

CONSTRUCTION IN THE WORK OF ROBERT WILLIS

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Keywords

Robert Willis; historiography; history of construction; work; structural archaeology; medieval architecture

Abstract

Robert Willis (1800-1875) was one of the pioneers of what he termed ‘the history of the science of construction’ and established a set of methods which remain fundamental to the study of building archaeology and construction history.

This paper sets out to explore how Willis conceptualised, used and communicated the evidence of construction, derived from the buildings themselves and associated documentation. It will argue that Willis’s writings treated buildings as problems of chronology and design, rather than as products of static forces and human labor. Yet, as will be demonstrated, Willis also showed a hitherto unrecognised commitment to artisan education, with the aim of promoting ingenuity and practical problem-solving abilities at all levels of society. These apparently dichotomous aspects of Willis’s *oeuvre* are here brought together for the first time.

The analysis of Willis’s treatment of ‘work’ and the worker across both words and deeds will lead to the conclusion that viewing historic buildings as the products of physical labor was too politically charged for a scholar who tried always to elevate his research above the taint of ‘party’ politics.

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INTRODUCTION

The subject of this paper is the treatment of construction in the *oeuvre* of Robert Willis. Willis is rightly identified as one of the pioneers of what he called ‘the history of the science of construction’ (Willis, 1842a, p. 2) and his research helped to provide the methods and frame the arguments of subsequent scholars. The study is based on Willis’s publications, his archive, and accounts of his activities from published and unpublished sources. The discussion will focus on the issue of ‘work’ as a point of differentiation between the study of architectural history (the context in which Willis’s work is normally set) and the study of construction history. Previous scholars have argued that Willis both ignored medieval engineering (Mark, 1977) and ‘dismissed and marginalised the skills of the artisan’ (Marsden, 2004, p. 423). Yet these criticisms fail fully to account either for Willis’s objectives or his practical contributions.

‘WORK’

In the nineteenth century, as the results of industrialisation — positive and negative — became widely felt and productivity, both individual and national, became a significant concern, the topic of ‘work’ was hotly contested (e.g. Barringer, 2005). On the one hand, writers on industrial economics, such as Babbage and Ure, represented the worker as a ‘problem,’ which increased mechanisation and further division of labor could solve; on the other hand, many architectural critics, most famously Ruskin, saw the division of labor associated with industrialisation as the problem, which a revalorization of hand-craftsmanship might address. Willis was himself a contributor to the debate, by defining the concept of ‘labouring force’ (a translation of the French *travail*, now generally translated as ‘work’), used by Whewell in his *Mechanics of Engineering* (1841). Willis was also consulted by economist Richard Jones to help calculate the productive capacity of a nation (Buchanan, 2013, pp. 239, 245). However ‘labouring force,’ which took into account all *paid for* sources of power, was a concept necessarily abstracted from human toil and represented production from the perspective of the commissioner rather than the worker.

In his first book, *Remarks on the Architecture of the Middle Ages especially of Italy* (Willis, 1835), Willis described architecture in terms which conceived of a building as a dynamic interplay of forces. He drew a distinction between ‘real’ and ‘apparent’ construction, in other words, between the static performance of a building and how this was represented through its ornamentation. His focus was on the latter because he argued that medieval builders had little understanding of architectural structure and therefore his focus on ornament was historically valid. Although recognised as an expert in engineering, Willis showed little interest in medieval structural performance, except by noting its almost invariable inadequacy, with a litany of collapsing towers, subsiding spires and hurried rebuildings (Willis, 1842b; Willis, 1861). Such limitations were not confined to the Middle Ages: Willis had had his own experience of such a disaster in 1842, when a vault at the new church at Great Bedwyn (Wiltshire), on whose design by Benjamin Ferrey he had reported favourably, crashed to the ground, killing a visiting clergyman (Mozley, 1882, pp. 182-9). Physical science, therefore, played little role in his architectural analysis.

Besides work performed (or not) by the structure, it may be posited that construction involves at least three types of labouring force: the administrative work of coordinating materials,

labourers, machinery and finances, the physical work of preparing and positioning materials and the intellectual work of design. Let us, therefore, explore how these topics were treated by Willis.

ADMINISTRATIVE WORK

Although Willis had first-hand experience of participation in construction, in the restorations of several churches in Cambridge and Ely Cathedral, the erection of a chapel at Wisbech and the reconstruction of the vault of the Great Gate at Trinity College, Cambridge, the human relationships involved find little place in his writings. Although he initially proposed titling his magnum opus 'The Architectural and Social History of the University of Cambridge,' his conception of the social history of architecture dealt with building functions, not the social interactions that enabled their erection. Building accounts and fabric rolls provided a major source for this project, but he did not discuss the administrative processes by which they were produced; they were simply used as evidence for the names of architects and the dates of buildings.

