

Agents of Change in the Greco-Roman and Early Modern Periods

Ten Case Studies in Agency in Innovation

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Contents

Preface VII

List of Figures and Tables VIII

List of Contributors IX

General Introduction: Agents of Change 1

Silvia Castelli

- 1 Mosquitoes, Molecules, and Megafauna: Who and What has Agency in Human History 28
J.R. McNeill
- 2 Builders, Architects, and the Power of Context: Agents of Architectural Change in Fourth-Century-BCE Epidauros and Delphi 40
Jean Vanden Broeck-Parant
- 3 Agents of Change around the Valley of the Muses 70
Robin van Vliet and Onno van Nijf
- 4 Callimachus vs. Conon: Competing Agents of Change for the Lock of Berenice 91
Brett Evans
- 5 Anonymizing Agents of Change in Philosophical Pseudepigraphy: The Case of Pseudo-Plato, *De virtute* 111
Albert Joosse
- 6 Cicero and Political Agency in Late-Republican Rome 129
Merlijn Breunese and Lidewij van Gils
- 7 *Primus Iuventus* and Other Agents of Change in the Rise of Christian Latin Poetry 148
Roald Dijkstra
- 8 John Cassian as an Agent of Change 168
Nienke Vos

- 9 Greek-Latin Translation at the Court of Pope Nicholas v (r. 1447–1455):
The Agents That Changed the Humanist Translation Movement 191
Annet den Haan
- 10 Erasmus, an Unsuspected Superspreader of New Ancient Greek? 212
Raf Van Rooy
- Index of Passages 239
- Index of Subjects 247

Builders, Architects, and the Power of Context: Agents of Architectural Change in Fourth-Century-BCE Epidaurus and Delphi

Jean Vanden Broeck-Parant

1 Introduction

In the fourth century BCE, Greece saw a number of architectural innovations, in terms of both design and techniques. On the mainland, the Doric order was marked by a series of developments, which were all, to various extents, anchored in tradition. The impulse of this renewal likely sprang from the Peloponnese, with some distinctly local evolutions and some inspired by the Ionic order or infused with Athenian influences. The novelties quickly reached Delphi, where Peloponnesian contractors, architects and building commissioners were active at the time. Much scholarly work has been dedicated to the evolutions of design, such as new architectural elements and changes in proportions.¹ While a whole web of similarities can be, and have been, drawn between most of the fourth-century monumental buildings of these regions, a firm, comprehensive chronology remains difficult to establish. Purely technical features of fourth-century construction have been noticed and discussed, but not to the same extent as the aspects of design.

Consequently, the technical innovations in fourth-century BCE Greek architecture have not been studied much with regard to the processes of their diffusion. Particularly little explored is the identification of the driving agents of architectural changes of that time. Later periods, for which the evidence is more abundant, have been better served by recent studies. The Hellenistic and Roman periods, with their mass production of materials, sometimes at an almost industrial level, and their high rate of preservation, have encouraged and facilitated the study of the diffusion of techniques.² Fourth-century BCE monumental construction does not lend itself as easily to this kind of analysis. While sustained building activity took place at that time, with what seems to

¹ Roux 1961; Winter 1982.

² See notably Hohlfelder and Oleson 2014: 227–230; Lancaster 2015: 192–204; Gerding and Östborn 2017.

have been a booming labor market, talking about a ‘nearly industrial’ production would be a stretch. As a result, the nature of the evidence is different. Yet, despite the difficulty of tracking the diffusion of techniques in time and space with accuracy, some agents of change, both human and non-human, can be identified and discussed.

2 Human Agents of Change: Architects and Contractors

A series of individuals, whether they belonged to socially distinct groups or not, were involved in the construction of monumental buildings. They can be divided into several categories, according to their function within the project. There were the commissioners, the financial and technical supervisors, the architects, the contractors, the guarantors, and the workers. It is undeniable that the architect’s choices must have had an important impact, notably on the design of the building. Technical details, however, might be more attributable to entrepreneurs and craftsmen.³ As Jim J. Coulton put it, ‘there are (...) two main vehicles for the transmission of architectural ideas: the masons and the architects’.⁴

Inscriptions and literary sources give the names of several architects active in the first half of the fourth century BCE, although some of these pose rather serious problems regarding their identification. The architect of the temple of Asclepius at Epidaurus (fig. 2.1), Theodotus, is mentioned in building accounts preserved on stone,⁵ but he is not otherwise known. Some have suggested that he should be equated with the Theodorus who, according to Vitruvius, wrote

3 In the inscriptions the people working on the construction site are usually referred to as *ergonai*, a rather vague term. The distinction that I make here between craftsmen and entrepreneurs is inspired by Burford’s use of these terms to denote the difference between artisans working with a small team of assistants (e.g. sculptors), on the one hand, and individuals dealing with large construction works who were sometimes responsible for several major steps of the project (e.g. quarrying, transport, setting) and were in charge of a large number of workers (Burford 1969: 148). The term ‘entrepreneur’ should be understood here in this narrow sense. The term ‘contractor’ refers to anyone who has entered a contract with the building commissioners (or with another authority in charge of the works). See further discussion below.

4 Coulton 1983: 453.

5 Prignitz 2014 n°1 (= *IG* IV² 102), l. 7, 29–30, 52, 102–103, 108–109, 110. The new edition of the inscription by Prignitz is now considered the edition of reference. Note that the line numbers do not coincide with those of the *IG*.

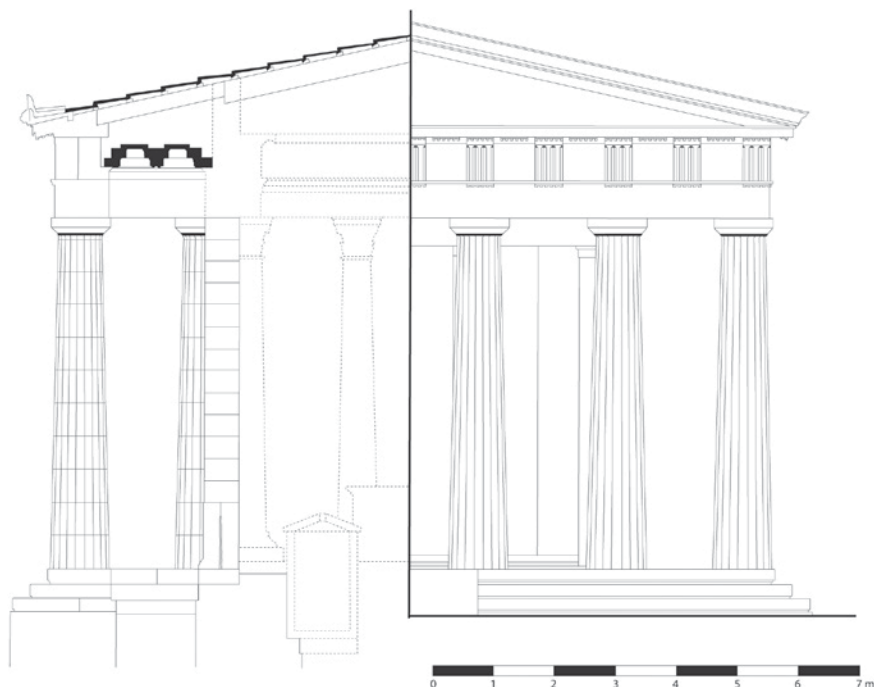


FIGURE 2.1 Section (left) and façade (right) of the temple of Asclepius in Epidaurus

DRAWING BY JEAN VANDEN BROECK-PARANT AFTER ROUX 1961: 125 FIG. 28

a treatise on the Tholos of Delphi⁶—and therefore probably also designed it.⁷ This hypothesis implies that Vitruvius would have made (or repeated) an error regarding the name of Theodotus. This Theodorus/Theodotus identification, which rests on the proximity of the architectural ornamentation and sculptural decoration of the temple of Asclepius and the Tholos, is impossible to prove at this stage. Another theory regarding Theodorus is that he was not, as Vitruvius wrote, from Phocaea (*Phocaeus*), that is, from Asia Minor, but from Phocis (*Phoceus*), the region surrounding Delphi, thus making him a local, an ‘enfant du pays’, and a potential pupil of Ictinus.⁸ While a decisive argument has yet to be put forward to determine the origin of the architect of the Tholos, the question has important ramifications regarding the architects’

