

Emerging archaeological heritage: the continuous and fragmented traces of the Thermae of Baia

Patrimonio archeologico affiorante: i segni continui e frastagliati delle Terme di Baia

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The heritage of the Phlegraean Fields comprises a multitude of sites whose blurred boundaries blend firstly with the natural landscape, from which they emerge and derive their particular morphological configurations, and secondly with the anthropised landscape layered, over the centuries, on top of these millenary memory places. The topic of collective memory thus becomes the basis for a specific reflection on issues concerning collective heritage, where individual memory is constructed by participating in communicative processes. The obstinate presence of the ruins, testifying to their eternity and their victory over the irredeemable passing of time, therefore reveals its entirety in one of the largest and most remarkably articulated archaeological complexes within the archaeological park of the Phlegraean Fields, i.e. the Thermae of Baia, whose monumental domes undoubtedly constitute an archetype for the Roman to build such ambitious opus caementicium structures.

Il patrimonio dei Campi Flegrei è caratterizzato da una miriade di episodi i cui confini labili si fondono da un lato con il paesaggio naturale, da cui sorgono e che ne ha spesso dettato le particolari configurazioni morfologiche e costruttive, e dall'altro con il paesaggio antropizzato che nei secoli si è sovrapposto, strato dopo strato a questi episodi di millenaria memoria. Il tema della memoria collettiva diventa fondante per una riflessione specifica sulle questioni che attengono al patrimonio comune, laddove la memoria individuale si struttura grazie alla partecipazione ai processi comunicativi. L'ostinata presenza delle rovine, che ne testimonia l'eternità e la vittoria sullo scorrere irreparabile del tempo, traspare quindi nella sua interezza in uno dei complessi archeologici più estesi e più straordinariamente articolati all'interno del parco archeologico dei Campi Flegrei guali le Terme di Baia, le cui monumentali cupole costituiscono senza dubbio un momento archetipico per la realizzazione, da parte dei Romani, di tali ardite strutture in opus caementicium.

documentation | documentazione

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Ortoimage the sector of the so-called Temple of Mercury.



Area of the archaeological park of the Thermae of Baia in relation to the remains of "Baia sommersa"





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Comparing the dimensions of the three large domes of Baia on the basis of Rakob's (1992) reconstructive hypothesis

MEMORY AND RUINS

The effect of the continuous motion of decomposing and recomposing reality into pictures that appear to be governed by a sort of "[...] metabolism proper to representation" (Florio, 2018; Guillerme, 1981), results in an endless flow of images that pour into our memory. Therein individual events are set in an interplay of relational connections that determine the personality and continuity of our Self.

Memory is a sort of imaginative place "[...] that captures reality through image-issues" (Gombrich, 1993)⁰¹ and in which past imprints are dynamically reactivated by triggering a series of re-elaborative processes, ultimately becoming a true creative act. "Each person," writes Israel Rosenfield, "[...] is unique: their perceptions are to some extent creations and memories belong to continuous processes of imagination. Mind life cannot be reduced to molecules. Human intelligence consists not only of a quantitative increase in knowledge,





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Left, plan of the so-called Temple of Mercury in Baia, drawing by Rajola T. (draughtsman active in the second half of the 18th century) in Paoli P.A., "Avanzi delle antichità esistente a Pozzuoli Cuma e Baia (1768) On the right, engraving by Volpato G. and drawing by Natali G.B., "Fabbrica rotonda a Baja la dicono le terme" (1765).

but of reworking, recategorising, and then generalising information in new and surprising ways" (Prattico, 1993).

Thus, the ability to explore becomes extraordinary; our interpretation increasingly assesses the essence of things and provides, by means of representation procedures, significant elements for understanding what is under analysis and for disclosing the investigative abilities of the one analysing.

