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Architectural Technology; Theories, Myths and Legends

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Abstract

The professional discipline of Architectural Technology is one that sits somewhere between architecture, engineering and construction. In the United Kingdom it is represented by the Chartered Institute of Architectural Technologists (CIAT) who advocate that
"The Chartered Architectural Technologist, MCIAT, will be able to analyse, synthesise and evaluate design factors in order to produce design solutions, which will satisfy performance, production and procurement criteria. This will be achieved through the design, selection and specification of material, components and assembly and the management, coordination, communication, presentation and monitoring of solutions which perform to the agreed brief and standards in terms of time, cost and quality".
(http://www.ciat.org.uk/)

The subject is well established as a professional and academic discipline in the UK, as discrete from, yet complementary to mainstream architecture. The proposed paper seeks to examine the theoretical underpinning that supports the technical aspects of architectural design, contrasting historical precedents with current thinking and the role of mythology as inspiration in defining architectural technology.
A key aspect of this study will be an analysis of the differences in approach to technical design and the relationships between theoretical notions and evidence based design in defining the outputs of the different architectural disciplines. Central to this process is the examination of what theory means in this instance, its role in design generally and its application to architectural technology specifically. The significance and impact of the myths surrounding the role of technology in defining architecture and in the work of some of the legendary proponents of technology inspired architecture, will be expressed primarily in terms of the theoretical foundation it affords.

The paper will therefore endeavour to demonstrate the significance of theory in the technical design of architecture, the importance of a more expansive understanding of architectural technology as a concept and to illustrate the intrinsic value of myths and legends.

The resultant point of reference will be of interest to all the allied disciplines involved in the design aspects of construction.

Key words: Architectural Technology, Theory and Evidence Based Design

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Introduction

The perception of architectural technology depends very much on the individual perspective of the viewer; be it the manifestation of the building technology creating all architecture or a specific component in the construction process of buildings, it remains inextricably linked to the concept of architecture. The impact of technology on architecture has been well documented and in one sense this view can represent the concept of architectural technology, however the story is much more complicated and is well beyond the scope of this paper. Taking a more focussed view however, with architectural technology seen simply as the technical design process in architecture, can allow an interesting examination of the process and how it forms an integral function in the emerging professional and academic discipline of architectural technology (Wienand 2011a).

Focussing on the technical design aspects of architectural technology opens up a potentially interesting line of enquiry, and that is, what drives this process? What are the design drivers that push forward and challenge the boundaries, what are the drivers that excite and motivate technical designers and where does that inspiration come from?

Existing theories of design may offer some answers, particularly those found in similar yet discrete disciplines such as engineering, inviting further enquiry into what theory means in this instance, its role in design generally and critically, its specific application to architectural technology.

Yet however well founded a theoretical framework may be, the motivational effect of a quasi-philosophical belief in something of value is probably of greater importance as a specific design driver. The present passion for environmentally conscious or 'green' design is a good example. The popular concept of 'myth' is a more positive and inclusive

description however and therefore preferable to the term 'quasi-philosophical belief'. Identifying these myths and recognising their ability to inspire and drive the design process is the first step towards a deeper understanding of the creative aspects of technical design; the characteristics that take it beyond a simple technical problem solving exercise. To do this we need to understand also that the planned outputs of this design process may differ depending on the professional and personal background of individual designers. Take for instance the concept of natural ventilation, one architectural designer may feel that incorporating the general principles is sufficient so long as it allows 'what architects do best - make form' (Brandt et.al. 2010), whereas another technical designer may feel very strongly that the design does not work until the functional aspect is optimised, perfected and working efficiently over time.

The concept of legends follows on from this school of thought by recognising that the work of some of the legendary proponents of technology inspired architecture, can and does lead the design agenda and thereby also motivate and arouse the ambitions to drive forward these developments at an individual level. Recognising that the influences that direct and shape technical design in architecture come as multi-faceted stimuli, is a second step to understanding the process and in so doing points towards a possible theoretical foundation for the discipline.

Architectural Technology

The role of technology in architecture has been subject to much discussion but little of this discourse includes any reference to the role of the professional architectural technologist or indeed any academic underpinning of that role. A theoretical exploration of the role of technology in architecture should begin by asking do we mean *the technology to build* or *the technology of building*? Most experts would agree the answer is both, depending on the circumstance, but it can also potentially be related directly to the role of architectural technology on building and therefore also the role of the architectural technologist. The reality that it is both means that it takes on a similar multipolar position to the concept of architecture where meanings can range between the 'built form' and the act of 'architectural design', to name just two.

So, architectural technology exists in many forms; from the technology that enables the creation of architecture to the profession of architectural technologists as practised in some parts of the world (Wienand 2011a). For the purpose of this paper the focus is on architectural technology, the academic discipline; as such it has been demonstrated that it exists as an academic discipline but also that it is still in the early stages of that development. In doing so it has the opportunity to borrow from adjacent disciplines, particularly in areas of overlap. The theoretical models of *ideation* in industrial design and the emerging concept of *evidence based design* in architecture are just two examples with much to offer in providing frameworks for what already essentially exists within architectural technology.