6 Vitr. 7 *praef.* 12.

7 See Viérneisel-Schlörb 1976: 80 (with earlier bibliography).

8 Bousquet has argued for this theory several times; for the most detailed argumentation, see Bousquet 1960: 287 n. 2. See also Coulton 1983: 454 n. 6. *Contra* Viérneisel-Schlörb 1976: 81.

role and agency in the implementation of innovations (see below). The architect of another round building, the Thymele of Epidauros, is recorded by Pausanias (writing ca. 150–175 CE) as being a certain Polyclitus, who was also responsible, according to the traveler, for the theater of Epidauros.⁹ It is almost certain that Pausanias was thinking of the sculptor Polyclitus the Elder, for he mentions qualities usually attributed to his work, such as ‘harmony of proportions’ and ‘beauty’ (*harmonia* and *kallos*). However, it cannot have been the famous Polyclitus, since he died around 420 BCE, a few decades before the Thymele was built. It is possible that Pausanias confused Polyclitus the Elder with a Polyclitus of the fourth century BCE, although no artist of this name is otherwise known for architectural works. There is, therefore, no certainty with regard to the identity of the architect of the Thymele.¹⁰

In Delphi, Pausanias gives the name of the architect of the temple of Apollo, Spintharus of Corinth.¹¹ The epigraphic accounts of the construction of the temple, however, mention a Xenodorus and an Agathon;¹² the latter probably took over from the former around 342–341 BCE.¹³ These pieces of information do not necessarily contradict one another: while Agathon and Xenodorus were evidently ‘effective’ architects in charge of supervising the works, Spintharus could have been the chief designer of the temple.¹⁴

In sum, the identification of the architects in charge of major buildings at Delphi and Epidauros in the fourth century BCE is, in most cases, uncertain at best, and their origins remain relatively obscure. Theodotus, who worked on the temple of Asclepius, might have been an Epidaurian, based on the absence of any ethnic following his name in the building accounts; the weakness of such an argument, however, does not need to be demonstrated. Theodorus, if he is not to be identified with Theodotus, may have been either from Phocaea or from Phocis, two widely distant regions. Agathon and Xenodorus were probably Delphians, but it is not certain that they were actively involved in the design of the temple of Apollo. The Corinthian origin of Spintharus, the architect of the temple according to Pausanias, is consistent with the Peloponnesian

9 Paus. 2.27.5.

10 See Roux 1961: 184–187; Prignitz 2014: 247.

11 Paus. 10.5.13.

12 Xenodorus: *CID* II 31, l. 40, 61, 66, 88, 99; 34, col. I, l. 51, 76; col. II, l. 37, 67. Agathon: *CID* II 46 A, l. 14–17; 50 col. II, l. 8–11; 55, l. 20–22; 62 col. II A, l. 22–25. Agathon is also referred to as the ‘architect of the temple’ (ὁ ἀρχιτέκτων τοῦ ναοῦ) in a later decree in honor of his grandson Damon: *CID* IV 44, l. 33.

13 Jacquemin 1990: 81.

14 On the architects of the fourth-century temple of Apollo at Delphi, see Amandry and Hansen 2010: 464–465.

aspects of the temple. One could argue that the attribution (although probably incorrect) of the Thymele to Polyclitus by the same author reflects the local nature of the building.

Unfortunately, it is difficult to go beyond these snippets of information, let alone reconstruct the careers of the architects. Furthermore, their origins, however important they might have been to their education, were not necessarily the most decisive factor in the diffusion of architectural innovations. According to Coulton, 'most architects seem to have stayed within one cultural area', as evidenced by 'the existence of recognizable local variants within more widespread patterns of similarity'.¹⁵ It is beyond doubt, however, that at least some architects, perhaps those with an established reputation, did travel in antiquity.¹⁶ The more important question for us is rather whether traveling architects automatically integrated architectural features from their home region (or the region where they were trained) at all. The question is a difficult one and is inextricably linked with issues regarding, on the one hand, the attribution of buildings to specific architects and, on the other hand, the nature and the extent of the architect's role in a building project. The case of the temple of Apollo Epicurius at Bassae (ca. 420 BCE) is illustrative of this problem. Its authorship was attributed by Pausanias to Ictinus, also known to have worked on the Parthenon and the Telesterion of Eleusis.¹⁷ From the point of view of both style and design, very little in the temple of Bassae can be compared to the Attic works of Ictinus, and some have questioned Pausanias' attribution on that basis.¹⁸ Most scholars, however, have accepted Pausanias' account and have proposed various explanations for the architectural discrepancies between Ictinus' attributed works.¹⁹ Frederick Cooper, in his monograph on the temple of Apollo at Bassae, made a case for its attribution to Ictinus, while at the same time 'realizing fully that it can never become a settled matter'.²⁰ Cooper points out the stylistic disparities between the three buildings but questions stylistic analysis as a valid method to identify the architect (in the sense of designer) of a building. Rather, his demonstration rests mainly on the idea that all three buildings designed by Ictinus—the temple of Bassae, the Parthenon, and the Telesterion—would have had interior Ionic columns.

15 Coulton 1983: 454.

16 Linder 2020: 230–231, 233–234, 238. See the useful list of architects with their origin when known in Miles 2017: 107–108, table 7.1.

17 Paus. 8.41.9; Plu. *Per.* 13.6–7; Str. 9.1.12–16; Vitr. 7 *praef.* 11, 12.6; 16.

18 Roux 1961: 21–22, 56–57; Eckstein 1960; Winter 1980.

19 See Winter 1980 and Svenson-Evers 1996: 160–166, 182–187 for useful summaries of the various explanations, with earlier bibliography.

20 Cooper 1996: 369–379.

It should be stressed that this is neither certain for the Telesterion nor for the Parthenon.²¹ A further argument by Cooper is that all three buildings were all architecturally unique, and that this very uniqueness makes it all the more likely that they were all designed by the same man.²²

In any case, if one accepts Cooper's demonstration, it follows that, in Ictinus' case at least, the architect's influence on the architectural features of the buildings would have been limited to one key element of design, i.e. the interior Ionic columns. One wonders, however, whether this must necessarily be connected to a specific architect, rather than to a general architectural trend of that period.²³

In the face of these uncertainties, the question of the reliability of Pausanias on such matters should not be avoided, especially as it has been raised for a number of his attributions to architects and, in general, to artists.²⁴ In the case of the temple of Bassae, serious doubts can be cast on Pausanias' explanation of the *epiklêsis* Epicurius, according to which Apollo would have helped the Phigalians struck by the plague at the time of the Peloponnesian War. Indeed, according to Thucydides (2.54) the virulence of the plague in the Peloponnese was nothing compared to what it was in Attica. Furthermore, the finds on the site of the temple of Apollo point to a cult with a martial connotation rather than a medical one.²⁵ The discrepancy between Thucydides' account and Pausanias' explanation casts doubt, in turn, on his attribution of the temple to Ictinus.

21 In the case of the Telesterion, the hypothesis rests in large part, on the one hand, on the assumption that the larger beddings of the Ictinian phase could accommodate Ionic bases and, on the other hand, on an inventory inscription (*IG* 1³ 386–387) that mentions *speirai* (l. 105)—commonly accepted as referring to moulded bases (Ionic or Corinthian; see Hellmann 1992: 377–378)—which had been ‘taken down’ from a *neos* (l. 103). This *neos* most likely refers to the Telesterion, but it has also been argued that the Ionic bases belonged to an earlier phase of the building; see Cavanaugh 1996: 169–172. More recently, Ioulia Kaoura (2019: 197 n. 31) considered the attribution of the Ionic bases to the Ictinian phase of the building impossible because this construction phase was abandoned at an early stage, which can hardly be conciliated with the 1750 pairs of roof tiles recorded in the inscription (l. 104). In the case of the rear chamber of the Parthenon, the existence of interior columns is almost certain, but Corinthian columns have also been suggested by Pedersen 1989.