The image of tangible reality that we give back is not only attributable to sensory perception, but above all to the reprocessing activity that the cerebral system performs on the information received. Perception is thus not the mirror image or 'photograph' of reality, but rather the result of an inferential mechanism through which man shapes the world he inhabits. "It is a fact that the totality of sensory experiences is constituted in such a way that allows us to sort them out through the power of thought - something that ends up astounding us, but also something we will never really be able to understand. One could almost argue: the eternally incomprehensible thing about the world is its intelligibility [...] the most beautiful experience we can possibly gain is the mystery, the underlying emotion one encounters in the genesis of art and the authentic sciences" (Holton, 1992)⁰². In Bergson's words, there are two fundamental memories, one physiological and one that declares an act of consciousness; the former, "[...] fixed in our organism, is nothing more than the set of cleverly constructed mechanisms that ensure an adequate replication of the various possible interpretations [...] Rather a habit than a memory, it involves our past experience, but does not evoke its image. The latter is true memory. Co-extensive with consciousness, it holds and arranges our states of consciousness progressively, giving each



Fabbrica votenda a Baja La dicono le Terme & dificium cen Pantheon Bais Thermas alu Altri il Tempio di Mercurio ora il Truglio .. Alti Mercurii Templum dicunt nune Truglio

fact its proper place and, consequently, date-marking it, and effectively allowing it to enter the definitive past, rather than, as per the former, relentlessly restarting the present" (Bergson, 1986). It is also true, as Ferrarotti (1993) states, that memory, in its dynamic aspect, preserves and recreates, reassembles and develops, selects, chooses and transforms, and makes the future grow whilst guaranteeing it. "[...] In the very moment in which it is conceived - and remembered - the past is no longer past. It is once again present, it is *re-presented*". Against Bergson's pristine memory and his conception of a wholly intimate image, Maurice Halbwachs (1975) opposes the continuity between image and social framework whereby the function of context is discovered and animated, as well as the connection between memory and collective history intended not as the absolute experience of time but rather as history, i.e., "[...] a node of multiple times, differentiated rhythms, behaviours and directions that only field research can uncover, describe, interpret, explain, predict (Ferrarotti, 1987, p. 95).

The theme of collective memory becomes the basis for a specific reflection on issues pertaining to the shared heritage, in a perspective that measures the "capacity of a community to construct and internally acknowledge a shared memory of the past" (Christillin & Greco, 2021) where individual memory is structured through participation in communicative processes.

Memory is also to be considered as "[...] resilience as fidelity to the original, rediscovery and re-evaluation of its bases, re-enactment of the past, perceived and understood as a repository of seeds that have yet to bear fruit" (Ferrarotti, 1994); then art, in particular figurative art, hence architecture, in its ancestral essence, is none other than a huge type of remembrance, which re-enacts the Ancient by building its image. "The existentially significant recollection, that [Wilhelm] Dilthey defines and indicates with the term Erlebnis, does not only recall past experience as past, i.e., the already endured and forever concluded, but also its yet unexpressed experiencing potential for recalling and bringing to life the past-future, the seeds of the future hidden in past experience" (Dilthey, 1954; Ferrarotti, 1987, pp. 84-85). Figurative art presents itself as the result of human experience in which past and present coexist, a hic et nunc where the character of contemporaneity is consolidated alongside historical memory, according to a hermeneutics process that "[...] is no different from the one carried out by contemporaries and will be carried out by posterity" (Strinati, 1994). Indeed, it is architecture that concretises the concept of figurative art as a historical place of excellence of memory and identity and that implies "[...] meditation on the criterion of the model [...] legitimised by the weight of the Ancient and constantly reworked and adapted to circumstances" (Strinati, 1994).

Among inherited cultural heritage, archaeological heritage takes on a multifaceted meaning due to its function as a distiller of memories that hold and retain different temporalities: the time of the Ancient, the time of transformations, the time of stratifications, the time of neglect, the time of depredation and oblivion, the time of revelation. "It is a pristine time, [...] time lying in ruins, the ruins of time that has lost history or that history has lost, [...] non-dateable, absent from our world of images, of simulacra and reconstructions, from this violent world whose debris no longer has time to become ruins. A lost time that art sometimes manages to rediscover" (Augé, 2003). Heritage, in its extreme fragility – not only physical but also inherent in the transmission of its testimonial presence –, presents itself as a vast field of events that the complex and articulated action of unravelling makes particularly productive as an active bearer of memories.

