic production while men practiced animal husbandry, ploughed, hunted, fought and processed metals. Is such a division of labour visible in the archaeological record of prehistoric Cyprus?

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³ This argument is much indebted to the work of Dobres and, in particular, Dobres 1995, 2000, 2001. See also Lemonnier (1993) and van der Leeuw (1993).

Not surprisingly, much of the evidence is problematic. Locating men or women by reference to archaeological residues often simply assumes its initial premises (eg that grindstones are indicative of women's activities and metalwork of men's activities). In Cyprus, also, identifying gender-specific artefacts in burial contexts is rarely possible because of poor preservation of skeletal remains and the distortion of burial/artefact associations through re-use, flooding and looting of tomb chambers.

The iconographic record—principally small clay figures and scenic compositions—offers more direct insights.⁴ A series of small-scale compositions, modelled in the round, show specific activities and suggest that certain tasks *were* consistently performed by women. Women are repeatedly represented in one or other of three major capacities—as lovers or partners; as mothers; and as a source of productive labour. This last category includes depictions of grinding, pounding, baking and pot-making. Where sex is indicated, the participants are exclusively female.

This repeated portrayal of women in secondary food processing and the lack of overlap between male and female tasks infer a sexual division of labour, in which men and women had consistent gender identities which were systematically related to their productive roles. Within the household these divisions probably served as a dimension of economic production and reproduction, with men engaged in agricultural work and animal husbandry and women in the transformation of the resulting products and raw materials into useful objects for consumption and storage.

We can, then, accept with some confidence that there was a sexual division of labour in Early Bronze Age Cyprus—one which saw women primarily engaged in activities such as food processing, pottery making and child-rearing. By extension, we can assume that women were the primary practitioners of technologies within these domains. As practitioners and active social agents, we may also assume that the transfer, adaptation and transmission of these technologies were largely if not exclusively in the hands of women.

1. Technology transfer

Prominent amongst the changes visible in Cyprus at the beginning of the Early Bronze Age are innovations in cooking practices and ceramic and textile production. The appearance of these new domestic technologies is a key element in a wider argument which proposes that the transformations in Cypriot material culture in the mid-third millennium were brought about by a migration of extended family groups. As Elizabeth Barber has argued, when non-prestigious domestic equipment invades an area we can proceed from the strong hypothesis that not only men but also women have moved. In the domains of food production and preparation and other domestic maintenance activities women were clearly present among the colonising groups as social agents, decision makers and producers and reproducers of material culture.

These technologies are also encoded with information on bounded cultural practices which allows us not only to recognise that women were present among migrating groups but also to identify their point of origin.

⁴ This material is most conveniently accessed in Karageorghis (1991).

⁵ The case is argued more extensively in Webb (2002b).

⁶ Barber (1991), 299.

1.1 Textiles

This is particularly clear in the case of technologies associated with textile production. In a major study of prehistoric textiles Barber has traced the origin and spread of spinning and weaving technologies across Europe and the Near East from Neolithic times.⁷ Prior to the second millennium four major zones of autonomous textile development can be distinguished on the basis of loom and fibre types and the position of the whorl on the spindle. In the northwest zone (ie across Anatolia and Europe) the vertical warp-weighted loom, wool and flax production and low whorl spindles (ie spindles with whorls mounted below the mid-point) were in common use. These aspects of textile technology differ markedly from those in use in Egypt and the Near East, where the horizontal ground loom and high whorl spindles (ie spindles with the whorl above the mid-point) were the norm.

In Cyprus shaped terracotta whorls appear for the first time at the beginning of the Early Bronze Age. They have clear typological antecedents in Anatolia. They appear, also, to have been placed below the mid-point of the spindle (ie they belong to a low whorl spinning tradition). This is suggested by a pattern of abrasion found on the lower end of almost all whorls, resulting from contact between the whorl and the ground during spinning—as well as by clay spindle models and a surviving copper spindle with a whorl in position on the shaft. Clay loomweights, present in the earliest Bronze Age deposits, also show that the vertical warpweighted loom was present on the island at the beginning of the Early Bronze Age. This evidence places Cypriot Bronze Age textile production in the north-western zone of development and leaves little doubt that key elements of this intrusive technology were introduced by women from this region—ie, most probably, from Anatolia.