22 Cooper 1996: 370.

23 As pointed out by Moretti 1997: 325–326, the Propylaea of Mnesicles and the hypostyle building in Argos also present an arrangement with interior Ionic columns and exterior Doric columns.

24 Habicht 1985: 147–150.

25 Eckstein 1960: 60–61.

A similar question has been raised about Pausanias' attribution of the Classical temple of Athena Alea in Tegea to Scopas of Paros,²⁶ who is known to have worked in Ionia, most notably on the sculptures of the Mausoleum of Halicarnassus and the temple of Artemis in Ephesus.²⁷ Pausanias is the only source qualifying Scopas as an architect, and it is certain that he did not confuse Scopas with someone else, as he also explicitly states his profession as a sculptor. There are a few arguments that support the idea that Scopas may have worked at Tegea, at least as a sculptor.²⁸ Assuming, therefore, that Scopas was indeed the architect of the temple, we are again left with the following question: what were his personal contributions to the temple of Tegea that could be linked specifically with the Cyclades (his home region) or Ionia (the region where he was trained as a sculptor)? In most regards, the building fits very well within the mainland Doric traditions and developments of the fourth century BCE, and it is especially close to the Thymele of Epidauros.²⁹ According to Erik Østby, a potential Ionic influence could be detected in the interior Corinthian half-columns (even if the Thymele of Epidauros also presents interior Corinthian columns) and the ornaments of the ceilings of the pterā, the antae and the tops and bases of the walls.³⁰ Naomi J. Norman had earlier suggested that the epikranitis could have been inspired by the Erechtheion³¹ but one explanation does not necessarily exclude the other and Scopas (if it was him) may have taken his inspirations from various sources. In any case, the richness of the interior ornament of the Tegea temple has been recognized as quite bold and innovative. Furthermore, Østby sees a further connection with Scopas' home region in the lintel of the north porch, which appears to have been richly decorated with Ionic ornaments, in the manner of Cycladic marble architecture.³² While Østby himself says that these links to

26 Paus. 8.45.5.

27 See Stewart 1977: 126–135 for the numerous literary sources on Scopas.

28 Scopas' sculptures present similarities with the ones from the Temple of Asclepius in Epidauros (Calcani 2009: 14–15, with earlier bibliography). The sculptor Timotheus, who is recorded in the building accounts of the temple, worked with Scopas in Halicarnassus (Plin. *Nat.* 36.30–31; Vitr. 7 *praeef.* 13), and it has been suggested that Scopas was his assistant on the Temple of Asclepius (Stewart 1977: 90). An early career of Scopas around 395–390 (Calcani 2009: 3) would be compatible with the reassessment of the date of the temple of Asclepius by Prignitz 2014 in the first decade of the fourth century BCE.

29 Østby 2014.

30 Østby 2014: 347.

31 Norman 1984: 181.

32 Pakkanen 2014: 361–362.

Scopas are 'admittedly rather vague' and 'independent',³³ it is tempting to see the rich interior ornament as the mark of an artist with an Ionic background.

Nonetheless, the question remains as to whether these bold innovations can be safely attributed to the architect and only him. According to Østby, another connection with the Cyclades is the use of marble for the construction of Tegea. It was local marble from Dholiana but admittedly at that time a temple made of marble was quite a novelty in the Peloponnese; in the Cyclades, on the contrary, there was an established tradition of building in marble.³⁴ Arguably, marble did not only call for an experienced architect, but also for skilled craftsmen familiar with this material. Furthermore, these craftsmen would also need to be familiar with the stylistic elements that were implemented in the temple of Tegea. In this regard, an interesting relief found in Tegea provides a possible indication of the presence, on the construction site of the temple, of craftsmen from Caria. The relief depicts Ada and Idrieus, Mausolus' successors as joint satraps between 351 and 344 BCE, and Zeus Stratios or Labrandeus, who was worshipped at Labraunda in Caria. While it was previously believed to be a dedication by a Carian craftsman who would have followed Scopas and his team from Halicarnassus to Tegea,³⁵ Geoffrey B. Waywell has argued that the relief was more probably part of an official Tegean decree recording a benefaction from Ada and Idrieus. According to Waywell, the satraps may have wanted to patronize a major architectural project on the mainland.³⁶ This interpretation does not exclude the presence of Carian craftsmen at Tegea, quite the contrary: if the example of later Hellenistic rulers is any good indication,³⁷ Ada and Idrieus may have sent, along with money, skilled and experienced workmen as part of their benefaction. While the involvement of Scopas and his team cannot be proven in this case, it should be stressed that in such cases where ornamental innovations were implemented using an unfamiliar material, the final execution rested mainly on the craftsmen's skills and experience, which could have been acquired in another region.³⁸ In such a context, a good understanding and an efficient cooperation between the architect and the

33 Østby 2014: 348.

34 Østby 2014: 347.

35 Dinsmoor 1950: 220.

36 Waywell 1993.

37 Particularly the Attalids; see Bringmann and von Steuben 1995, n°28 (craftsmen for the stoa of Eumenes II in Athens), n°29 (craftsmen (?) for the stoa of Attalus II in Athens), n°93 (builders for the theater and other votive gifts in Delphi), n°95 (painters in Delphi).

38 Pfaff 2003: 194–196 suggested that the 'Attic' stylistic features of the temple of Hera at the Argive Heraion were due to the possible participation in the construction of Attic craftsmen with an experience in such decorative elements. This is all the more likely that the sima blocks and the metopes, which are among the most 'atticizing' elements, were

craftsmen were vital. The discussions about the temples of Bassae and Tegea show that we know very little about the extent of the architects' agency when it came to introducing innovative, personal architectural features to buildings. They also suggest that the implementation of architectural features were necessarily collective and shared between the architect and the craftsmen; this will be discussed further below.

So, even if some architects did travel, it is questionable whether this was the most important factor in the diffusion of architectural innovations. The architects' new ideas, however, may have been transmitted more efficiently by written accounts than by traveling, as was argued by Coulton.³⁹ Vitruvius says that Theodorus wrote a treatise on the Tholos of Delphi, and Coulton suggested that such written works were key agents in transmitting 'new rules of proportion' and, in the case of Theodorus, 'fourth-century Peloponnesian styles'.⁴⁰ Technical descriptions, *sungraphai*, were used by the architects to convey their intentions to the commissioners and, more importantly, to the craftsmen. A good example of such written instructions is the one made for the Arsenal of Philo, preserved on stone; they were found to correspond very accurately to the architectural remains of the building, which were first discovered in Piraeus in 1988.⁴¹ Part of these *sungraphai* at least were later turned into books, some of which are mentioned by Vitruvius. They likely were part of the diffusion of innovative designs, alongside with the complete treatises from which they originated, even though they probably circulated only within narrow circles of specialists.⁴² Details were communicated by the architects to the craftsmen and the commissioners by means of *paradeigmata* 'specimens' and *anagrapheis* 'templates', but the available evidence suggests that they were normally made at full scale,⁴³ making them impractical for the transmission of new styles across regions. Smaller models from later periods are known to have traveled great distances, but the examples remain scarce.⁴⁴ In any case, the conventional aspect of Greek architecture usually made drawings unnecessary; rules of proportions were sufficient, and they could easily be written

probably all made of Pentelic marble, i.e. from Athens. The architect of the temple was, according to Pausanias, a man from Argos named Eupolemos (2.17.3).

39 Coulton 1983: 454.

40 Vitr. 7 *praef.* 12; Coulton 1983: 462–463.

41 IG 11² 1668; von Eickstedt 1991: 148.

42 Wesenberg 1984.

43 Such is the case of the drawings found in the temple of Apollo at Didyma; see Haselberger 1980. More recently, on ancient blueprints, see Capelle 2019.