But memory, in its deeply reconstructive action of the past, both discloses and conceals at the same time. Every memory holds within itself the risk of forgetting and the temptation of oblivion. It must be questioned in its elusive relationships with oblivion.

In the continual oscillation between present and past in the "[...] grafting of today onto a multitude of yesterday", (Settis, 2006) there is once again a recurrence to the role of the ruins, to the always tense relationship with the relics, the mutilated monuments of antiquity,



Planimetry of the sector of the so-called Temple of Mercury (Rakob 1988).



Pictures of the extrados of the dome of the so-called Temple of Mercury, detail of the oculus.

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Pictures of the intrados of the dome of the so-called Temple of Mercury, detail of the oculus.

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Pictures of the intrados of the dome of the so-called Temple of Mercury, detail of the oculus (left) and of the radial openings (right).

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those 'remains' that in their state of visible decay mark its end, but which, however, also herald, through the presence of impending traces, its relentless rebirth. "[...] the ruins are both a powerful metaphorical epitome and a tangible witness not only of a vanished ancient world but also of its intermittent and rhythmic awakening to new life. [...] The ruins signal [...] both an absence and a presence: they show, or rather are, an intersection between the tangible and the intangible. What is invisible (or absent) is highlighted by the fragmentation of the ruins, by their 'useless' and sometimes incomprehensible appearance, by their loss of functionality (or at least of their original functionality). But their stubborn visible persistence testifies [...] to the durability, and indeed the eternity, of the ruins, their victory over the irreparable passage of time" (Settis, 2004).

This condition of apparent perpetual and immutable stillness transpires in its entirety in one of the largest and most extraordinarily articulated archaeological complexes such as the Thermae of Baia within the Archaeological Park of the Phlegraean Fields (Amalfitano et al., 1990). From the mighty domes of the so-called temples of Diana and Mercury, through the astonishing vertical profiles of the *Ambulatio* villa that climb the steep slope to the west, where the original intimacy of the inner spaces now becomes an exteriority exhibited with remarkable charm; proceeding to the Aphrodite of Sosandra complex, where from





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Photobashing of the parametric modelling process of the intrados of the Mercury dome in the Dynamo for Revit environment designed according to Rakob (1988).

the lawn of the ancient pool its rooms are placed across the different levels of the rugged overhanging hill, up to the architectural clustering of the small thermae in the southern sector of Venus, which are now separated by the so-called temple whose interior space celebrates, seamlessly, its direct ascent to the sky. This imaginative sequence of mutilated architectures, e.g., the semi-collapsed dome of the temple of Diana, regains the value of its presence through a deafening silence that yearns for a new condition of belonging to the fate of a contemporary landscape, through a combined action of scientific exploration and dissemination of knowledge, which, together with the necessary protection and preservation actions, will explore "[...] the echo of that harmonious insurrection that testifies to human greatness throughout the centuries".

THE THERMAE OF BAIA AND THE SO-CALLED TEMPLES OF MERCURY, VENUS, AND DIANA

Although the Phlegraean Fields have been appreciated by scholars since antiquity, albeit mainly as a holiday resort, they acquired great prestige between the 17th and 20th centuries when this destination was included among the sites of the *Grand Tour*, for the inherent cultural value of a landscape stratified and reshaped over the centuries by volcanic phenomena and bradyseism. The balanced equilibrium between nature and archaeological evidence, particularly evident in the area of the current archaeological





dome in the Dynamo for Revit environment through the volume of the whereav of the suitable equations derived from that of Kepler's ovoid.

