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Intra-Cross-Craft Interaction and Cross-Craft Interaction in the Architectural Domain from the Bronze Age to Archaic Period in Mainland Greece[1]

Abstract

This paper examines the evidence for intra-cross-craft and cross-craft interaction for architectural innovations in mainland Greece from the Early Bronze Age to the Archaic period. Ceramic roofing tiles of the Early Bronze Age, Late Bronze Age, and Archaic period are given particular focus due to their long history in the region and their unmistakable materialisation of both forms of interaction. Following a discussion of this case study, a survey of architectural innovations during the study period is presented. The survey largely confirms the observations about the pace, visibility, and influences on both intra-cross-craft and cross-craft interaction that were noted for the ceramic roofing tiles. It shows that intra-cross-craft interaction never seems to occur without cross-craft interaction, and that the latter was often obscured in the final appearance of the architectural feature; the same is not true for the contributions from non-architectural craftpersons.

Keywords: Greek architecture, architectural innovation, clay building materials, intra-cross-craft interaction, cross-craft interaction, Aegean prehistory, Greek archaeology

Introduction

In most pre-modern societies, non-elite, domestic structures were typically built by the people living in them, often with the help of their kin or community. This was most likely true in mainland Greece in the Bronze and Early Iron Age (Table 1).[2] The typical vernacular structures of these periods were stone-and-mud brick constructions with flat or pitched roofs (Fig. 1).[3] Although rather modest in appearance, such structures required a diverse set of building techniques and materials. Stones were first collected and stacked in a deliberate manner to form the solid wall socles. Next, hundreds of mudbricks were mould-formed, sun-dried, and stacked on the socles. Timber was then collected, shaped, and arranged to create frames for the windows/doors, ceiling, and roof. Only after this were the roofing materials collected, processed, and arranged. To ensure a longer lifespan for the building, lime or mud plaster was prepared and applied to the walls. Finally, any fixed or semi-fixed features, such as clay bins or hearths, were constructed in place.

Of course, many of the tasks were not unique to a particular architectural feature or the architectural domain specifically. For instance, the shaping of timber was necessary for various other architectural elements, as well as outside crafts, such as furniture or wooden tool-making. Thus, typical stone-and-mudbrick vernacular constructions incorporated both cross-craft and intra-cross-craft interaction.[4] Unfortunately, for anyone studying such craft interactions, however, the specific field in

[1] I would like to thank Stephanie Aulsebrook and the University of Warsaw for inviting me to speak and present my paper in this volume. I also thank the Greek Ministry of Culture and the American School of Classical Studies at Athens for facilitating and/or permitting my visits to numerous archaeological sites and collections of ceramic roofing tiles.

[2] Jazwa 2016.

[3] See, among many others, Fagerström 1988; Darcque 2005; Wiersma 2014; Jazwa 2016; 2021.

[4] For definitions and discussion of these terms (along with references), see Aulsebrook's (this volume) introduction to this special issue.

Table 1. The absolute and relative chronology of Mainland Greece during the study period. All dates approximate and BC.

Early Helladic (EH) = Early Bronze Age	
EH I	3100–2650
EH II	2650–2200
EH III	2200–2100
Middle Helladic (MH) = Middle Bronze Age	
MH I–III	2100–1700/1600
Late Helladic (LH) = Late Bronze Age	
LH I	1700/1600–1600/1500
LH II	1600/1500–1410/1390
LH IIIA	1410/1390–1315/1300
LH IIIB	1315/1300–1190
LH IIIC/Submycenaean	1190–1000
Early Iron Age (EIA)	
Protogeometric (PG)	1000–900
Geometric (G)	900–700
Archaic	700–479

which many of these tasks, especially the very basic ones such as the retrieval and stacking of stones in deliberate arrangements, were initially developed is unlikely to ever be ascertained. Similarly, it is impossible to tease apart the precise origins and direction of the interaction among crafts due to the ubiquity and long history of vernacular architecture and its associated activities. More promising contributors to such studies are the numerous innovations and additions to the architectural domain that occurred throughout the Bronze and Early Iron Ages in mainland Greece. For instance, it is much clearer when and where the ceramic tiled roof was invented and developed within mainland Greece.[5] Careful study of this and other architectural innovations can, therefore, reveal how these technologies relied upon, added to, or altered techniques and methods that had already applied to other areas of construction (intra-cross-craft interaction) and/or incorporated techniques from other craft domains of the period (cross-craft interaction).

Although several different architectural features and innovations have been incorporated into one final product (the building), the innovations can be studied individually as additions to vernacular traditions. Not only were the innovations never accompanied immediately by a complete revision of fundamental building techniques and materials, but the building construction never relied entirely upon one or more specialist craftspersons.