44 Haselberger 1997.

down.⁴⁵ More unusual constructions, like the Tholos of Delphi (or the Thymele of Epidauros), perhaps required more explanation. Written documents, in any way, must have been the main agents of transmission for new elements of design. Oral explanation, although rarely accounted for, must also have played an important role, if not for details, at least for conveying the spirit of new constructions.⁴⁶ Ultimately, the edifices themselves, of course, were agents of transmission, albeit immobile ones, inasmuch as they were the tangible results of the projects. However, technical details were not necessarily visible once the building was completed. Therefore, their diffusion must have depended primarily on the craftsmen and entrepreneurs themselves.

The entrepreneurs and craftsmen appear, most often by name, in the building accounts of Delphi and Epidauros as contractors in charge of various jobs such as stone quarrying, stone transport, assemblage, sculpture, roofing, material supply, etc.⁴⁷ The fact that only their names are mentioned in the building inscriptions (sometimes along with the names of their guarantors) is the reflection of an administrative reality rather than a faithful image of a working site: the important contractors employed a number of workmen whom they hired on a more or less temporary basis. As Alison Burford put it, 'the entrepreneur organized the performance of a service by coordinating the resources of others'.⁴⁸ This is a compelling view, even though that does not mean that they were not skilled professionals and did not look for profit themselves.⁴⁹ The entrepreneurs, therefore, must have had authority over numerous workmen, with the ability to give orders and, consequently, to implement significant changes, at least at the technical level.

At least some of the entrepreneurs and craftsmen took up contracts in various sanctuaries and cities, making the materials, the workmen, and the techniques travel at a regional level.⁵⁰ For the construction of the temple of Asclepius at Epidauros, the foreign contractors came mostly from the large neighboring city-states of Argos, Corinth and Athens, but also from Tegea, Troezen, Stymphalus and more distant places like Crete and Paros. These foreign contractors must have come with their own experience, skills and

45 Coulton 1983: 462.

46 Plutarch recounts the story of two architects who had to defend their projects orally in public in Athens (*Moralia* 802 B).

47 For a view of the construction labor market in the classical and Hellenistic periods from the point of view of the craftsmen, see Feyel 2006.

48 Burford 1969: 149.

49 Vanden Broeck-Parant 2022.

50 On traveling craftsmen in the context of construction, see Hellmann 2000; Feyel 2006. On traveling *technitai* in general, see Massar 2020: 84–87.

techniques. The building accounts of Delphi show an even wider range of origins of contractors, but with a similar predominance of Argos, Corinth, and Athens. In fact, a series of contractors appear both at Epidauros and at Delphi, like Molossus of Athens,⁵¹ Chremon of Argos,⁵² Nicostratus of Argos,⁵³ and perhaps Onasimus.⁵⁴

Several individuals, known as architects or entrepreneurs, also took other roles in monumental construction. It is only a small step from architect to entrepreneur, and vice versa. Callicrates, who was active in Athens in the fifth century BCE, is known by an inscribed decree as the architect of the temple of Athena Nike on the Acropolis.⁵⁵ According to Plutarch, he also worked on the Parthenon with Ictinus, as well as on the construction of the Middle Wall to Piraeus.⁵⁶ With regard to the latter work, Plutarch used the verb ἐργολαβέω, which usually translates to 'contract for the execution of work'.⁵⁷ The use of this specific term has led some scholars⁵⁸ to believe that Callicrates was the contractor of the works, that is the entrepreneur, and not the architect. Even if other experts disagree with this interpretation,⁵⁹ it can be safely said that Callicrates was at least both a 'designer-architect' and someone with practical skills in charge of more utilitarian projects.⁶⁰

51 CID II 32, l. 10–11; Prignitz 2014, n°2 (= IG IV² 103), l. 207–208, 216–217.

52 CID II 62, col. II A, l. 2–3, 12, 24; 79A, col. I, l. 35; Prignitz 2014, n°2, l. 144, 176, 186, 187, 220, 248.

53 CID II 46 B, col. II, l. 4–10; 48, l. 5–7; 59, col. I, l. 25–29; 79 A, col. I, l. 32–38; Prignitz 2014, n°2, l. 144, 176, 185. Nicostratus was a common name; other individuals of that name appear in the Epidaurian accounts (see Prignitz 2014: 303–304, s.v. Νικόστρατος).

54 The case of Onasimus is more uncertain: mentioned for a small work of gluing at the stylobate of the Thymele of Epidauros (Prignitz 2014 n°2, l. 299), he is a *lithagôgos*, a 'stone transporter', in the Delphian accounts (CID II 31, l. 47, 54).

55 IG I³ 35, l. 12–13.

56 Plu. *Per.* 13.4–5. Even though Pausanias and Vitruvius do not mention Callicrates when evoking the Parthenon, it is probable that he was at least the co-architect of the building.

57 LSJ s.v. ἐργολαβέω.

58 Jacquemin 1990: 83 considered that he was both an architect-designer and an entrepreneur, while Holtzmann 2002: 148 tried to reconcile the two aspects, calling him an 'architecte-entrepreneur', a sort of master builder in charge of minor works, including on the Parthenon.

59 Burford 1969: 111 n. 2; Coulton 1977: 164 n. 69; Wesenberg 1982: 110. The two arguments against Callicrates being the entrepreneur of the Middle Walls are, first, that ἐργολαβέω does not necessarily mean 'contract for the execution of works' in Plutarch, who might have only used it for *oratio variata*; and second, that Plutarch may have referred to a later practice than mid fifth-century Athens, and therefore used a later term.

60 Callicrates is also known by an inscription (IG I³ 45) to have been in charge of repairing security features on the Acropolis (perhaps its walls) to prevent runaway slaves and thieves to enter it. In his role of 'designer-architect', he has been credited (in addition to

In the fourth century BCE too, several examples are known of architects who appeared in other roles. Still in Delphi, the aforementioned Agathon appears several times in the building accounts as the architect of the temple of Apollo, from about 342–341 to 335 BCE.⁶¹ In 333–332 BCE, the accounts mention an entrepreneur called Agathon who was in charge of rebuilding the middle part of the eastern *peribolos* wall of the sanctuary.⁶² Whether the two are in fact the same individual cannot be ascertained but is plausible.⁶³ In third-century Delos, a few names appear in the accounts both as entrepreneurs and as architects. The rarity of some of these names allows us to think that they refer to single individuals rather than homonymous ones, even though in some cases time differences between two mentions call for caution.⁶⁴ Dinocrates, for instance, appears as an entrepreneur between 284 and 274 BCE,⁶⁵ and is mentioned again as an architect almost 30 years later, in 246 BCE.⁶⁶ The time gap is much smaller, however, in the case of Phaneas, mentioned as an entrepreneur from 279 to 275 BCE,⁶⁷ and then as an architect paid by the city in 274 and 269 BCE.⁶⁸ When names are more common, one should be more cautious, as with Antigonus, an architect in 250 BCE; could he be identified with one of the seven artisans of that name recorded in the inscriptions?⁶⁹ Finally, the entrepreneur Harpalis might have been the son of the architect Simos.⁷⁰

Returning to fourth-century Delphi, the case of Epiteles, son of Soinomus, of Athens is worth looking into. He appears first in an account of 327–326 BCE, as a *naopoios*.⁷¹ The *naopoioi* were a board of individuals from various regions of the Greek world, in charge of supervising the reconstruction of the temple of Apollo. Their mission was technical and financial: they were the ones who made the payments to the contractors (after verification of the works by the

the temple of Athena Nike) with the Ilissos Temple, the Temple of the Athenians in Delos, and the Erechtheion; see Shear 1963.

61 See above, n. 12.

62 *CID* II 81 A, l. 15–18.

63 Jacquemin 1990: 81–83. Hansen (Amandry and Hansen 2010: 464 n. 8) considered the identification likely, because Agathon appears as a ‘practical’ architect, in charge of running the construction works, and because it would not have been easy for him to find another job as an architect on another large temple, even in the fourth century BCE. An Agathon is also mentioned in 356 BCE for a small job of stone transport: *CID* II 31, l. 27; he is probably a homonymous person.