park of the Thermae of Baia, was, however, altered during the last century when first the opening of the Cumana railway, then the construction of the dockyards - between the Aragonese castle and the thermal area - and finally the urban redevelopment activities created a rift between the park and the so-called temples of Diana and Venus. Although characterised by a high degree of interpenetration with the modern city, the archaeological structures of Baia's Roman thermae were finally declared a 'Monumental Park' in 1936 by the then Superintendent of Antiquities in Campania Amedeo Maiuri, who also supervised the restoration work carried out - albeit not continuously due to the ongoing war - from 1941 to 1961 (Maiuri, 1958; Veronese, 2018). The so-called Temples of Baia - named so because of the sacrality inspired by their daring dimensions - undoubtedly constitute an archetype for the Roman construction of monumental domes in opus caementicium. While the dome of the so-called Temple of Mercury is the first in chronological order, dating back to the late Republican or early Augustan period, it is followed by the dome of the Temple of Venus, dating back to the time of Hadrian; whereas the latest is that of the so-called Temple of Diana, presumably attributed to Emperor Alexander Severus (Rakob, 1992). Of the three aforementioned structures, the pseudo-dome of the Temple of Mercury, built by concentrically superimposed horizontal rows, is the only one that has been preserved in its entirety, while the dome of the Temple of Diana, with an apparent geometric matrix similar to the latter except for the apex opening, has partially collapsed; unfortunately, the 'umbrella' dome of the Temple of Venus has only scarce historical documentation and a few traces still visible at its springing (De Angelis d'Ossat, 1942; Rakob, 1988).

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Although the first actual example of an opus caementicium dome was the round hall of the sanctuary of Fortuna Primigenia in Palestrina, it was very small in size; therefore, the domes of Baia represent the first example of monumentalisation of this type of construction. In particular, the dome of the so-called Temple of Mercury would also seem to precede the laconicum of the Thermae of Agrippina in the Campus Martius in Rome, known to date only in literature, while it certainly predates by two generations the vaulted halls of the laconicum in Herculaneum and Pompeii and later became the inspiration for the dome of the Pantheon in Rome (Rakob, 1992). These deductions refer to the complicated constructive circumstances of the Phlegraean Fields, a field of experimentation, both for the use of *pulvis Puteolana* - volcanic ash extracted from the solfatara in the Phlegraean Fields area of Pozzuoli - to enrich the mortar and give it hydraulic properties, and for the traces still visible on the dome caused by uncertainties in the construction process, thus bearing tangible witness to an optimisation of the technique occurring throughout the building process. At the same time, it is possible to read in the spatial organisation of the sector of the Thermae of Mercury - of which the great hall covered by the dome probably constituted a *frigidarium* - an initial attempt to arrange the covered thermal rooms by superimposed levels, yet almost unconscious and only fully resolved in the Hadrianic period.

The first results of the studies conducted in the search for the generative matrices of the domes of the Temples of Mercury and Diana are presented in the following. Certainly, also due to the construction technique employed, the shape of these pseudo-domes takes on a characteristic pattern, described in the literature as a polycentric profile, which adopts two different radii of curvature (*Rakob*, 1988).

These graphic constructions, therefore, involve a cusp at the top, which is visible in the case of the temple of Diana and ideal in the case of the temple of Mercury, where it culminates in an oculus slightly eccentric in relation to the general layout. Thus, the experiments conducted in the literature on the basis of Rakob's first considerations were mainly focused on the search for curvature radii that would best approximate the polycentric profile of the more recent of the two so-called temples (Sinopoli et al., 2018; Sinopoli & Aita, 2021). Drawing on the graphical analyses conducted previously, it was first postulated and subsequently empirically verified (Florio et al., 2024; Maggio & Garozzo, 2024) that the three-dimensionality of the domes under consideration could be described by means of Kepler's pyriform ovoid equation (Davis, 2009). The original formulation of this fourthdegree equation with two variables, however, accounts for a fixed proportion between the maximum height of the ovoid (along the 'y' axis) and the maximum width (along the 'x' axis), so an additional coefficient 'b' was introduced for the purposes of the present investigation, in order to modify the maximum radius of the ovoid keeping the same rise⁰³. In order to compare the literature assumptions concerning the geometric genesis of the domes' intrados with the experiments currently in progress, two parametric scripts - implemented via Visual Programming Language (VPL) in the Dynamo environment for Autodesk Revit - were developed and tested on the dome of the Temple of Mercury. The first script aims solely at the three-dimensional generation of the structure's intrados on the basis of the polycentric profile proposed by Rakob [Figs. 08., 10.], while the second can automatically determine thanks to an *ad hoc* routine - the optimal value of 'b' as the rise and the maximum span taken into consideration vary (being these measurements still uncertain due to the current state of conservation of the complex) in order to obtain a dynamic response in the threedimensional rendering of the dome. The chosen formulation made it possible to generate both the surface area at the intrados and extrados of the dome - determining a value of 8.85m and 10.77m as the maximum rise and radius for the intrados and 10.4m and 11.7m for the extrados - then compared with the point cloud from the terrestrial laser scanner to detect any deviations; these deviations were summarised in graphs, supplemented with histograms, and marked in red if positive and in blue if negative [Figs. 09., 10.].