Fig. 1. A modern mudbrick structure in Greece that possesses many of the features of the prevailing vernacular methods in the region (photo by K. Jazwa).

[5] Wiencke 2000; Marzolff 2017; Jazwa 2018; 2020.

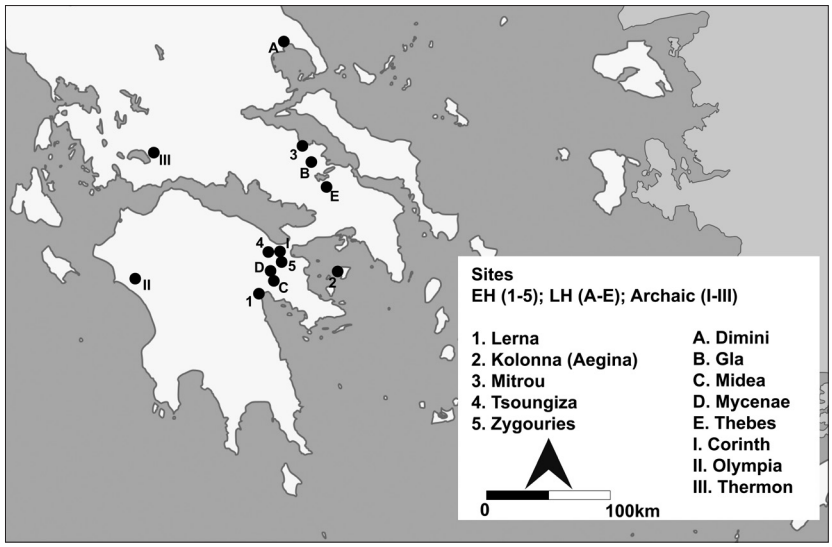

Fig. 2. A map of mainland Greece and location of sites mentioned in the text (compiled by K. Jazwa).

The production of other elements of the building (*e.g.*, stone foundations, mudbrick walls, timber framing) were accessible to and practised by nearly every inhabitant of mainland Greece. This is true even for elite or monumental constructions of these periods. Only with the construction of the Temple of Artemis at Kerkyra in 580 BC, a building made almost entirely of worked stone, does a substantial deviation from the vernacular, such that non-craft specialists were almost entirely unnecessary in its construction, appear in the study area.[6]

In this paper, the variety and pace of intra-cross-craft and cross-craft interaction evident in mainland Greek architecture of the Early Bronze Age to the Archaic period are examined and compared among periods. The invention of ceramic roofing tiles in the Early Helladic (EH), Late Helladic (LH), and Archaic periods is first offered as an illustrative case study. Following this discussion, other architectural innovations/additions from the study period are surveyed and the apparent intra-cross-craft and cross-craft interaction noted. The results attest to the importance of both types of interaction, and demonstrate that they were equally stimulated during periods of increasing socio-political complexity and depressed during others.

Ceramic Roofing Tiles

Ceramic roofing tiles were independently invented in mainland Greece on three separate occasions: the EH period, Mycenaean (LH) period, and the beginning of the Archaic period (Fig. 2).[7] In the first two instances, the technology was widely used for several centuries before being abandoned; only after the third episode of invention did the technology endure. In this section, each episode of roofing tile use is briefly described, and the outside craft and architectural influences are emphasised.

EH Tiled Roofs

EH ceramic roofing tiles are thin, rectilinear slabs of clay *c.* 20–25 x 20–25 x 1–2 cm. They were occasionally accompanied by similarly sized schist roofing tiles. All tile types were arranged in a shingle-like arrangement on the buildings' roofs (Fig. 3).[8] This roofing system appears to have been developed at the end of the EH I period and continued to be constructed during EH II, before it became a casualty of the accompanying sociocultural changes and transition to EH III.[9] The tiles roofed a variety of structures including the period's corridor houses, fortifications, and domestic buildings, but they never became the primary roofing method in mainland Greece nor were they adopted outside the mainland. Instead, vernacular traditions – pitched thatch and/or flat, unfired clay roofs – persisted.[10]

Although EH ceramic roofing tiles appear to have been produced without a single, standard production method, the *chaîne opératoire* of one subgroup, *i.e.* those produced by the mould-and-cut method, has recently

[6] For earlier monumental construction methods, materials, *etc.*, see Barletta 2001.

[7] For an overview, see Winter 1993, 8–10; Sapirstein 2008, 29–78.

[8] Caskey 1954; Wiencke 2000, 197–307; Marzolff 2017; Jazwa 2018; 2020.

[9] Jazwa 2018. For this period of transition, see Caskey 1960; Forsén 1992; Maran 1998; Weiberg, Finné 2013.