64 Jacquemin 1990: 83.

65 For his numerous appearances, see Feyel 2006: 210–211.

66 *ID* 290, l. 107.

67 Feyel 2006: 282.

68 *IG* XI 2, 199 C, l. 41–42; 203 A, l. 60.

69 See Feyel 2006: 195–196.

70 Lacroix and Glotz 1914: 142.

71 *CID* II 97, l. 22.

architect).⁷² Epiteles is mentioned again, in the very same inscription, as a contractor in charge of a water work at the gymnasium.⁷³ A few years later, in 322–321 BCE, he appears again as an entrepreneur for a similar contract.⁷⁴ Epiteles is known from other inscriptions; his career shows that a high social status was not incompatible with being an entrepreneur.⁷⁵ Another *naopoios* at Delphi, Astias of Epidaurus, could be the same individual as the contractor mentioned in the Epidaurian accounts.⁷⁶

In Epidaurus too, the accounts of the fourth century BCE contain evidence of individuals who worked for the building commission after having worked as contractors. This was the case with Anaxilas and Damophanes, who both appear first as contractors in the accounts of the temple of Asclepius and then as commissioners in charge of letting out the contracts⁷⁷ in the accounts of the Thymele; Damophanes also appears in the accounts of the Fountain House.⁷⁸

These examples show that the entrepreneurs did not necessarily stick to their job as contractors, but sometimes found themselves on the other side of the fence, working either as architects, building commissioners, or board members in charge of letting out contracts. When we also consider that they often did not hesitate to travel in order to perform contracts, and that they served as intermediaries between the workers, the architects and the building commission, it becomes clear that they must have been key agents for the adoption and diffusion of technical innovations. One of the most important technical innovations of the fourth century was the adoption of a new type of clamp for monumental construction, to which I now turn.

3 A Case Study of Technical Innovation: The Π-Clamp

In ancient Greek monumental architecture, stone blocks were often tied together with metal clamps, which had the primary function of guaranteeing

⁷² Roux 1979: 95–120.

⁷³ *CID* II 97, l. 38–39. There is no conflict of interest here: the expenses made for the gymnasium were not overseen by the *naopoioi*, but by the Treasurers.

⁷⁴ *CID* II 109 A, l. 7–8.

⁷⁵ The same Epiteles was one of the commissioners of a festival at the Amphiareion of Oropos (*I. Oropos* 298), was granted a range of honors by the city of Delphi in 327 BCE (*FD* III 1: 408) and proposed a decree in Athens in 323–322 BCE (*IG* II³ 375).

⁷⁶ *CID* II 31, l. 35, 39, 60; Prignitz 2014, n^o 1, l. 109; n^o 2, l. 170; n^o 3, l. 59, 64, 192.

⁷⁷ Prignitz 2014: 165–166 has shown that the ἐγδοτῆρες and the θυμελοποιοί were not building commissioners, as was previously thought, but a board in charge of letting out the contracts. The building commissioners are not mentioned in the accounts.

⁷⁸ Prignitz 2014: 293 (s.v. Δαμοφάνης); Prignitz wonders whether one should perhaps distinguish between two different Damophaneis.

the integrity of the buildings. Various types and shapes of clamps were used throughout Greek history. As they vary according to regions and times, they are sometimes taken as loose indicators of chronology. The use of different types of clamps in the same building can indicate that it was repaired at some point, or that different teams of workers worked on the construction. Few scholars have studied the clamps in their own right, and the syntheses and tables by Roland Martin remain unparalleled and useful, although in many cases the dating has been revised since then.⁷⁹

Perhaps in the first half of the fourth century BCE, a new type of clamp appeared, commonly called Π -clamp because of its shape. The two vertical branches were inserted on either side of the joint between two blocks, usually on their bedding surfaces. This clamp shape was not entirely new: other Π -clamps existed before, especially in the Greek West, the Aegean Islands, and Asia Minor.⁸⁰ The fourth-century clamp distinguished itself from the others by the fact that it was made of a single piece of metal and by the shape of its cavity, which was rectangular, contrary to the so-called 'dovetail' Π -clamps.⁸¹

Π -clamps are often used as a vague indicator of chronology when dating stone constructions. Since their use became so preponderant in the Hellenistic period, it is generally assumed that a building presenting this type of clamp dates from this period or later and cannot, in any case, be earlier than the fourth century BCE. However, within the fourth century BCE, it is generally agreed upon that a more or less extensive use of Π -clamps in a building cannot be taken as a chronological indication, with commentators insisting instead on the variability of the workers' habits and economic considerations.⁸² The situation is not helped by the fact that the chronology of the architecture of the fourth century, in particular of the Doric order, is far from being resolved. Just recently, the dating of some buildings has been significantly reassessed. Can we nonetheless attempt to date the 'birth' of this new clamp?

The first attestations of the Π -clamp seem to be localized in Delphi and Epidaurus. For some time, one could think that the earliest known example of its use in large-scale construction was the niche-portico *SD* 108, near the Southeastern entrance of the sanctuary of Apollo at Delphi. The niche-portico

79 Martin 1965: 238–296. Other serviceable overviews include those by Orlandos (1968: 99–122) and Hellmann (2002: 93–95).

80 Martin 1965: 276–277.

81 Martin 1965: 273, 279; Orlandos 1968: 102–105, 109. Plain, rectangular cuttings for Π -clamps did occur in the Archaic period, although rarely and often in combination with other types of cuttings and clamps; see Wescoat 2012: 24 n. 25.

82 Pouilloux and Roux 1963: 12–14 attempted to outline the evolution of the Π -clamp in the fourth century BCE. However, a series of dates have been reassessed since then, making a number of the observations obsolete.

used to be attributed to the 'Navarchs' of the Spartan Lysander, with a date of 405–404 or 404–403 BCE, but the monument of the Navarchs has been identified since then as the monument *SD* 109, on the other side of the road. Consequently, the date of *SD* 108 had to be reconsidered. In terms of relative chronology, it is in any case prior to the construction of the base *SD* 105 and of the monument of the Argive kings (*SD* 113), which constitute *termini ante quos*. The latter also presents Π -clamps and is traditionally dated to 369 BCE or shortly after, but could possibly be a bit later. However, because the erection of the base *SD* 105 is also linked to events that happened in 369 BCE, this date remains a *terminus ante quem* for the construction of the niche-portico *SD* 108.⁸³ Π -clamps were also used very sporadically in the bearers (that is, under the pavement) of the naos of the temple of Apollo, which probably started to be rebuilt in 366 BCE.⁸⁴ In the nearby sanctuary of Athena Pronaia, the famous Tholos, traditionally dated to ca. 380–370 BCE, and the so-called Limestone temple, which used to be dated to the 350s, both made a more extensive use of the Π -clamp.⁸⁵ Recent investigations concluded that both buildings must have belonged, in fact, to the second half of the fourth century BCE.⁸⁶

With the recent reshuffling of the dates of monumental buildings in the region, it appears that the earliest known use of the Π -clamp must in fact be attributed to the temple of Asclepius in Epidaurus (fig. 2.2). Its dating, which has fluctuated between ca. 400 and ca. 360 BCE, had reached a near-consensus around 370 BCE, until Sebastian Prignitz recently moved it back to ca. 400–390. Prignitz's dating rests on an analysis of the lettering and the spelling of the inscriptions, on the style of the sculptures of the temple and on reconstructions of the careers of some of the craftsmen mentioned in the textual sources, but not on the architectural features.⁸⁷ In any case, the temple of Asclepius is a significant step in the development of the Π -clamp,⁸⁸ which quickly became widely used in Epidaurus, for the Thymele, which started to be built shortly after the temple of Asclepius, also presents numerous Π -clamps.⁸⁹

83 Bommelaer 2012.

84 Courby 1927: 87; Bommelaer and Laroche 2015: 211.

85 Charbonneaux 1925: 23–24; Michaud 197: 105–106.

86 Huber et al. 2022.

87 Prignitz 2014: 225–247 (225–226 for a useful summing up of the earlier dating). More recently, Virginie Mathé (2017: 138) has questioned this date and advocated for a later date, around 370 BCE, on the basis of the parallels with the accounts of Delphi: the accounting practices are similar and some craftsmen found in the Thymele accounts in Epidaurus appear in the Delphian accounts between 343 and 335 BCE.