10.

Cross-section of the so-called Temple of Mercury with the insertion of the dome models developed according to Rakob's indications (blue) and derived from Kepler's ovoid equation (red) within the point cloud model obtained from the laser scanner survey.

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ACKNOWLEDGEMENTS

The study is conducted within the framework of the research activities of the PRIN 2022 SPLASCH (Smart PLatform and Applications for Southern Cultural Heritage - CUP: E53D23013940006) project and the PE5 CHANGES (Cultural Heritage Active Innovation for Sustainable Society - CUP: E53C22001650006) project, funded by the European Union - Next Generation EU. In addition, we would like to thank the Director of the Office for the Protection and Management of Archaeological Areas, Monuments and Collections of the Archaeological Park of the Phlaegrean Fields Dr. F. Pagano, the manager of the Archaeological Museum of the Phlaegrean Fields in the Castle of Baia Arch. M. P. Cibelli, the head of the Archaeological Park of the Baths of Baia Arch. A. Klein, the head of the Underwater Park and the Baths of Baia Dr. E. Gallocchio for authorising the survey operations of the Archaeological Park of the Baths of Baia and Eng. A. G. E. Florio for his contribution to the aero-photogrammetric surveys of the area of the Archaeological Park of the Baths of Baia.

NOTES

011 Cf. Frances A. Yates (1966), The Art of Memory in A. Biondi (Ed.), trans. it., L'arte della memoria, with the essay "In memoria di Frances A. Yates" by Ernst H. Gombrich (1993), footnote 39.02I See: https://civic-city.org/nonsapere/

021 Albert Einstein, in Gerald Holton (1992).

03I Having set the Cartesian reference system at the 'key of the dome' with 'x' positive towards right and 'y' positive upwards, Kepler's ovoid equation $(x^2 + y^2)^2 + ay^3 = 0$ was modified as follows $(bx^2 + y^2)^2 + ay^3 = 0$. To generate the profile, the two non-imaginary roots of 'x' were then determined for 'y' varying along the negative semi-axis, once the relationship between the coefficient 'a' and the value of 'y' had been empirically determined using a= -ymax/0.563, where 'ymax' is the maximum radius of the dome at the impost. Therefore, the value of 'b' that best approximates the dome analysed is the only one to be determined.

BIBLIOGRAPHICAL REFERENCES

Amalfitano, P., Camodeca, G., & Medri, M. (1990). I Campi Flegrei: un itinerario archeologico (1. ed.). Marsilio. Augé, M. (2003). Le temps en ruines. A. Serafini (Ed.), trans. it., Rovine e macerie. Il senso del tempo (2004) (pp. 135-139). Bollati Boringhieri

Bergson, H. (1986). Matière et mémoire. F. Sossi (Ed.), trans. it., Opere 1889-1896 (pp. 28-259). Mondadori. Camus, A. (1951). L'homme révolté. L. Magrini (Ed.), trans. it., L'uomo in rivolta (2009) (p. 301). Bompiani.

Christillin, E., & Greco, C. (2021). Le memorie del futuro. Musei e ricerca. Giulio Einaudi editore. Davis, A. E. L. (2009). Kepler's 'Via Ovalis Composita': Unity from Diversity. Journal for the History of Astronomy, 40(1), 55-69. https://doi.org/10.1177/002182860904000105

De Angelis d'Ossat, G. (1942). Il Tempio di Venere a Baia. In Estratto dal Bull. del Museo dell'Imp. Rom.: Vol. XIII. Stabilimento tipografico ditta Carlo Colombo

Dilthey, W. (1954). Critica della ragione storica. Einaudi

Ferrarotti, F. (1987). Il ricordo e la temporalità (pp. 82-83 and p. 95). Laterza.