[10] Jazwa 2020.

Fig. 3. A schematic representation of typical EH II ceramic roofing and the arrangement of these tiles on the roof (drawing by K. Jazwa).

been reconstructed.[11] This technique is recognised among several assemblages, including Mitrou's, Tsoungiza's, Lerna's, Tiryns's, Kolonna's, and Zygouries's. With this, prepared clay paste was first spread in a long, narrow mould, before individual tiles were cut by making single slices through the narrowest width of the clay pad; these formed tiles were then dried and fired. Such a production process demonstrates clear interaction with other tasks in both the architectural repertoire (mudbrick making) and non-architectural craft traditions (pottery production). Whereas the latter is evident in the preparation of the refined clay paste and expert firing of the tiles, the former is manifest in the use of a mould for the forming. The addition of chopped organic (straw/grass/chaff) temper to the clay paste and the use of a specially prepared production surface covered by a suitable parting agent, such as grass, straw, or sand, are also shared with mudbrick making, along with another architectural feature of the EH period: monumental clay hearths.[12] Consequently, the development of the ceramic roofing tiles reflects an entanglement of multiple influences, including both cross-craft and intra-cross craft interaction.

LH Tiled Roofs

Nearly a millennium after the EH tiled roof technology was abandoned, the LH IIIA inhabitants of mainland Greece again turned to fired clay for roofing some buildings, but this version was considerably different in form. Unlike the EH ceramic tiled roofs, the Mycenaean roofing system required two distinct varieties of ceramic roofing tiles: pan and cover tiles (Fig. 4).[13] The flat pan tiles have walls on two parallel sides (*c.* 4–8 cm) and are slightly longer (*c.* 50 cm) than they are wide (*c.* 40 cm) with the width tapering at one end. The cover tiles are semi-cylindrical, *c.* 45–60 cm long, also with a tapered width. The roof itself was formed with the pan tiles first covering the roof surface such that the wall of one pan tile abutted a wall of another pan tile on either side. The narrower ends of the tiles then slotted into the wider end of the tiles in the row below them. With the pan tiles thusly arranged, cover tiles were placed over the pan tiles' abutting walls.

Unfortunately, the architectural contexts of the Mycenaean roofing tiles are not as well known as in the EH period, because most LH assemblages are rather small in quantity and were from disturbed contexts.[14] While it is true that fragments have mostly been recovered from the period's more substantial settlements, such as Mycenae, Midea, Dimini, Gla, and Thebes, the tiled roof does not appear to have been reserved for the primary palatial or monumental structures at the site. At Thebes, for instance, tiles were found distributed throughout the Kadmeia and associated with a storage shed, among other structures.[15] During this period, the tiled roof appears to have been especially popular in Boeotia and the Argolid. It also managed to survive the initial palatial collapse at the end of LH IIIB, but did not endure to the end of the LH IIIC period.

Like the EH tiles, the published evidence for the Mycenaean tiled roof attests to the influences from outside

[11] Jazwa 2018.

[12] For Bronze Age mudbricks, see: Darcque 2005, 75–78; Devolder, Lorenzon 2019; Lorenzon 2021; for parting agents, see: Sapirstein 2008, 100–102, 269–270, 340; 2009; Jazwa 2018; and for EH hearths, see: Galligan 2013.

[13] Iakovidis 1990; Jazwa 2020; 2021; Aravantinos *et al.* 2020.

[14] There was previously some debate about the proper identification of this material as roofing tiles (for a summary of this debate, see Sapirstein 2008, 29–78). This was largely the result of the small number of fragments found at sites with LH roofing tiles, and the fact that sometimes cover tiles were found without pan tiles and vice versa (Aravantinos *et al.* 2020 count at least 11 sites with both tile types). Recent discoveries at Thebes (Aravantinos *et al.* 2020) and Eleon (Jazwa 2020), however, prove that the ceramics were, indeed, for tiling roofs, due to their abundance, locations of deposition, and weathering marks. With these discoveries, the debate about LH ceramic roofing tiles has largely ceased.

[15] Aravantinos *et al.* 2020.