1.2 Cooking

Other domestic technologies introduced to Cyprus in the mid-third millennium also suggest the movement of women of Anatolian origin. These include cooking practices involving the use of baking pans, braziers, above-ground ovens and horseshoe-shaped hearth surrounds, which also served as supports for newly introduced clay cooking pots. These innovations in cooking and heating technology suggest the introduction also of a new 'culinary grammar': ie not only of new utensils but also of radically new ways of preparing food and a significant expansion in the range of foods utilised.

This is most clearly seen in the case of specially designed, clay cooking pots used for the preparation of stews, porridges and other dishes requiring long, slow cooking over minimal heat. These direct fire-boiling vessels enabled the Cypriots, for the first time, to convert milk into yogurt and cheese, thereby prolonging the use-life and nutritional value of one of their principal agricultural products.

⁷ Barber (1991).

⁸ The earliest extant examples from stratified settlement deposits come from Marki *Alonia* (Frankel and Webb (2006), 160–62, figs 5.5–5.6, pl. 51) and Kissonerga *Mosphilia* (Peltenburg (1998), 199, fig. 100, nos 16–20, pl. 37.9).

⁹ Webb (2002a).

¹⁰ The earliest known Bronze Age loomweights come from Marki *Alonia* (Frankel and Webb (2006), 175–77, fig. 5.17, pl. 51.

¹¹ This argument is presented more extensively in Frankel and Webb (1996), 194 and (2006), 169–75; Webb (2002a); Webb and Frankel (1999) and Crewe (1998).

¹² For a more extensive discussion of pans, braziers, ovens and hearth surrounds, or hobs, see Frankel and Webb (1994) and (2006), 17–22, 130–33, figs 2.5–2.8, 4.42–4.45, pls 9, 10, 47.

2. Adaptation and improvement

The subsequent development of these technologies in their new homeland can also be assumed to have been in the hands of women. These concern some of the most fundamental aspects of living and must have impacted significantly on the health and welfare of individuals and communities. This is particularly evident in the case of the clay cooking pot. These vessels underwent considerable evolution in the generations following their introduction, resulting in greatly increased efficiency. As women were both potters and cooks, the initial process of adaptation to new clay sources and ongoing innovation are likely to have been achieved by women.

Developed Cypriot cooking pots show a remarkable degree of adaptation to function.¹³ They are consistently fired red-brown, suggesting the selection of iron-rich clays to produce dark-coloured fabrics effective in retaining heat. Similarly, they have dull, dark surfaces. Shallow vertical striations on the exterior, together with voids left by burnt-out organic temper, improved heat absorption and increased evaporation and permeability by creating an enlarged surface area.

They also have non-plastic inclusions, predominantly quartz. Quartz has a high thermal coefficient and expands by 2% of its volume when undergoing inversion from its α to β form at 573°C. During firing of the vessel, the quartz particles expand at the inversion point, opening up the texture of the clay matrix. On cooling the grains of quartz contract but the surrounding clay does not. As a result voids appear around the inclusions which help counteract expansions and contractions of the pot walls during heating and cooling on the cooking fire and arrest cracks. Large voids in the clay matrix were also achieved by adding organic temper, which subsequently burned out during firing. These also act to arrest cracks and improve resistance to thermal stress.

