

¹Introduction

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Je me présente la vaste enceinte des sciences comme un grand terrain parsemé de places obscures et de places éclairées. Nos travaux doivent avoir pour but, ou détendre les limites des places éclairées, ou de multiplier sur le terrain les centres de lumière. L'un appartient au génie qui crée, l'autre à la sagacité qui perfectionne.²

Denis Diderot, Pensées sur l'interprétation de la nature, Paris, 1752, Pensée 14

After Madrid in 2003, Cambridge in 2006 and Cottbus in 2009, Paris was selected to host the Fourth International Congress on Construction History. Building upon the momentum of the previous congresses, more than 680 paper proposals were received, representing at least 1000 researchers, obliging the Scientific Committee to undertake a rigorous selection process. This publication includes all of the 240 papers written by the participants. In respecting the established tradition, we have retained the idea that the congress, and the proceedings, be a reflection of the discipline in all its diversity, both thematically and geographically.

The evolution of the field

Through these congresses, and without a doubt in part thanks to them, the field has been structured, enriched and enlarged. The multiplica-

tion of events since Cottbus is evidence of this: *Actas del Sexto Congreso Nacional de Historia de la Construcción* [Madrid, 2009]; *Edifice & artifice: Histoires constructives* [Paris, 2010]; *História da construção: Os construtores* [Braga, 2011]; *L'architrave, le plancher, la plate-bande* [Lausanne, 2012];³ the creation in 2010 of the Francophone association of construction history and the first Portuguese national congress in February 2010.⁴

Even if the definition of this field is not unanimously agreed upon, it is possible to see a clear trend emerging, which is likely a reflection of the dynamism of construction history today. Even if it is not a distinct discipline, since its teaching is not officially recognized as such and it lacks a structuring organization,⁵ it can without a doubt be recognized as a “boundary object,”⁶ a multidisciplinary research field centered on the technique of the art of building around which two complementary approaches are developing: one cultural and the other social.

The first congress, held at the initiative of Santiago Huerta,⁷ was strongly marked by studies focusing on theorization and on physical objects. For Huerta, the history of construction remains above all a history that has a practical end, “a technical approach for understanding the built universe,” practiced by historians capable of understanding “technically advanced” objects [making mortars, stone cutting, carpentry, etc...].⁸ That is, a history of construction inscribed in the tradition of its founders [Rondelet, Willis, Viollet-le-Duc, Semper, Ungewitter, Choisy, etc.], engineers and architects who, for the most part, sought in history the principles and models destined to teach and renew the constructive practices of their time.

Fairly close to this, the lens of material history advocated by Bruno Reichlin and Franz Graf⁹ privileges action. It is about orienting the practice of the “project,”¹⁰ identifying important “works” to be protected as well as developing knowledge about historic and contemporary techniques with a view to their restoration. Investigations are rather monographic and relate to objects or individuals. The valuation of techniques, commonly overlooked and underappreciated, remains a major objective of this approach to construction history.

Meanwhile, Roberto Gargiani and the Laboratory of the Theory and History of Architecture at the Polytechnic School of Lausanne, through the project of writing a “new history of construction,” see it as a domain “both technical and theoretical, destined for students, architects, engineers, technicians and contractors,” which, by its approach focusing on “construction, materials, techniques” allows renewing in a larger sense the “analyses of architecture.”¹¹ Their privileged objects are “architectural elements”: column, lintel, window, staircase; that is, objects that link aesthetic and technical issues.¹²

To these “practical” approaches, which are intended to teach professionals how to build, protect and restore, one adds those that aim to develop a more critical history of techniques. The 2006 Cambridge Congress marked a certain moment in this evolution, identified by Antoine Picon, as characterized by the decrease of “internal” approaches, which were less concerned with the context in which the objects are produced.