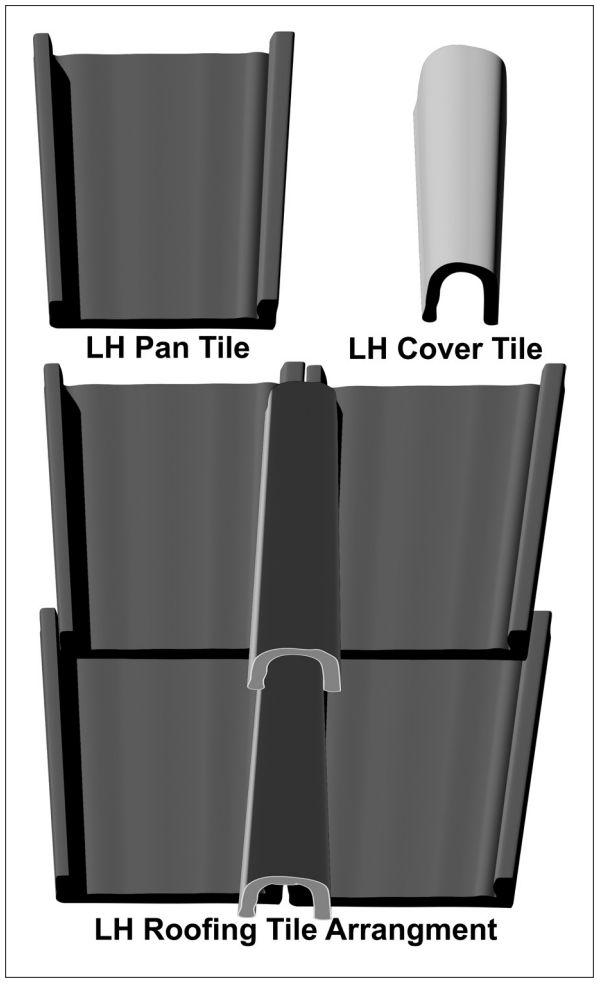

Fig. 4. A schematic representation of typical Mycenaean ceramic roofing and the arrangement of these tiles on the roof (after: Aravantinos *et al.* 2020, fig. 22).

crafts and other aspects of architectural construction. Both the clay paste and firing of the cover tiles, for instance, demonstrate a close affinity with contemporaneous pottery of the period; the manufacture of these tiles also borrowed other pottery techniques, such as the initial forming with clay coils and finishing on the wheel. In these regards, cover tile construction resonates with another form of well-fired architectural ceramics, clay chimneys.[16] This is apparent in both the shape and forming methods, as both required the initial forming of a coil-built tube and wheel finishing. However, the chimney (slightly wider and thicker) remained cylindrical, while individual cover tiles were formed by cutting the cylinder in half lengthwise prior to firing and became narrower towards one end.[17] All the chimneys cited by Pascal Darcque's survey of Mycenaean architecture date to LH IIIB or later, and thus appear to post-date the earliest Mycenaean roof tiles (LH IIIA).[18] Although there has yet to be a thorough study of Mycenaean chimneys, it therefore appears that the direction of influence was from ceramic roofing tiles to the chimneys. In any case, the cover tiles (as well as the chimneys) clearly reflect cross-craft interaction and inter-cross-craft interaction.

Compared to the Mycenaean cover tiles, pan tile production was rooted in more vernacular mud-based architectural constructions than the pottery industry. Mudbrick making, for instance, would have been helpful for any clay pads initially formed with a mould. Additionally, the clay paste used for the pan tiles includes much coarser inclusions, organic temper, and parting agents, just like mudbricks. The clay paste and the forming methods also have analogues in a class of low-fired, prehistoric clay objects: 'utilitarian trays' or 'clay bins'. This type of semi-fixed furniture consisted of a rounded slab of clay, with a wall on at least one side turned upwards.[19] The low firing temperature, handmade appearance, and coarse fabric suggest that these utilitarian trays were probably built by non-specialists. Thus, Mycenaean pan tiles are also the product of both cross-craft and intra-cross-craft interaction.

Archaic Tiled Roofs

Approximately four centuries after the abandonment of the Mycenaean roofing tiles, in the 7th century BC, the tile roofing system was again invented in mainland Greece. This version was initially given to monumental temples, before being deployed on civic structures and domestic buildings.[20] The various ceramic roofing tile systems developed in this period were quite diverse in form, but nearly all feature an arrangement that resembled the Mycenaean system with an appearance (if not use) of distinct pan and cover tiles.[21] This is exemplified in the two earliest-known roofing systems. The seemingly older of the two, the mid-7th century BC roof 1 from Olympia, employed separate pan and angled cover tiles, much like the Mycenaean predecessor (Fig. 5).[22] The Protocorinthian roof from Corinth primarily consisted of 'combination tiles', each of which included a cover tile attached to the pan tile (unlike the Mycenaean system with separate pan and cover tiles) that interlocked with other combination tiles to create a contin-

[16] Shear 1968, 11; Nelson 2001, 66–70; Darcque 2005, 81; Adrimi-Sismani 2014, 169–170, 232–233.
[17] Jazwa 2020; 2021.
[18] Darcque 2005, 81.
[19] Mersereau 2020, 458–466; Jazwa 2022.
[20] For overviews, see Winter 1993; Sapirstein 2016.
[21] Winter 1993; Skoog 1998, 21–44; Sapirstein 2016.
[22] Sapirstein 2016, 41.