Resistance to thermal shock is a major consideration, also, in the forming of cooking vessels. Thermal shock is caused by the differential temperature between the exterior of the vessel, exposed directly to the fire, and the inner wall which is kept cooler by the contents (and, conversely, the more rapid cooling of the exterior once the vessel is removed from the fire). Thermal gradients, which cause cracking, can be minimised by ensuring that there are no sharp angles in the vessel body. Hence developed Cypriot cooking pots have simple body contours and broad rounded bases, allowing a more regular exposure of vessel and contents to heat.

Care was also taken to ensure a uniform thickness of the vessel wall, as thicker areas localise maximum stresses upon heating and cooling. This is especially evident in the method of neck attachment, where the neck/body join involves little or no build up of excess clay. Cooking pots are also consistently thin-walled. This improves the conduction of heat, reduces the thermal gradient between surfaces and allows moisture to convert rapidly to steam during cooking.

Cypriot cooking vessels are also ovoid and deep-bodied to conserve heat, have large openings for adding and removing food and a low neck with flaring rim to prevent boiling over and reduce evaporation. Also characteristic are the high asymmetrical handles, for manoeuvring the vessel in the fire and pouring, lifting and carrying. The rounded bases, also, are

¹³ On Cypriot Early and Middle Bronze Age cooking pots see Frankel and Webb (1996), 166–70, (2006), 133–37; Webb and Frankel (2004); Pilides (2005).

¹⁴ Bronitsky and Hamer (1986), 98; Grimshaw (1971); Jacobs (1983), 8.

¹⁵ Woods (1986), 169, fig. 12; Rice (1987), 367.

well-suited to use with clay hearth surrounds which raised the vessel above the fire, reducing the effective heat to which it was exposed while in use.

The remarkable sophistication of these vessels could not have been achieved without considerable experimentation and continuous feedback between potters and cooks. The fact that women were active in both domains—that is, the fact that women were both makers and users of these vessels as well as responsible for the intergenerational transmission of their associated technologies—must in large part explain the process and quality of these achievements.

3. Transmission

In Cyprus, during the early years of the Early Bronze Age, both enculturation and acculturation processes were at work. 16

Enculturation—that is social reproduction within descendant migrant communities— followed the normal pattern of intergenerational transmission and slow cumulative change as 'immigrant technologies', social norms, attitudes and modes of behaviour were absorbed, enacted and transmitted.

Of greater interest are processes of acculturation arising from interaction between migrant and indigenous communities, with subsequent changes in the cultural patterns of both (Table 2). What forms did this interaction take and, specifically, what role did women play?

It is clear from the archaeological record that the indigenous Chalcolithic communities in Cyprus began, albeit slowly, to be affected by the presence of immigrant (ie Bronze Age) communities with their radically different technologies. Some innovations within these indigenous communities can be attributed to casual interaction and cultural borrowing—visible, for example, in the recovery of trinkets and small tools of copper. These individual items crossed the permeable boundary between the two groups relatively easily. The adoption of complex technologies (such as plough agriculture) and of significantly different behaviours, however, required different relationships. In this context learning is a key component. The acquisition of new skills requires both an appropriate social context and a close association between expert and novice.¹⁷

Material adopted	Implied mechanism of interaction	
Minor trinkets	Casual interaction, cultural borrowing	
Picrolite, copper artefacts	More structured exchange	
Ceramic technology		
Textile technology	Movement of women in virilocal marriage pattern	
Cooking practices	Movement of women in virnocal marriage pattern	
Plough agriculture	Interaction/movement of men in uxorilocal marriage pattern	
Metallurgy		
Cattle/donkeys		
Burial customs	Movement of people	
Architecture	Overall social transformation	

Table 2. Mechanisms of interaction leading to the transfer or adoption of cultural elements and technologies between indigenous and settler communities

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¹⁶ For a more detailed discussion of enculturation and acculturation in Cyprus at the Chalcolithic/Bronze age transition, with references, see Frankel (2005).

¹⁷ There is a considerable literature on formal and informal modes of learning in non-literate societies. See eg Pelissier (1991).