Several introductory articles of *Édifice & artifice* argue for the de-compartmentalization of construction history and its opening towards other disciplines and, in particular, for a more human and social history of construction that is more attentive to people, practices and customs. Of note, Antonio Becchi proposed that the history of construction be a place where competences meet.¹³

Theoretical foundations

Two privileged objects of study in construction history can be identified.¹⁴ On the one hand, there is a strong interest in knowledge and theorization [through topics such as structural design, stereotomy, sciences applied to construction, etc.], i.e. for their intellectual or even cognitive aspects. On the other hand, much attention is given to physical objects, to certain works [for example, bridges, dams, walls, floors, vaults, etc.], or to materials or technical processes. Technical culture has maintained conflicting relations with the sciences since the Middle Ages.¹⁵ The adjective “cultural” seems adequate for qualifying the history of construction because, etymologically, the word culture comes from the Latin “colere,” meaning “dwelling,” “cultivating” or “honoring”; its polysemy may nevertheless be misleading. Human and social sciences cannot be reduced to the opposition between culture and technology as in Anglo-American cultural studies.

Thus, without trying to minimize the place of technology, we propose an extension towards the trades as well as an additional line of research, that of the “society,” in order to complete the constructive vision by an ontological contribution. The architect and engineer, of course, but also the contractor – in their multiple social arrangements [professional communities, industrial companies], in their professional hierarchies and with the groups of unskilled laborers – participate in the act of building.

This established pragmatic link, which is the concern principally of social practices, does not of course limit itself to studies of heroic builders – quite the contrary. It uncovers little known aspects in the work of certain actors, highlights the

labor of groups of workers who anonymously traverse history, analyzes the mechanisms of immigration, is enriched by ordinary construction techniques, captures the exceptional moments of passage from one professional status to another, from mason to architect, from craft to industry,¹⁶ analyzes technical tasks [*gestes*¹⁷ *techniques*] of artisans, dissects the changing labor and real estate markets as well as the diverse modalities of the conception of ownership. To resituate the components of the “society” in the history of construction also is to study the institutions responsible for managing the art of building, to indicate the way forward, to orient it towards a particular purpose, to infuse it with salvational means for the national economy or for the welfare of populations affected by disasters, to conquer a dominant position at a colonial and even international scale. After social and economic history, we must not forget law. Studying the legal writing of technical norms and professional standards, tracing the evolution of legal concepts such as ownership, liability and consent, also deserve their place within construction history. It is often necessary to find these things there where they are not expected, beyond the boundaries of the domain of law, in the hands of construction practitioners themselves. What indeed was Auguste Choisy doing if not practicing the humanities and social sciences, in his *Art of Building among the Romans*, in 1873?¹⁸

It is not only the themes that are diversifying, but also the construction historian’s sources that are getting richer. Certainly, archaeologists, architects and engineers use built objects above all else in their historical approaches, material objects that are constructed or deconstructed, reduced to the state of material memory. The history of techniques requires a study of the experimentation of inventions, failed attempts, testing mechanisms, machines and tools, modeling and study models, etc. But also, and this is explicitly the case for the history of construction, the reconstruction of a particular constructive element in a workshop at a 1:1 scale in order to verify the potential operation of something when subjected to particular constraints.

Historians dig through archival paper. Manuscripts, unpublished treatises or courses,

construction drawings, patents, companies’ archives, correspondence and field notes, but also estimates and contracts, consultants’ meeting minutes, a host of conventions and individual contracts, pay slips, etc.; these also widen the palette.

Finally, more and more, it will be necessary to retain oral sources, indeed audio-visual sources, which permit us to hear the last living examples of vernacular construction: whether these be emergency hut carpenters or traditional lime manufacturers. Much should be saved of the traces of designers and workers whose memory could be conserved and discovered through photographic reporting.¹⁹

Nuts & bolts

Indeed, the displacement of the objects of study appears clearly in the structure of this collection. The larger debates concerning construction history, seen from a proto-disciplinary point of view, are extended and enriched in this volume [see the first part]. It is devoted to a series of reflections on the epistemology of construction history, its heuristics, its sources and methods, its teaching and its necessity for restoration and rehabilitation. These contributions form the backdrop against which we can measure the evolution of our collective research, which follows in the ensuing chapters.