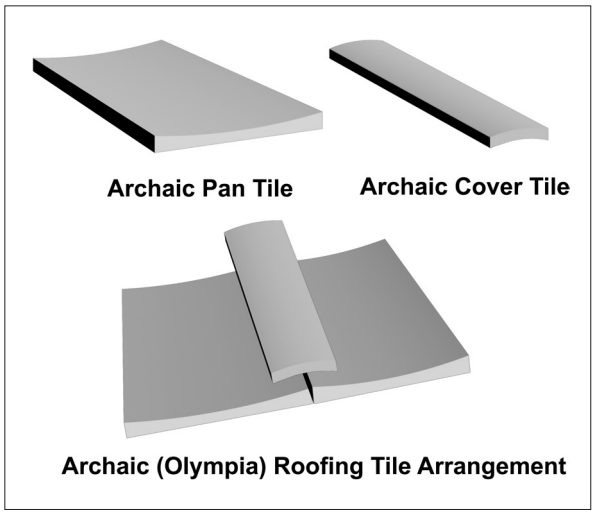

Fig. 5. A schematic representation of an early Archaic ceramic roofing tile (after Roof 1 from Olympia) and the arrangement of these tiles on the roof (after: Sapirstein 2016, fig. 4.1).

uous roofing surface.[23] The Laconian tile system from later in the same century was again different, in that it employed both semi-cylindrical cover and pan tiles.[24]

Archaic tiles of all forms employed ceramic specialists, most likely potters, for the preparation of the clay paste and firing. Philip Sapirstein's study of the Protocorinthian roofing system also documented the essential use of a mould for much of the forming of the combination tiles at Corinth. He thus concluded that potters, coroplasts, and/or sculptors all played important roles in the development of the technology.[25]

In addition to this cross-craft interaction, the tiles appear to reflect interaction with other areas of the architectural domain. During the late 7th and 6th centuries BC, ceramic architectural elements, most of which had decorative functions, greatly proliferated in number, variety, and type. There are, for instance, painted terracotta plaques (Temple of Apollo at Thermon), acroteria, and antefixes.[26] The shared medium of fired clay thus indicates the presence of intra-cross-craft interaction for the ceramic architectural constructions of the period. It is even possible that the ceramic tiled roof had an important role in the proliferation of intra-cross-craft interaction in architecture, as the Archaic-period use of ceramic roof tiles appears to predate those other forms of architectural ceramics.[27] Perhaps, the extensive use and deployment of ceramics for the new tiled roofs helped set a precedent for involving ceramic (or other) specialists in the production of monumental civic architecture. The subsequent additions then expanded upon the practice and repertoire.

Sapirstein has similarly shown that the Archaic ceramic tiled roof was an important agent of intra-cross-craft interaction in cut-stone masonry. He identified the use of band anathyrosis in tiles that predates the first use of this technique in worked stone.[28] This arose as one of many "solutions to the challenges of manufacturing and installing tiles inspired important innovations subsequently incorporated as masonry techniques".[29] Thus, intra-cross-craft interaction can also be shown to have incorporated different materials.

Assessing the Roofing Tile Systems

Though different in form and arrangement, the ceramic tiled roofs of all three periods were important agents of both cross-craft and intra-cross-craft interaction. For the two prehistoric episodes, the technology was primarily rooted in vernacular technologies while leveraging skills from pottery production. Thus, almost any individual living in mainland Greece could have contributed significantly to the tile-making process; however, entire roofs could not have been built without the help of outside specialists. In this respect, the Archaic period's ceramic tiled roofs are different, because they appear to have primarily relied on ceramic specialists (*i.e.* potters and/or coroplastic artisans). They were also not solely connected to or influences upon other ceramic architectural innovations, but may have influenced stone construction as well.

Despite the important influence of other vernacular architectural traditions in the development of the prehistoric ceramic tiled roofs, it is noteworthy that this influence would not have been detectable when the roofs were fully assembled. The specific production techniques that were shared with vernacular architectural methods, such as mould-forming (mudbricks), would not have been detectable with the roof fully assembled.[30] The same is true for the distinctive features that the Mycenaean pan tiles shared with the utilitarian trays (*i.e.* the walls) which would have been entirely covered by the refined cover tiles. Instead, the material, *i.e.* fired clay, would immediately have been associated with an outside craft activity (pottery) due to the absence of similar exterior architectural features (notwithstanding the less visible chimneys and drains).