PHYSICAL WORK

Willis's fullest treatment of fabric roll evidence related to an example from Westminster Abbey dated 1253 (Willis, 1860). His main focus was on nomenclature, defining the meanings of medieval terms according to a project he had already established (Willis, 1844; Parker, 1850; Buchanan, 2013, pp. 149-56). In the first detailed analysis of such documents, Willis showed some interest in construction technology, noting that payments for hurdles were for use in the scaffolding, as planks are used in modern works. He also listed the crafts involved and numbers of workmen, but had no interest in their names and although he identified that holy days were assigned alternately to the masons (taken as holiday) and to the king (worked), he passed over without comment the evidence of remuneration by daily wages, piece or task work. However he was critical of such accounts as sources because they could rarely be linked with identifiable parts of the building and therefore were unhelpful for dating purposes.

The other main source of evidence for physical construction was the fabric of the building. Here again, Willis was a pioneer, for example, in a tour of Canterbury Cathedral for the British Archaeological Association in 1844, where he pointed out to his admiring audience the distinction between axe-cut and chiselled masonry in the presbytery side aisles as a means of distinguishing between the old Norman work and the new Gothic additions (Willis, 1845).

Close observation of the fabric made Willis into an expert archaeologist, able to use the evidence of masonry coursing to demonstrate construction sequences and to identify later insertions or alterations. Figure 1 shows the level of detail recorded in his notes on masonry. He also made accu-

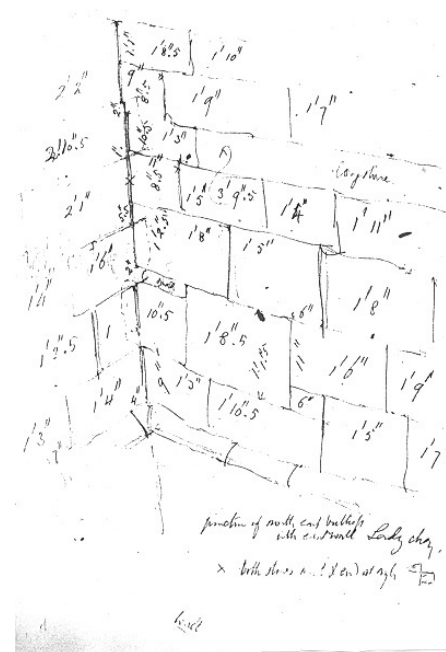


Figure 1: Junction of north east buttress with east wall, Lady Chapel, Ely, drawn by Willis (Cambridge University Library, MS Add. 5039, f. 3).

rate records of moulding profiles, using a piece of equipment termed the ‘cymagraph’ he had invented for the purpose (Willis, 1842c). Another unpublished note shows Willis trying to explain his approach to stratigraphy (probably in the context of preparing a lecture on Peterborough Cathedral, where two previous accounts disagreed radically on the weight to be accorded to such evidence). As he wrote, ‘Courses of stones when continuous do not necessarily prove that the work was not intermitted. Ditto when discontinuous does shew that it was intermitted. But courses are always stopped at doors or windows.’ (CUL, MS Add. 5043).

As the above analysis suggests, Willis used the physical fabric of a building primarily as evidence for its date, rather than for the processes by which it was constructed. He showed little interest in building technology, such as scaffolding and cranes, and offered no thoughts on the meaning of the masons’ marks, whose existence had been identified by George Godwin, editor of *The Builder*, who brought one of the present-day Canterbury masons before the Architectural Section at the BAA congress to explain their function (Godwin 1844).

INTELLECTUAL WORK

In an unpublished series of notes on restoration, probably dating from around 1845, Willis adopted a proto-Ruskinian approach by suggesting that every stone of an ancient building had value because ‘it retains upon it the chisel marks of the original workmen’. Nevertheless, he distinguished between the workmen and the designer, under whose eyes and with whose sanction the work was created and the value of the ancient stones was as evidence of the original design (CUL MS Add. 5135, ff. 6-16, quoted in full in Buchanan, 2013).