Construction materials and technologies [see the fourth and fifth parts] alone account for half of the articles. However, if the approaches are often monographic and if the analysis of case studies dominates, the investigations are less descriptive than before and take more into account procedures for the implementation and production of objects. The scale of observation, both spatial and temporal, is wider. This evolution is particularly visible through topics in full development such as industrialization, prefabrication, networks or techniques associated with comfort [heating, ventilation, lighting, etc.]. Researchers seek now more than before to situate the trades in their production context, they focus on “technical systems” [ensembles of compatible techniques implemented during the same epoch] and even the “large technical systems” [systems that involve “an organizational, decision making and manage-

rial dimension of practices, including the point of view of uses”).²⁰

Knowledge and theorization [see the second part] also remain privileged objects, but there also is a perceptible evolution here. To the research on the design of structures and traditional structural analyses as well as on the modeling of complex objects comes the addition of new themes common to social and cultural studies, such as the transfer of knowledge, technical literature or education, where one finds a shared interest in educational and professional issues. The essays on the rules and standards of construction and on the organization of markets also reveal the fruitful exchanges that construction history weaves with legal and economic history.

Finally, the third part entitled, “People & Organization” brings together new subjects that the history of construction henceforth shares with the history of sciences and techniques, especially the history of *savoir-faire*, gestures and actions. More concretely, this deals with the skill of artisans, contractors and technicians [economists, auditors, experts] and the role of institutions and organizations [professional associations, consulting firms, government departments, etc...] that the works permit us to shed light on. It is important to emphasize that the numerous practitioners who participated in the congress [architects, engineers, contractors, restoration specialists] are particularly well placed to illuminate the back-and-forth between theory and practice that are currently a central concern of historians of sciences and techniques. They offer, thanks to their knowledge related to their professional activities, heuristic readings of practices, tasks and customs. As the subtitles of this part indicate, the history of construction is moving towards a history of the process and the concretization of projects. Several papers focus on the organization of construction sites, offices and teams or on the technical and financial policies or histories of lived experiences in buildings and of make-shift repairs.

It is clear that, for the contemporary period, these new approaches that reconstitute varying view points or various practices [designers, implementers and users], constitute a valuable tool for assessing techniques. As Gilbert Simondon pointed out in his time, these modalities of evaluation are, in

a world shaken up by the growing importance of techniques, absolutely necessary.²¹ Technical objects are not neutral objects for which it is only a matter of describing or understanding questions like “How to build it?,” “How much does it cost?,” “Is it a safe design?” or “What caused the failure?”²² As shown by Jacques Guillerme and H el ene V erine, the study of “deliberations, reflections, calculations, experiments motivating decision making, abandonments and achievements” are essential to understand the projects of the engineers involved in the matter,²³ because it is indispensable for historians to assess the consequences of technology on living organisms and to assess their ethical value. The urgency of such a reflection is evident in the progression of studies on the contemporary period [in line with what is happening in the social sciences] and in particular on the 20th century [as numerous in these proceedings as those on all the other periods combined]. The evaluation of techniques sometimes misunderstood, looked down upon, reductively opposed to humans and to nature or, conversely blindly praised, remains for us a major objective of construction history.

In a recent collective work that was meant to “re-invent” construction in a prospective optic, one can read that: “Construction [...] is much more than a mere act of production; it is a multilayered process of re-organizing matter, taking place in a variety of scales and time frames. – Most of today’s construction is based on concepts, technologies, materials and social models, which are more than a hundred years old, and does not take advantages of the knowledge we currently have. But with climate change, shrinking resources of raw materials, radical demographical shifts, and exacerbating social inequalities resulting from the rise of neo-liberal economy, construction needs to be re-invented now more than ever.”²⁴ This shows the importance of history in this field of research for developing, on the one hand, new technologies not only concerning materials, techniques and energy but also the promising concept of common ownership [the notion of “commons” developed by Nobel Prize winner in Economic Sciences Elinor Ostrom] and, on the other hand, rediscovering the virtues of vernacular architecture. We find these two lines of research to be historic contributions to the present book.

All in all, therefore, the first goal of the event, which was to bring together a wide community of researchers and practitioners from various disciplines, can be considered fulfilled. Historians of sciences and techniques, of art, law and economics and also archaeologists and anthropologists bring to the architects, engineers and technicians at the origin of the “history of construction” a cultural and social dimension that enriches a strictly technical vision of building and public works.