Thus, in all periods, the materialisations of the intra-cross-craft interactions that contributed to the development of the roofing tile technology were largely hidden

[23] Winter 1993, 12–18; Sapirstein 2008; 2009; 2016.
[24] Winter 1993, 95–109; Skoog 1998; Sapirstein 2016.
[25] Sapirstein 2008, 328–331.
[26] Winter 1993; Skoog 1998, 29–40; Barletta 2001.
[27] Winter 1993.
[28] Sapirstein 2008, 325–328; 2016, 56–57.
[29] Sapirstein 2016, 56.
[30] Jazwa 2018.

in the architectural innovation's final form. The contributions of specialist craftpersons from other domains, however, were highlighted by the materiality of the feature and, in some cases, the general form (*e.g.* curved clay). Because those ceramic specialists had not previously participated in architectural construction in any of the three episodes, those contributions would have been noted as a contrast to the more familiar clay-based architectural elements (*e.g.* mudbricks) that almost everyone had experience making.

Surveying Intra-Cross-Craft and Cross-Craft Interaction

In this survey, the evidence for intra-cross-craft interaction and cross-craft interaction among the architectural innovations of the Bronze and Early Iron Ages are presented (Table 2). In doing so, it provides insight into the potential influences stimulating such interaction and the reception of the intra-cross-craft interaction for architectural constructions. Although this overview aims for extensive coverage, it certainly does not claim to be exhaustive.

Early in the study period, the evidence for both forms of craft interaction is rather limited. Roofing tiles are among the few architectural innovations that clearly demonstrate both. Nevertheless, this single innovation was quite widespread in the EH period and used for various building types, including domestic architecture, fortifications, and large communal buildings, like corridor houses. While EH ceramic roofing tiles have already been discussed, the schist varieties may also reflect at least some cross-craft interaction, because some trained stone-workers may have been used to shape and form holes in the rarer schist roofing tiles. However, it remains to be determined if such contributions were necessary.

The appearance of both the ceramic and schist roofing tiles coincided with a growth in settlements, craft specialisation, and sociopolitical complexity. Monumental architecture (*e.g.*, corridor houses, fortifications) also became more common, and roofing tiles were associated with several of these monumental EH buildings. This development, therefore, attests to a desire to elaborate upon the established vernacular for communal buildings at least. However, the distribution of roofing tiles at some sites indicates that the architectural innovations (and thus the intra-cross-craft and cross-craft interaction) were not reserved for the monumental buildings, but were more widely accessible.

After the abandonment of the tiled roof, evidence for architecturally innovative features (and thus related intra-cross-craft and cross-craft interaction) is absent for many centuries (EH III–MH II). This coincided with the almost exclusive construction of modest architecture and the presence of smaller communities.[31] While there were certainly craft specialists in these periods, such as potters, it is unlikely that there were largescale industries in any domain.

All this changed by the MH III period (if not slightly earlier), alongside the emergence of local elites in several regions of mainland Greece.[32] The increasing

Table 2. Non-vernacular architectural features that demonstrate evidence for cross-craft and intra-cross-craft interaction.

	Cross-Craft	Intra-Cross-Craft
EH	Ceramic Roofing Tiles Schist Roofing Tiles	Ceramic Roofing Tiles Schist Roofing Tiles Ceramic Hearths
EH III–MH II	–	–
MH III–LH II	Ashlar/Cut-Stone Masonry Painted Plaster	Ashlar/Cut-Stone Masonry(?) Painted Plaster
LH III	Cut-Stone Masonry Carved/Sawn/Drilled Stone Painted Plaster Ceramic Roofing Tiles Half-Timber Masonry Ceramic Chimneys Ceramic Drains	Cut/Worked Stone(?) Painted Plaster Ceramic Roofing Tiles Half-Timber Masonry Ceramic Chimneys Ceramic Drains
PG–G	–	–
Early Archaic	Ceramic Roofing Tiles Acroteria/Antefixes/*etc.* Wall/Plaque Painting Cut-Stone Masonry	Ceramic Roofing Tiles Acroteria/Antefixes/*etc.* Wall/Plaque Painting Cut-Stone Masonry

[31] Wiersma 2014; Jazwa 2016.

[32] See, for example, Wright 2006; also, discussions in Wiersma 2014; Jazwa 2016.

construction of elite and monumental architecture was met by new architectural innovations and the participation of a wider variety of outside specialists for architecture. For the first time in mainland Greek (pre-) history, for example, cut-stone masonry was incorporated into the region's architecture.[33] This is evident at Pylos with the numerous ashlar blocks found in the later Mycenaean palace, but assigned to an earlier structure on the site.[34] This ashlar masonry was probably influenced by Minoan Crete where the technique had already been in use.[35] While stone had been employed for architectural construction in mainland Greece for millennia before the appearance of ashlar, the methods used for the production of ashlar masonry did not otherwise have clear analogues in the architectural sphere. Instead, the relevant production knowledge most likely had precedent in other crafts, such as the construction of stone vessels. Due to the external origin of the building method, such craft interaction must have occurred in an area outside mainland Greece and long before the technique arrived there.