88 Martin 1965: 279.

89 Roux 1961: 183–184.

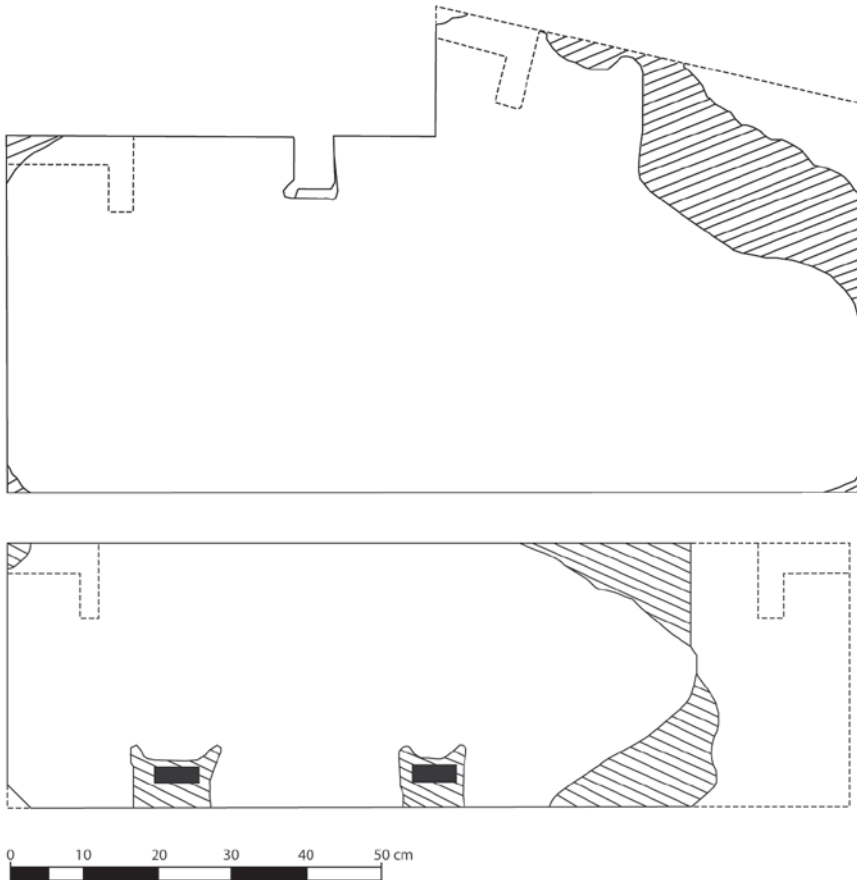


FIGURE 2.2 Fronts of tympanon block (above) and parpen block (below) of the temple of Asclepius in Epidaurus, with mortises for Π-clamp
 DRAWING BY JEAN VANDEN BROECK-PARANT AFTER ROUX 1961:98 FIG. 19; 111 FIG. 24 (RESPECTIVELY)

For the first two years of the construction of the temple of Asclepius, the origins of the contractors are systematically mentioned in the building accounts. The entrepreneur Antimachus, who undertook to assemble the blocks of the ‘visible’ *krêpis*, where Π-clamps were found, was from Argos, as was another entrepreneur who undertook to assemble the blocks of the *sêkos*, which also bear traces of these clamps.⁹⁰ It is tempting to conclude from that evidence

90 Prignitz 2014 n°1, l. 5–6, 20; Roux 1961: 90–91, 110.

that the Argives were early adopters of the Π -clamp.⁹¹ While this is a possibility, two elements call for caution. First, it must be stressed that the Epidaurian building accounts for the Temple of Asclepius do not give a detailed description of the works that were done, and it is not certain that the ‘assemblage’ of the blocks included the making and placing of the clamps.⁹² Finally, and perhaps more importantly, there is no trace, to date, of a precocious usage of Π -clamps in Argive territory in the late fifth or in the early fourth century BCE. The South Stoa and the West Building of the Heraion—both dated to the second half of the fifth century—as well as the temple of Hera, which was completed at the end of the fifth or the beginning of the fourth century BCE, present mostly T-clamps⁹³ and the few early fourth-century buildings do not seem to have had Π -clamps either.⁹⁴

And yet, it seems that in the course of the fourth century, the Π -clamp was used most enthusiastically in the Argolis and nearby Arcadia, as well as in Delphi, where Argive entrepreneurs are known to have been active. The most important testimonies, in that regard, are the ones associated with the sanctuary of Demeter Chthonia in Hermione, which saw an intensive building phase in the early fourth century BCE. Π -clamps were found in orthostates (fig. 2.3), which are ‘almost identical’ to the orthostates of the South Stoa and the West Building in Argos.⁹⁵ In Hermione, the connection with Argos and, more specifically, with Argive contractors is further evidenced by a fragmentary building inscription found in the wall of a nearby house, which is dated to the early fourth century BCE and resembles the early building inscriptions from Epidaurus. It is very likely that this inscription pertains to a construction in the sanctuary of Demeter. In line 9, orthostates are mentioned and while the name of the contractor is missing here, in lines 5 and 19, individuals, perhaps citizens of Hermione, are given a travel allowance to go to Argos, presumably in order to hire workmen.⁹⁶

91 For a discussion of the terms ‘early adopter’ and ‘inventor’, see Castelli, this volume, General Introduction.

92 It should be noted that mostly special clamps (for instance for lintels) are mentioned in this account. Prignitz 2014: 260 rightly supposes that the ‘normal’ clamps were included in the stone orders.

93 Blid 2021: 114 (South Stoa); Miller 1973: 14 (West Building); Pfaff 2003: 34 (temple of Hera). The use of T-clamps is consistent with the other features of the temple of Hera, which is more an epigone of Periclean architecture than a precursor of the Peloponnesian architecture of the fourth century BCE (Roux 1961: 58). It should be noted that cuttings for Π -clamps are found on some blocks of the temple, but that they certainly belong to later repairs (Pfaff 2003: 34).

94 See Pfaff 1989 for the Lower Stoa and the Northwest Building at the Argive Heraion, now both dated to the fourth century BCE.

95 Blid 2021: 126.

96 IG IV 742; see Blid 2021: 131.

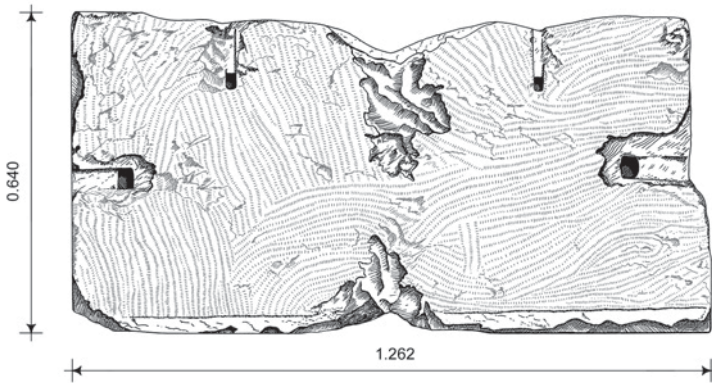


FIGURE 2.3 Top of orthostate block (O 4) of the sanctuary of Demeter Chthonia

ILLUSTRATION BY J. BLID, WITH PERMISSION FROM THE
AUTHOR, AFTER BLID 2021: 116 FIG. 18

Another possible indication comes from the area of Hermione. Some reused blocks in the Venetian wall of the Bisti promontory present cavities for Π -clamps. These blocks are located in the vicinity of a series of four bases with dedications to Demeter Chthonia, two of which mention that Argive artists made the statues which were placed on the bases; these artists can be dated respectively to ca. 400 and ca. 370 BCE.⁹⁷

In Epidaurus, as already mentioned, the Thymele was erected shortly after the temple of Asclepius. The first parts of the Thymele to be built (which include the foundations, the peristasis, the cella wall, and the basis of the interior Corinthian columns) present Π -clamps, while the blocks of the later parts are tied together with T-clamps. Georges Roux compared the Π -clamps of the Thymele with those of the temple of Athena Alea at Tegea.⁹⁸ All the clamps of the temple of Athena Alea at Tegea (dated to the third quarter of the fourth century BCE⁹⁹) are Π -shaped.¹⁰⁰ The temple of Zeus at Nemea, which is usually considered to have been heavily influenced by the Athena temple,¹⁰¹ also presents only Π -clamps¹⁰² and may have had as an architect a man also active in Argos.¹⁰³

97 I owe the information about the blocks with Π -clamps to Jesper Blid (*per epist.*). See Jameson 1953 for the bases with the dedications.