Ferrarotti, F. (1993). La tentazione dell'oblio. Razzismo, antisemitismo e neonazismo (p. 7). Laterza.

Ferrarotti, F. (1994). Al setaccio della storia. Sfera, Memoria e Identità, 41(agosto/ottobre), 9.

Florio, R., Catuogno, R., Della Corte, T., Sanseverino, A., Borrelli, C., & Tortoriello, A. (2024). 'Modello' e forma del cosiddetto tempio di Diana presso le Terme di Baia/ 'Model' and form of the so-called temple of Diana by the Therme of Baia. In F. Bergamo, A. Calandriello, M. Ciammaichella, I. Friso, F. Gay, G. Liva, & Monteleone C. (Eds.), Measure / Out of Measure. Proceedings of the 45th International Conference of Representation Disciplines Teachers (pp. 1395–1424). FrancoAngelo srl.

Gombrich, E. H. (1993). In memoria di Frances A. Yates. In A. Biondi (Ed.), tr. it., L'arte della memoria. Einaudi. Guillerme, J. (1981). La figuration graphique en architecture. L. Agnesi (Ed.), tr. it., La figurazione in architettura (1982) (p. 13). FrancoAngeli.

Halbwachs, M. (1975). Les cadres sociaux de la mémoire (1925). Mouton.

Holton, G. (1992). Le vie della scoperta. Sfera, Noto e Ignoto, 26(marzo), 6.

Maggio, F., & Garozzo, A. (2024). L'analisi grafica tra tradizione e innovazione. TRIBELON Journal of Drawing and Representation of Architecture, Landscape and Environment, 1(1), 60-73. https://doi.org/10.36253/tribelon-2857 Maiuri, A. (1958). I Campi Flegrei. Roma: Istituto Poligrafico e Zecca dello Stato. Istituto Poligrafico e Zecca dello Stato. Libreria dello Stato.

Prattico, F. (1993). L'lo et l'altro. Sfera, 35(luglio/agosto), 53.

Rakob, F. (1988). Römische-Kuppelbauten in Baiae. Die Gewölbeprofile. In Mitteilungen des Deutschen Archäologischen Instituts. Römische Abteilung (Vol. 95, pp. 257-301). Verlag Philipp von Zabern.

Settis, S. (2004). Futuro del 'classico' (pp. 84-85). Einaudi.

Settis, S. (2006, October 27). Una panchina davanti ai ruderi. La Repubblica.

Sinopoli, A., & Aita, D. (2021). The Dome of the Temple of Diana in Baiae: Geometry, Mechanics and Architecture. In P. Roca, L. Pelà, & C. Molins (Eds.), 12th International Conference on Structural Analysis of Historical Constructions. SAHC 2020 (pp. 433-444). CIMNE. https://doi.org/10.23967/sahc.2021.285

Sinopoli, A., Valenti, G. M., Bruno, M., Conti, C., Romor, J., & Martines, G. (2018), Primato romano delle volte, Il Tempio di Diana a Baia. In S. D'Agostino & F. R. D'Ambrosio Alfano (Eds.), International Conference on History of Engineering, atti del 7° Convegno di Storia dell'Ingegneria (pp. 57-71). Cuzzolin.

Strinati, C. (1994). Il ritorno dell'Antico. Sfera, Memoria e Identità, 41(agosto/ottobre), 54.

Veronese, L. (2018). Alle origini di una difficile tutela: Amedeo Maiuri ei restauri al parco archeologico delle terme di Baia. Restauro Archeologico, 26(1), 20-43. https://doi.org/10.13128/RA-234

Florio, R. (2018). Origini evoluzioni e permanenze della classicità in architettura (pp. 41-42). Officina Edizioni.

Rakob, F. (1992). Le cupole di Baia. In M. Gigante (Ed.), Civiltà dei Campi Flegrei. Atti del convegno internazionale (pp. 229-258).