At roughly the same time (*c.* MH III), representational wall painting on plaster was introduced to the Greek mainland, probably from Minoan Crete.[36] This innovation is more clearly the product of cross-craft and intra-cross-craft interaction. Regarding the former, the painting itself probably had predecessors in established visual arts such as decorated ceramics and painting of stone vessels.[37] At the same time, the addition of paint to plaster intersects with established methods of plastering (lime or mud plaster) walls and floors that had existed in mainland Greece and elsewhere for millennia.[38] It is, however, unlikely that this interaction initially occurred in mainland Greece, but in Minoan Crete, Egypt, or otherwise, where the technology was initially developed and similar vernacular methods were also in use.

During this early Mycenaean period, both forms of craft interaction were rather limited in their distribution and only sparingly used in the mainland. They are exclusively found in monumental and/or elite structures, particularly at locations that later became palace sites. They were also shown to have been brought in from outside where the relevant interactions (cross-craft and intra-cross-craft) initially occurred. Thus, this period cannot necessarily be classified as one in which cross-craft or intra-cross-craft interaction were stimulated in the architectural domain. Instead, it was driven by the adoption of foreign architectural features that happened to have such influences already "built in".

This pattern is not true in the subsequent period, LH III. The first subphase, LH IIIA, coincides with an acceleration of elite, intra-regional competition and, in some areas, the first regional palatial kingdoms. These are manifest in the construction of massive elite and palatial structures, such as palace complexes and monumental tholos tombs.[39] During this mature Mycenaean period (LH IIIA–B), new architectural innovations that materialise both intra-cross-craft and cross-craft also expanded throughout the Greek mainland, especially for those elite and palatial structures. In addition to the continued use of cut-stone masonry and painted plaster, ceramic roofing tiles were re-invented, other ceramic fixed and semi-fixed features, such as chimneys and drains, first appear, and half-timbered masonry, a technique that was probably developed in and adopted from Anatolia, was applied.[40] Used more sparingly also were other forms of stoneworking, such as sawing and drilling for constructions like the Lion Gate, that were also initially developed elsewhere but had predecessors in crafts, such as seal/gem carving.[41]

Needless to say, many of these mature Mycenaean architectural innovations were owed to outside craftspeople, and the evident cross-craft and intra-cross-craft interaction associated with them most likely occurred elsewhere. However, this is not true for most of the architectural ceramics. Ceramic chimneys and ceramic roofing tiles, for instance, reflected the ongoing influences from within the architectural domain and outside. Drains, while having antecedents in Minoan Crete, also probably leveraged the skills of established potters and/or vernacular traditions, as the general shape and/or forming methods were not too dissimilar from cover roofing tiles and utilitarian trays. This is evident among the semi-cylindrical examples from Zygouries and U-shaped

[33] Wright 1978; 2020; Blackwell 2020; Kreimerman, Devolder 2020, 41–45.

[34] Wright 1978; 2020; Nelson 2001.

[35] Wright 2020; Blackwell 2020, 215; Kreimerman, Devolder 2020.

[36] For Mycenaean wall painting see, among others, Immerwahr 1990; Tournavitou 2017; Egan 2021. For the Minoan influence and/or the early date, see Immerwahr 1990, 105–146; Egan 2021.

[37] Immerwahr 1990, 17–19, 21–40.

[38] Immerwahr 1990, 11–13, 21–22.

[39] See Wright 2006, among others.

[40] Wright 2006, 28–33. Half-timber masonry elsewhere: Dakouri-Hild 2001, 89–92; Nelson 2001, 154–169.

[41] Wright 2006, 33–34; Blackwell 2014.

examples from Pylos and Dimini.[42] Half-timbered masonry, which did not necessarily require specialist skills and was introduced from outside the Greek mainland, probably drew upon the experience and skills already present among the workforce engaged in building production as well. Indeed, almost any resident of mainland Greece would have had experience felling trees, preparing timber for domestic constructions, and mixing clay mortar. In short, the mature Mycenaean period represents an acme in architectural innovations that owed much to cross-craft and inter-cross-craft interaction, even if these interactions did not always occur in mainland Greece. The application of these innovative features was largely limited to monumental, elite constructions.