The second goal, however – to open this research to men and women coming from geographical areas other than Europe and the United States and, in particular, to those areas in rapid transformation, notably Africa, Asia and the still too little explored territories of Eastern Europe – is only partially attained. Aside from South America, where studies on the 20th century are particularly dynamic, the other continents are rather poorly represented and the African continent remains conspicuously absent. To stir up interest, to encourage, to enable research relevant for thinking or rethinking the identity of territories shaken up by globalization remains one of the challenges for the next International Congress on Construction History.

NOTES

1. “I understand the vast enclosure of sciences as a large field strewn with dark places and illuminated places. Our work must have as its objective, either to extend the boundaries of illuminated places, or to multiply the illuminated places in the field. One belongs to the genius that creates, the other to the wisdom that perfects.”
2. Huerta, S., R. Marín, R. Soler and A. Zaragoza (eds), 2009. *Actas del Sexto Congreso Nacional de Historia de la Construcción*. Madrid: Instituto Juan de Herrera.; Carvais, R., A. Guillerme, V. Nègre and J. Sakarovitch (eds.), 2010. *Edifice & artifice: Histoires constructives*. Paris: Picard.; Sousa Melo, A. and M. do Carmo Ribeiro (eds.), 2011. *História da construção: Os construtores*. Braga: CITCEM [This team plans to hold annual conferences, each organized around a different theme, with the acts published the following year – in 2011, they focused on materials and, in 2012, they will focus on techniques.]; Gargiani, R. (ed.), 2012. *L'architave, le plancher, la plate-bande*. Lausanne: Presses polytechniques et universitaires romandes.
3. Conference: “A História da Construção em Portugal: Alinhamentos e Fundações.” 19 Fevereiro 2010. J. Mascarenhas Mateus, J. Antonio Bandeirinha and

Finally, we must also justify the title under which we decided to publish the proceedings. If the phrase “nuts & bolts,” suggested to us by Robin Middleton, is well known to English speakers, it is less so for those who are not and merits a brief explanation. Nuts and bolts are familiar components on any construction site; the bolts are rods that slip through different pieces of an assemblage, which are then secured in place by nuts, essentially fastening devices that terminate the bolt. As a phrase, “nuts & bolts” is also a slang expression that makes reference, in its most general sense, to communicative processes and contents. More specifically, it signifies detailed, practical information concerning either how something works or what it will take to get something done. The title of the proceedings plays upon this dual understanding. What’s more, it announces the position of the Organizing Committee that the nuts and bolts of construction history are culture, technology and society, an inseparable trio. This triad permits us to examine “the nuts & bolts” of construction history, thus allowing us to erect together new understandings that simultaneously concern how things worked and what it took to get things done.

- S. Barca (eds.). Universidade de Coimbra / Núcleo de Arquitectura e Urbanismo.
4. Boutier, J., J.C. Passeron and J. Revel (eds.), 2006. *Qu'est-ce qu'une discipline?* Paris: EHESS.
5. Leigh Star, S. and J.R. Griesemer, 1989. Institutional Ecology, ‘Translations’ and Boundary Objects: Amateurs and Professionals in Berkeley’s Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science* 19 (3, Aug.), 387-420; Akrich, M., 1992. The De-Description of Technical Objects. *Shaping Technology, Building Society: Studies in Sociotechnical Change*. W. Bijker and J. Law (eds.). Cambridge: MIT Press, 205-224.
6. Founding member of the *Sociedad Española de Historia de la Construcción*, professor at the Architecture School of the Polytechnic University of Madrid.
7. Huerta, S. L’Histoire de la construction en Espagne: origines et état des recherches. *Edifice et artifice, op. cit.*, 65-76. For Huerta, “Construction is aimed at a practical end,” adding that, “Construction is the how: it is the center of our discipline.” (Huerta, S. Historia de la Construcción: la fundación de una disciplina. *Actas*

del sexto Congreso de historia de la Construcción, op. cit., p. xiii).

8. , B., 2002. Quelle histoire peut nous aider à travailler sur l'architecture moderne et contemporaine ? Une opportunité de redéfinition de la discipline. *Les Cahiers de la recherche architecturale et urbaine* 9-10, 169-178. See also the contribution of F. Graf in "Material History and Conservation of Contemporary Building Fabric."