The clearest examples of Willis’s use of physical remains as evidence for design may be found in the two papers he presented before the fledgling Institute of British Architects (Willis, 1842a and 1842d). In his paper on the construction of medieval vaults, he offered a brilliant analysis of the methods by which the relationships between the vault ribs and conoids were managed in the absence of stereometric projection based on both inductive (evidence-based) and deductive (theoretical) methods. He proposed two processes which could theoretically have been used: the *tas-de-charge* could have been erected as a plain solid, on which the rib mouldings could thereafter have been worked *in situ*. Scribed lines on masonry blocks from collapsed vaults, however, suggested a method which Willis described as ‘upwards and downwards projection’, by which the basic forms of the rib blocks could be obtained from a full scale plan of the vault in two dimensions. Described by Willis as ‘geometrical’ (his preferred approach to problem solving, as opposed to the fashionable ‘analytical’ methods promoted by some of his Cambridge contemporaries), this method involved no mathematical knowledge and was within the intellectual grasp of the cutting masons working on site, referred to throughout the article as ‘workmen’ and allowing for simplified methods ‘reduced to the capacity of a much lower class of workmen’. Yet, as he pointed out, these methods resulted in vaults aesthetically superior to the feeble examples of the modern day. His admiration both for the visual imagination of the designers and for the practical contrivances worked out by their colleagues on site in order to realise the designs is evident throughout the discussion and he adopted the same methods himself in his reconstructions of the lierne vaults of Prior Crauden’s Chapel at Ely and at Trinity College.

A similar approach may be seen in his article on Flamboyant mouldings, based on sketches made on his 1832 tour of Europe (Willis scrapbooks, Royal Institute of British Architects Draw-

ings Collection and Society of Antiquaries of London). Tracing the intersections between different mouldings emphasised to Willis the significance of apparent construction, for these features were purely decorative and performed no structural function. Yet again, they revealed the aesthetic rationality of medieval design and the ingenuity of its practitioners.

For Willis, the work of design was not the application of a series of universal aesthetic principles but the solving of a series of problems, which were defined by the specific context of each project. As he recognised, after the great post-Conquest rebuilding, most new works in England were additions or alterations to existing fabric, so the architectural imagination was rarely unfettered and successful design often involved reconfiguring old work and adapting new fashions to fit the needs of the site. In this context, he saw it as his role to identify the nature of the problems the designer was trying to solve and to locate them within their appropriate temporal frame.

CHRONOLOGY

Willis's main concern was chronological, following a model already established by Thomas Rickman's *An Attempt to Discriminate the Styles of Architecture* (1817) but seeking to identify the changing design principles underpinning stylistic change and firmly founded on documented datings. At a time when the study of architecture could rouse strong emotions, he thus offered a historicising alternative to the accounts of polemicists like Pugin and Ruskin. Throughout Willis's life, he showed extreme reticence on any issues that might be considered 'political'. A desire to remain dispassionate was typical of contemporary scientific discourse which demanded strict avoidance of any taint of 'party' (De Morgan, 1835). When Willis was writing in the 1840s and early 1850s, his audience would inevitably have been aware of the bitter labor disputes taking place in the building industry, with strikes halting construction of the Palace of Westminster and Nelson's Column. Closer analysis of medieval fabric accounts could have revealed similar disputes taking place in the Middle Ages. It is therefore not surprising that Willis omitted discussion of medieval labor, limiting his observations to drawing parallels between the modern professional architect and his medieval counterpart. The physical traces of workmanship recorded in his drawings were transformed into evidence for architectural principles and historical processes.

EDUCATING INGENUITY

Willis's reticence regarding practical subjects did not stem from ignorance nor from social disdain. We know that he had been a regular visitor to industrial workshops since his youth when he worked alongside James Erat to build a harp and Charles Joseph Hullmandel to develop a lithographic pen (CUL MS Add. 5133, 110v). He fostered close connections with the Holzapffel firm and evidently conversed with other artisans and craftsmen. Thus in his *Principles of Mechanism* (Willis, 1841), he used technical terms he had learned from Manchester manufacturers Sharp and Roberts and in 'Vaults' he cited the terminology used by modern building workmen in setting out vaults, which to him suggested medieval methods might still be in use.

Willis first became directly involved with artisan education when he was commissioned in 1834 by the Society for the Diffusion of Useful Knowledge to write a book on mechanism aimed at a popular (i.e. artisan) audience (SDUK Papers, University College London). Copious notes demonstrate the diligence with which Willis pursued the project (Cambridge Engineering Library, Willis scrapbook), more extensive than the notes for any of his architectural projects other

than *The Architectural History of the University of Cambridge*. Nevertheless, his appointment as Jacksonian Professor of Natural Philosophy in 1837 and the consequent need to create a textbook for his students, as well, no doubt, as his generally poor publication record (of his 17 ‘cathedral histories’, fewer than half made it to print in his lifetime), resulted in the project being shelved.