Following the collapse of the palaces and the LH IIIC period, there was again an absence of architectural innovations and new intra-cross-craft and cross-craft interaction in this domain. This occurred alongside a contraction of settlement/population numbers, wealth, and external contacts.[43] Only a few monumental or large-scale constructions, such as the Heroön at Lefkandi, were built during this period, and none included new architectural features *per se*.[44]

It was not until the emergence of the *polis*, population expansion, and reinvigorated external exchange that monumental constructions became more common and architectural innovations again proliferated. Such innovations were primarily in two media: ceramic and stone. They were first limited to monumental civic constructions, such as temples, but were rather swiftly adopted for other structures, including domestic. Unlike in the Mycenaean period, however, few if any of these architectural features appear to have been primarily introduced from abroad.

Assessing Craft Interaction

Overall, this survey demonstrates that architectural innovations that materialise intra-cross-craft or cross-craft interaction were not evident during the entirety of the study period. Both forms of interaction were exclusively stimulated during times of elevated sociopolitical complexity, elite/monumental building, and wealth. In fact, monumental architecture appears to have been an important conduit for such interaction in these periods. This is equally true whether these constructions were elite structures (Mycenaean palaces), communal buildings (EH corridor houses), or civic/religious buildings (Archaic temples). Of course, the architectural innovations were not always limited to such monumental buildings (except, arguably, in the Mycenaean period). However, in at least the second two instances, they appear to have been initially developed for monumental constructions.

In the periods of lesser complexity and fewer monumental constructions, both forms of interaction were significantly depressed. Such a decline cannot be attributed to an absence of knowledgeable labourers because the essential skills that were incorporated into the production of these innovations were retained within the origin crafts of the specialists. Painting, for instance, endured among potters between the Mycenaean period and the Archaic period and, though ceramic-tiled roofs ceased to be built for long periods, clay continued to be worked and fired by potters. This suggests that the presence or absence of such interaction in the architectural domain was driven by cultural, political, social, or economic factors.

At the same time, the survey shows that intra-cross-craft interaction always occurred in tandem with cross-craft interaction in the architectural domain. For instance, the EH ceramic roofing tiles were equally influenced by the mudbrick traditions of vernacular architecture and the specialist pottery industry. Whether the architectural innovations were initially developed in Greece or not, in no case do they indicate intra-cross-craft interaction without complementary contributions from outside craftpersons.

The intra-cross-craft interaction, however, rarely appears to have been highlighted in the final construction. This contrasts with the cross-craft interaction which, in many cases, was quite apparent. For instance, the materiality, form, and painted decoration of all three periods' ceramic-tiled roofs would immediately associate the technology with pottery production, but not mudbricks or low- or unfired clay furniture. This suggests that the ties to other craft specialists were more appealing than any novel application of established architectural methods within this new feature.

That the efforts of the outside labourers had an important aesthetic or visual function is clear from the other innovations as well. The wall paintings, for instance, provided a richly decorated interior wall surface that unmistakably linked them with non-architectural artisans. Ashlar courses also lent additional visual appeal to the wall courses with the regular and neat appearance of the blocks. During the Mycenaean period especially,

[42] Blegen 1928, 28–38; Nelson 2001, 60–66; Shaw 2004.
[43] Murray 2017.
[44] Fagerström 1988; Jazwa 2016.

the influences – if not direct contributions from foreign craftpersons – would have been on full display with these features. Consequently, these buildings materialised the inhabitants'/communities' access and ability to marshal this specialist labour for cross-craft interaction.

Understandably, the products of intra-cross-craft interaction typically lacked the same aesthetic function. A clay bin is unlikely to have been considered as visually appealing or distinctive as a figural wall painting. This is owed in large part to the accessibility associated with the origin traditions, their vernacular origins, and their prevalence within domestic contexts. Indeed, the intra-cross-craft influences reflected methods and abilities that were achievable by most and resonant with many vernacular constructions of the period. Consequently, they were probably far less impressive when placed on a building. The intra-cross-craft interaction may have simply been considered a means to an end and, though integral to the design, an incidental component of the construction process.

Conclusion

In short, intra-cross-craft interaction for architectural innovations of the Bronze and Early Iron Ages of mainland Greece appears to have been fundamentally tied to cross-craft interaction and monumental architecture. Although intra-cross-craft interaction never appears without cross-craft interaction, the recognition of the former was often hidden in the final appearance/placement of the new architectural feature. The opposite, however, is true for cross-craft interaction. This is most likely because most individuals had experience with vernacular constructions and, thus, the contributions of related crafts/skills to the new architectural component would have been less impactful than those of the skilled craftpersons. Thus, intra-cross-craft interaction appears to have fundamentally contributed to most new architectural features of the Bronze and Early Iron Ages, but it was not something that was advertised.

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