98 Roux 1961: 184.

99 Østby 2014: 341–346; Hill 1966: 44–45 (ca. 345–330).

100 Dugas et al. 1924: 55–56.

101 Winter 1982: 400.

102 Hill 1966.

103 Miller 1994.

Several Argive entrepreneurs are known to have worked in Delphi in the fourth century BCE, Nicodamus and Pancrates certainly being among the most important. The latter worked extensively on the temple of Apollo, and masons' marks referring to him (with the letters ΠΑΓ or ΠΑΝ) were found on various blocks of the cella, including in the substructions.¹⁰⁴ Some of the bearer blocks of the cella that present Π-clamps also bear masons' marks. One of those marks reads ΔΑΟ,¹⁰⁵ a likely reference to the contractor Daos of Megara, known to have collaborated on at least one contract with Pancrates of Argos.¹⁰⁶ The general importance of the Argives in the rebuilding of the temple of Apollo in Delphi is further attested by the large number of *naopoioi* from Argos compared to the other represented states.¹⁰⁷

Still in Delphi, the already mentioned Monument of the Argive Kings, which presents Π-clamps, was dedicated by the Argives according to Pausanias.¹⁰⁸ It presents two inscriptions which further attest the Argive character of the monument: one, below the statue of Danaos, reads Ἀργεῖ[οι] or Ἀργεῖ[ων]¹⁰⁹ and the other, on a pedestal block, records that the sculptor 'Antiphanes of Argos made' the statue. The latter block was attached to the blocks on its right and left sides with Π-clamps.¹¹⁰

Thus, a series of elements point toward an Argive origin of the Π-clamp. However, the nature of the evidence and the context of the period call for caution. Argos seems to have been one of the main providers of skilled labor for monumental construction at the time,¹¹¹ hence its marked presence in the sources. It would be rash to credit Argive entrepreneurs specifically with this invention. However, it is likely that they were among its early adopters. In Athens, it is only toward the end of the fourth century BCE that the Π-clamp started to be used, often still in combination with T-clamps.¹¹²

Whether the entrepreneurs and craftsmen came up with the new clamp shape themselves or not, the ultimate decision to implement them was not only theirs. The architects, as we have seen, were in charge of supervising the works at different stages of the project. Having (presumably) good engineering skills, they had the capability and the authority to accept or refuse

104 Amandry and Hansen 2010: 33–35, 494.

105 Amandry and Hansen 2010: 363, pl. 45 T 425.

106 *CID* II 49 A, col. I, l. 2–6.

107 See the useful table by Roux (1979: annexe 6).

108 Paus. 10.10.5.

109 Bommelaer and Laroche 2015: 140.

110 Marcadé 1953: I, 5.

111 Feyel 2006: 348–356.

112 Martin 1965: 274–275.

the use of specific techniques. Furthermore, the payments of the contractors (and, sometimes, the fines inflicted on them for faulty works), depended on these checks, and it is unlikely that they would have deliberately used types of clamps that had not been previously approved by the architect. An inscription from Lebadeia giving specifications for the construction of the exterior pavement of the temple of Zeus Basileus (ca. 220 BCE) is quite explicit about the importance of the verification of clamps. The entrepreneurs had to submit their work to the scrutiny of the architect and the architect's assistant; the former checked the working of the blocks and their placement, while the latter verified the joints and the beddings of each block.¹¹³ Only then was the entrepreneur allowed to seal the stones together with clamps, an important action that sanctioned the suitability of the work done so far. As such, the placing of the clamps was the object of even more attention, as described in minute detail in the following passage:

However that entrepreneur shall proceed with the introduction of the dowels and the clamps and dovetails, the weighing [of these clamps and dowels] and the sealing with lead all in the presence of the *naopoioi*, and he shall not fasten anything in secret. And if he fastens anything [in secret], he shall do everything again from scratch.¹¹⁴

The insistence on the fact that the fastening should be done in the presence of witnesses can only be interpreted in terms of the money value that the clamps represented. Metal was expensive and the contractors could be tempted to use fewer clamps, or to make thinner clamps than had been agreed in the contract in order to make more profit. The temptation must have been all the greater as the clamps were concealed as soon as a second course of blocks was laid down, and could not be checked anymore. In this regard, the presence, during the operation, of the *naopoioi*, who were in charge of the financial aspects of the construction, is significant: since metal was so expensive, it was important to make sure that the product delivered corresponded to the price paid. The inscription from Lebadeia is unusually detailed and dates to a later period than the one under consideration.¹¹⁵ However, its similarities with other contracts have been pointed out, including the one from Tegea dating to the

113 IG VII 3073, l. 159–162.

114 IG VII 3073, l. 170–174.

115 For a recent study, which shows the peculiarities of this inscription, see Pitt 2014.

fourth century.¹¹⁶ While the regulations discussed above may not have been in force on all working sites of the fourth century, it is safe to assume that it reflects concerns and practices that already existed at the time. Clauses pertaining to inspections of the works are found in other contracts, including already in the fourth century BCE.¹¹⁷ In particular, a fourth-century Athenian contract shows a high level of scrutiny for the insertion of dowels and their sheathing with lead, which had to be done according to the architects' specifications.¹¹⁸

To sum up, the fastening of the blocks with clamps was a collective operation, perhaps the most collective one in the whole construction process, since the entrepreneurs, the architect, and the building commissioners were directly involved in it. However decisive the role of the entrepreneurs was in the 'invention' of the new clamp, its adoption and diffusion depended on various categories of human agents, at various levels of hierarchy and agency. This is a good illustration of William H. Sewell's claim that 'agency is collective as well as individual'.¹¹⁹

4 Explaining the Π-Clamp's Success: Non-human Agents, Structures, and the Power of Context

Having clarified this point, we can start looking into the reasons why the Π-clamp was so widely adopted, to the point that it would become the norm in the Hellenistic and Roman periods. In doing so, I will address the contribution of inanimate objects and human institutions to the new clamp's success. Before going further, some points need to be clarified. In the framework of this chapter, 'agency' is understood as the power to act upon something, and does not imply any intent or will. As such, it is close to the definition of John McNeill, who extends agency beyond the human realm.¹²⁰ However, here I am going

116 IG V 2, 6. For the similarities between the two inscriptions, see Choisy (1884: 187–188), with similar clauses presented side by side. According to Rhodes and Osborne 2004: 295, the Tegean contract was not linked to a specific project, but had a 'general force'. This might explain the absence of more specific clauses, such as the one about the clamps and dowels in Lebadeia. The Tegean contract does, however, insist on the contractors' compliance with the *epimelomenoi*, 'those put in charge' (l. 45–51).

117 See Burford 1969: 91–102 and Feyel 2006: 491–495 for references and discussions.

118 IG II² 1678 l. 5–6 (= ID 104–4). The text is dated to shortly before 360 BCE (for the date, see Chankowski 2008: 202–206) and pertains to the construction of an Ionic building in Delos. The text also specifies that each block will be placed in the presence of the assistant architect (l. 6–8).