Once installed in the Jacksonian chair, Willis was inevitably involved in the question of the relationship between professional and academic education. Cantabrigians who wanted the University to provide a more professionally-orientated education, including engineering and architecture, assumed Willis was on their side but he left no direct record of his views, which suggests he opted for discretion, particularly given that his friend Whewell was in the opposing camp.

Nevertheless, at the same time as the Royal Commission of the University of Cambridge was recommending that Willis should head a school of engineering (Royal Commission, 1852-3, pp. 97-8), he was taking direct action at the Royal School of Mines. He taught there for 15 years and saw three of his own sons pass through the establishment. His professorial duties included giving public lectures to working men which had audiences of around 600 (including the non-proletarian Karl Marx). We may gain some idea of what Willis hoped to achieve from an earlier lecture given on the occasion of the 1851 Great Exhibition (Willis, 1852). Reporting on the Crystal Palace’s display of machines and tools, he argued that the exhibition had two very desirable objects: a closer understanding between scientific and practical men (which required improved communication on both sides) and a more universal knowledge amongst mechanics and artisans of the materials and tools employed in trades and regions other than their own. He felt this would broaden their understanding of what was necessary and what merely custom, giving them the capacity to improve their methods through the application of intellect. As in his studies of medieval design processes, Willis believed that ingenuity need not be the preserve of the academically educated, but could transcend class barriers.

Through his involvement with the Crystal Palace project, Willis became connected with another Cambridge graduate with a strong interest in practical education: the Rev. Arthur Rigg, Principal of the Chester Diocesan Training School. The Chester school was one of the earliest teacher training establishments in the country but Rigg’s greatest enthusiasm was reserved for the associated schools designed to teach practical subjects to both middle and working class pupils (Foden, 1959; Seaborne, 1974). His radical approach to pedagogy involved laboratories and workshops, integration between all classes of pupil and physical labor: the school chapel was erected by the students themselves. Correspondence between Rigg and Willis (CUL MS Add. 5136) suggests that the two men viewed the programme as a shared project and Willis maintained their relationship even after Rigg was sacked for prioritising practical subjects over teacher training. The two men continued to collaborate on the commercial production of models and demonstration devices intended for schools, colleges and institutions for adult education.

More closely connected with architecture, we also find that Willis was a supporter of the Architectural Museum, another experimental establishment set up in 1851 and intended to promote the education of the art workman (Architectural Museum, 1855, p.48). Here again, the target audience consisted of artisans, whose role in building had been damaged by the rise in general contracting and associated deskilling. The Museum received widespread support from Gothic Revival architects, who recognised that without adequate craftsmen to carry out their designs, their

stylistic revolution was doomed. Although Willis was not a key figure in the Museum's history, no other Cambridge man was closely involved, suggesting personal commitment to the cause.

Although Willis made no obvious efforts to support practical education at Cambridge, it is clear that he was actively involved in supporting both professional and artisan education through other channels. Nevertheless, all his efforts were associated with the intellectual aspects of labor - its ingenuity rather than its sweat and toil. There is no evidence that Willis had any interest in the latter, nor in unskilled labourers or their conditions.

CONCLUSION

Overall, therefore, Willis's analysis had two emphases: dating of the individual monument and the intellectual work of the mason as architectural designer. He showed no interest in the physical labor involved in working the stones and putting them in place, and paid no attention to the social and administrative processes by which designs might have been agreed with the patron and transmitted from the tracing house to the building site.

It is evident that those architectural scholars who chose to explore historical working practices, including Ruskin and Godwin in England and Viollet-le-Duc in France, were those with overt political commitment to worker rights (albeit still limited to the rights of the skilled labourers). For them, the Middle Ages offered a polemical contrast with the present, from which lessons could be learned. It is from these scholars that the twentieth-century study of the social and economic conditions of construction derived, although most also took from Willis both a set of archaeological methods and a notion of design as contextual problem-solving, consistent with Viollet-le-Duc's principles of structural rationalism, despite their different views on the engineering skills of the medieval mason. By focusing on chronology, rather than construction practice, Willis's method historicised the study of medieval architecture. This was itself an ideologically-charged manoeuvre but one which provided ideologically-neutral tools for the study of buildings to provide historical evidence to support numerous different arguments, which helps to explain the near-universal esteem in which Willis was held by contemporaries and successors.

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