9. Concerning the question, "What purpose does the history of construction serve?" Philippe Potié, professor at the École nationale supérieure d'architecture de Versailles answers: "To make architectural projects," and then, a little later on, "to construct." (Potié, P. *Les Temporalités de l'histoire de la construction. Édifice & artifice, op. cit.*, 53, 56).

10. Gargiani, R. (ed.), 2008. *La colonne: Nouvelle histoire de la construction*. Lausanne: Presses polytechniques et universitaires romandes, 6. The collection aims to "decompose architecture in elements" analyzed in chronological fashion; the column then the architrave are the first elements studied.

11. Gargiani, R. (ed.) *L'architrave, le plancher, la planche, op. cit.*

12. See Becchi, A. Histoire de la construction: un regard italien, 59-63; Carvais, R. Plaidoyer pour une histoire humaine et sociale de la construction, 31-43; Nègre, V. Pour une histoire technologique de l'architecture, 17-22; Sakarovitch, J. L'histoire de la construction et l'histoire des sciences, 24-29, all in *Edifice & Artifice, op. cit.*

13. See Picon, A., 2006. Construction History: Between Technological and Cultural History. *Construction History*, vol. 21, 5-19.

14. See, for example, the ideas developed by Jacques Ellul or Hans Jonas.

15. See, for example, Bertels, I., 2011. Building Contractors in Late Nineteenth-Century Belgium: From Craftsmen to Contractors. *Construction History: Journal of the Construction History Society*, vol. 26, 1-18.

16. In French, the word *geste*, which may be translated in English as gesture, comes from the same Latin root as *gestion*, translated as management.

17. Carvais, R., 2009. Auguste Choisy: pour un usage des sciences sociales au service de l'histoire de la construction. *Auguste Choisy: 1841-1909, L'architecture et l'art de bâtir*. S. Huerta and J. Girón (eds.). Actas del Simposio International celebrato en Madrid, 19-20 noviembre 2009. Madrid: Instituto Juan de Herrera, escuela Técnica Superior de Arquitectura, 121-150.

18. Such as those, re-exhibited during this Congress, of the exhibition "Photographies à l'œuvre: Enquêtes et chantiers de la Reconstruction des villes françaises (1945-1958)", retracing construction work in urban France just after WWII: The exhibition was organized by Didier Mouchel, with David Benassayag and Daniel Coutelier, by the Jeu de Paume and the City of Tours. The exhibition catalogue was edited by the Jeu de Paume and Le Point du Jour with the support of the Ministère de l'Écologie, du Développement durable, des Transports et du Logement, 2011.

19. See Gille, B., 1979. La notion de *système technique* (essai d'épistémologie technique). *Techniques et Culture* 1 (October), 8-18; Bijker, W., T. Hugues and J. Pinch (eds), 1994. *The Social Construction of Technological Systems (New directions in the Sociology and History of Technology)*. Cambridge: MIT Press.; Summerton, J. (ed.), 1994. *Changing Large Technical Systems*. Oxford: Westview Press.

20. See Bontems, V., 2011. L'éthique de la technique chez Simondon et chez Gonseth. *L'Éthique en prise avec la 'réalité' et le pragmatisme de Ferdinand Gonseth*. E. Emery and L. Benaroyo. Lausanne: Digilex, 53-66.

21. We borrow these questions from John Ochsendorf, "Engineering Analysis for Construction History: Opportunities and Perils," Keynote Lecture, in Dunkeld, M. et al. (eds), 2006. *Proceedings of the Second International Congress on Construction History*. Cambridge: Construction History Society, 89-107.

22. Vérin, H., 1993. *La Gloire des ingénieurs: L'intelligence technique du xvie au xviiiè siècle*. Paris: Albin Michel, 11.

23. Ruby, I and A. Ruby (eds.), 2010. *Re-Inventing Construction, With an Illustrated Index Compiled by Something Fantastic and Written by Jessica Bridger*. Berlin: Ruby Press/Zürich: Holcim Foundation for Sustainable Construction.