It is also possible to see this process in terms of gender. Assuming that women were potters, weavers and cooks, the earliest evidence for significant contact between indigenous communities and new settlers suggests the movement of women. That is, the earliest indications of contact take the form of innovations in textile production and pottery form and decoration, suggesting that initial technology transfer from settler to indigenous groups took place in the domestic sphere—possibly as a result of a movement of migrant or descendant migrant women into indigenous villages in a pattern of virilocal marriage alliance. As these individuals moved across communities, they maintained their own ways of making and using objects and participated in the enculturation of their children, ensuring that these new technologies were not lost or subsumed by the host community.

The differential timing of the adoption of innovations at Chalcolithic sites suggests several stages in an evolving process of interaction and acculturation between migrants and pre-existing populations. At some times we may suggest that women, and at other times men, moved, as inter-marriage played its part as a key element of boundary arbitration. Notably, Chalcolithic people took longer to modify more deeply embedded aspects of everyday practice, retaining their circular architecture, for example, well after other intrusive elements had been adopted. Embedded gender roles appear to be one explanatory factor in this complex process. Women—as wives, mothers, potters, weavers and cooks—were involved in specific forms of interaction and responsible for the transfer of particular technologies. In tracing the residues of these technologies we can trace the movement of women between communities and gain some understanding of their role as agents of transmission and acculturation.

Conclusion

It is often assumed that women can be regarded as responsible for the invention, transfer and transmission of technologies located within the domain of women's work. This is likely to be the case. When it comes to the archaeological evidence, however, we are on firmer ground with regard to the last two. The transfer and transmission of complex technologies can only be achieved through habitual practice and intergenerational learning. Thus, they can only be achieved by active practitioners operating within an active social context. Therefore, those who were engaged in food preparation, cooking, pottery making and textile production will be those who were responsible for both the lateral transfer (between groups) and vertical transfer (between generations) of the physical skills and knowledge involved in those activities. We can make a strong case that these were women.

The issue of invention is more difficult. While it is probable, once again, that practitioners were responsible for radically new technologies, such specific events in the history of technology are rarely, if ever, visible in the archaeological record.

Two further observations arise from the archaeological data. Firstly, a focus on settlement excavation means that domestic landscapes are those which most often engage the attention of archaeologists. Domestic technologies are therefore likely to form the greater part of the archaeological record. Secondly, domestic technologies involve small-scale, personal interactions between closely related individuals. They are therefore likely to be conservative and to reflect finely nuanced and deeply embedded aspects of cultural and social identity, particularly with regard to culinary practices and food preferences. Many male activities, on the other hand, took place elsewhere in the landscape. These are less often reflected in the ma-

terial record and more likely to have been influenced by external factors. Thus different technological domains relate to different levels and forms of cultural interaction. Recognition of these has significant explanatory value within archaeology (see Table 3).

Finally and more specifically, technologies are grounded in social practice. Our Cypriot case study suggests that gender, as part of social identity and practice, is similarly inscribed onto the world of material resources and technological activities. Archaeological residues can be used literally to track the movement of women (and men) in prehistory. This provides us with a valuable interpretive tool with which we can, in some circumstances, identify embedded social practices, trace the patterned movement of gendered individuals and measure rates of change and innovation within different technological domains.

Technological domain	Behavioural and archaeological implications
Male Technologies (eg metallurgy; hunting; ploughing; animal husbandry; transport; defence)	Likely to be practiced outside settlement Unlikely to enter the archaeological record Likely to be influenced by external interaction Likely to change rapidly in response to external stimuli Unlikely to be a sensitive indicator of social/ethnic identity
Female Technologies (food processing, preparation, storage; childrearing; textile and pottery manufacture)	Likely to be practiced inside settlement Likely to enter the archaeological record Unlikely to be influenced by external interactions Likely to change slowly and cumulatively Likely to reflect deeply embedded social/ethnic identity

Table 3. Aspects of behaviour associated with male and female technologies

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