119 Sewell 1992: 21.

120 See McNeill, this volume, Chapter 1.

further, by granting agency to inanimate objects. The alleged problem of attributing agency to minerals, which are inert things and, therefore, apparently unable to *act*, can be solved if one takes a different time perspective, either by adopting a larger scale¹²¹ (in geological time, minerals are formed and transformed, and they move) or, on the contrary, by developing ‘a detailed temporal anatomy of the act’.¹²² Human institutions and rules are seen as integral to the issue since they both constraint and enable agency.¹²³ In this sense they represent what is usually called ‘structures’ in the field of social sciences, that is—to put it simply—‘patterns’. Structures and agency ‘presuppose’ each other and therefore must be considered together when trying to explain innovation.¹²⁴

A hypothesis of Jean-François Bommelaer on the emergence of the Π-clamp that it was originally made for and used in breccia construction.¹²⁵ According to Bommelaer, there was a practical, structural advantage of using such clamps in this type of stone, which is more brittle than limestone: the vertical pins of the Π-clamp, which were rooted deeper in the stone, were better suited than other types of clamps. T-clamps, for instance, were only attached to the surface of the block and would have run the risk of not being firmly clamped, defeating their very purpose. Affordance, defined by Donald Norman as perceived possible actions offered by the environment (in this case, a type of stone) to an observer, would have played a major role in this case.¹²⁶ In other words, the stone itself would have been an agent of change in the sense that it dictated the use of specific shapes of clamps. It might well have been the case, at least at the very early stages of the diffusion of the Π-clamp, even though the (so far) only known example of its use in breccia construction was probably not as early as was previously thought.¹²⁷ In any case, it does not account for its

121 Bennett 2010: 10–11.

122 Malafouris 2008: 25.

123 Giddens 1993: 114.

124 Sewell 1992: 4.

125 Bommelaer 2012: 171 n. 68.

126 Norman 2013: 10–13. The term ‘affordance’ was first coined by J.J. Gibson; for the most detailed description of the concept, see Gibson 1979: 127–137.

127 See above, Section 3. A well-dated monument of the early fourth century, that of Dexileus in the Kerameikos in Athens (394 BCE) presents breccia foundations. Unfortunately, it is impossible to say whether they presented clamps at all. The only clamps known in this monument are the four T-shaped mortises on the Pentelic base of the stele; see Ensoli 1987: 169 n. 12. I am grateful to the anonymous reviewer for this suggestion, which deserves further investigation.

relatively rapid expansion, in the course of the fourth century BCE, into limestone and even marble construction.¹²⁸

Another contributing factor that has been invoked is the economic advantage of the Π -clamp in comparison to other types of clamps. The new clamp was indeed cheaper to produce because it was easier to make, as it only required the bending of one piece of metal (the T-clamp, in contrast, needed at least two solderings), and because it needed less metal for a similar effect.¹²⁹ The economic aspect must have been decisive and, in a number of cases, its use can only be explained by economic reasons. For instance, in Stratos it was used along with T-clamps on the same course of blocks.¹³⁰

This economic advantage must have been noticed early on by the entrepreneurs, as it could make them more competitive. In the classical and Hellenistic periods, most of the building contracts were awarded through bid solicitation.¹³¹ Heralds were sent abroad and announcements were made in public spaces to inform potential contractors that works were being let out, and to invite them to make offers. Provided that he could present suitable guarantors, the successful contractor was probably chosen on the basis of his reputation but also, and perhaps more importantly, of the price he was offering to perform the job. From the perspective of the entrepreneurs, therefore, lowering their own costs was a way of offering a more competitive price and, therefore, to increase their chances of winning the bid. The competitive system of bid solicitations, therefore, can be considered as the main *structuring* rule that enabled agents to exert their creativity, in turn favoring the adoption and diffusion of the Π -clamp.

If the early date of the temple of Asclepius at Epidaurus proposed by Prignitz is confirmed, it would make it the first large building to make extensive use of Π -clamps. This would be consistent with the idea of competition as a social structure eliciting change, considering that the temple had a relatively low cost. Indeed, the whole construction cost about 24 talents, a rather low price if compared to the estimated 400 talents of the temple of Apollo at Delphi,¹³² which dates from about the same period, or even to the Thymele, whose cost has

128 Π -clamps were used, for instance, in the lower parts of the Thymele at Epidaurus, which comprised marble courses (Roux 1961: 183–184). However, it is interesting to note that in the upper parts, T-clamps were preferred, perhaps for structural reasons (Roux 1961: 142).

129 Roux 1961: 183–184; Bommelaer 2012: 171.

130 Courby and Picard 1924: 83.

131 Burford 1969: 159–166.

132 Mathé 2017: 144.

been estimated at 50 to 60 talents.¹³³ Various elements explain this price difference, notably the steep, difficult terrain of Delphi and the size of the building and of its blocks. In comparison, the terrain on which the Epidaurians built their temple was flat and relatively easy to access (from the port of the town, there was about 11 km with a gentle slope). On top of these favorable conditions, the Epidaurians built a temple of moderate size, and in good but simple materials (the Thymele, by contrast, made extensive use of Pentelic marble). The whole construction process took only five years or less. The temple was not a cheap building, since the sculpted decoration was made of marble, but it certainly was a modest one if compared to other constructions of the time. Based on these observations, one can assume that the Epidaurians kept a keen eye on expenses and favored contractors who were able to offer lower prices.

The competition that might have led to the adoption of a new form of clamp would not have existed without the favorable context of an intense building activity that occurred in the fourth century BCE, in particular in Delphi and Epidaurus. The sanctuary of Asclepius underwent a major phase of monumentalization which started off with the construction of the first temple of Asclepius in Epidaurus. This monumentalization coincided with an increased popularity of the healing god and, perhaps, with a political agenda aiming at tightening his links to Epidaurus.¹³⁴ In any case, it is at this time that the cult started to attract a wider audience and acquired regional importance.¹³⁵ In Delphi, the destruction of the temple of Apollo (probably in 373 BCE) resulted in the start of a new ambitious building program, in which the temple was rebuilt and the sanctuary was reorganized.¹³⁶ These two contexts no doubt stimulated the building activity at the time. The fact that the building programs were more or less simultaneous, combined with the relative geographic proximity of Delphi and Epidaurus, favored the circulation of craftsmen and entrepreneurs and the transmission of skills and techniques across the whole region. The spreading of ideas and forms is illustrated by the erection, only a few years apart, of round colonnaded buildings, the Thymele in Epidaurus and the Tholos in Delphi. The radically innovative aspect of these monuments shows that the authorities of the sanctuaries were striving to be at the forefront of novelty or, at the very least, that they were open to innovative architectural forms.

133 Hellmann 2002: 57. Stanier 1953 estimated that the whole Parthenon cost about 469 talents.

134 Burford 1969: 18–21.

135 Mathé 2017.

136 Perrier 2019.



FIGURE 2.4 Map of the main places mentioned in the text; by Jean Vanden Broeck-Parant

5 Conclusion

Architects were important agents of architectural changes in terms of design. The evolution and innovations of the Doric order must have circulated mainly in the form of treatises and specifications written by them. Their separation from the world of the entrepreneurs, however, was not airtight, far from it: architects could become entrepreneurs, and vice versa, which facilitated the circulation of new ideas. The entrepreneurs could also have access to positions with higher decision-making power, such as building commissions, where they could encourage implementing new techniques and methods based on their skill and experience. This versatility, combined with the fact that entrepreneurs were in close contact with all the parties involved in building contracts, made them efficient ‘connectors’ who enabled and encouraged the diffusion of new ideas. The case study of the Π -clamp, however, shows that their execution was subject to the approval of all the parties involved. It also illustrates the importance of taking into account non-human agents, as well as institutions. The materials themselves might have originally prompted the use of specific shapes of clamps. The institutions, in this case the awarding of contracts by bid solicitations, encouraged the entrepreneurs to adopt a cheaper kind of clamp in order to be more competitive. This competition, in turn, was made possible by a booming labor market and a favorable context of intense building activity in the sanctuaries of the region.

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