A primary theoretical challenge confronting the profession and discipline of architectural technology is the need to establish that it is a design based discipline with a corresponding need to develop supporting design theories. It has been suggested by the author (in a wholly exploratory sense) that in designing buildings, architectural technologists strive to produce high performance construction as opposed to great architecture. Core to this task is the design of architectural details; a highly creative process, it is a ‘knowledge-centred activity that bristles with equal creative endeavour as the larger conceptual design phase’ (Emmitt et. al. 2004).

In the wider historical context, the seminal work, *Architectural technology up to the Scientific Revolution* starts with a declaration in the preface from Robert Mark that, 'Although designed to be used as a "handbook" to aid both students and teachers in treating questions of technology in courses dealing with European architectural history before the enlightenment, our intent is not to place technology in a privileged or deterministic position' (Ed. Mark 1993). This unemotional and objective approach to an important component of architectural history is unlike most in the field and possibly one of the reasons that architectural technology as a branch of learning, remains under explored.

Theories

The question that poses; *is there a need for a theoretical approach to support technical design in architecture?* has to look to a definition of theory in the first instance. The concept of theory has many interpretations and of the three proposed by the Concise Oxford Dictionary, 'the sphere of abstract knowledge or speculative thought' seems the most appropriate for a design based process. The other definitions,

'exposition of the principles of a science etc.,' and 'a collection of propositions to illustrate principles of a subject', both have a role to play in technical design, particularly those aspects related to building physics and architectural theory but neither fully capture the concept of 'theory as thinking rather than doing' (Wienand 2012). Theory in this case provides a framework for structuring thoughts and particularly in technical design, ideas. All of the above definitions whether it be theory in building science or theory in architectural philosophy, are about ideas; and ideas are about thinking and therefore have no limit; "In this abstract or speculative sense, the strength of ideas comes from their very nature and therefore, as concepts, they are there to be considered in depth rather than any notion of being deemed factual" (Wienand 2012).

Design theory abounds and can be found supporting many academic and professional disciplines but where design may not be central to the perceived practice of that discipline, it is not necessarily understood as the principal feature. Architectural technology is one of those where in common with mechanical engineering, the idea of function predominates. With a history of design in mechanical engineering focussing on analysis and individual problem solving, the idea that function is mathematical, scientific and measurable dominates (Maier 2008). A move to systematic engineering design (Pahl & Beitz 1996) viewing design problems as being part of systems rather than individual components suggests a systematic approach that was by coincidence, always an integral part of the architectural technologist's attitude to design; a process brought about by necessity rather than through any deliberate plan. The technical and aesthetic construct of a building already exists within the whole procurement *system* as the design process proceeds.

Maier and colleagues put forward the idea of affordances borrowed originally from perceptual psychology, where 'the affordances of a product are what it provides, offers, or furnishes to the user or to another product' (Maier 2008). A house may function as a shelter yet it affords comfort, prestige, investment etc. Again it could be argued that architectural technologists as practising professionals are already very aware of the complete range of affordances derived from traditional solutions, both positive and negative, yet remain cautious of new technologies. Projects systematically designed with a deliberate and full assessment of positive and negative affordances may help to mitigate some of the barriers to innovation sometimes found in the risk-averse world of technical design in architecture.

Another valuable contribution on the theme of innovation, and another variation on design thinking, comes from the realms of industrial design with the concept of ideation. Organised ideation, or brainstorming in this instance means in effect organising design meetings specifically to generate new ideas. It starts from the position that if something needs changing, then understanding that need in depth is part of the process. The knowledge palette and experience of those involved have a great influence on the process; 'In order to see the shape of a horse in the clouds one must be equipped with the knowledge of what a horse actually looks like' (Wylant 2002). So by choosing a wide range of thinkers from the systematic to the chaotic, it allows the generation of an equally wide range of informed ideas but within an environment that can also control and harness the outputs. 'The wild, nonsensical idea may eventually be discarded but open-minded consideration of the wild idea can lead to a potentially useful idea' (Wylant 2002).

Design theory directly applicable to architectural technology is as yet unstated but there exists a good deal of interesting and relevant precedent to choose from. A particularly interesting discourse is that surrounding the development of evidence based design in architecture. Brandt et.al., argue that the architectural profession has become too reliant on intuitive design and "must be able to rely on evidence to anticipate the effects of our work' (Brandt et.al. 2010). In providing a strong argument in favour of the concept they point to research as the primary supply of the required 'evidence', and in so doing also present six attributes for quality research:

- *A clearly defined and proactive research question, related to client goals and informed by prior research and experience (Hypothesis)*
- *Use of both disciplinary and interdisciplinary knowledge as a foundation (Epistemology)*
- *Use of accepted standards for measuring performance outcomes (Metrics)*
- *Striving for the most reliable and valid performance predictors, preferably from more than one study and using more than one methodology (Strength of evidence)*
- *Peer review to certify the quality of methodology and reasonableness of outcomes (External validation)*
- *Clear and understandable communication of research approaches, including assumptions, limitations, constraints, and methodology, so others can make good critical judgements about applicability to their context (Transparency)*
  (taken from Brandt et.al. 2010)

Interestingly, and of great importance, this list of research criteria matches quite closely the publicly stated requirement of professional architectural technologists in the United Kingdom, represented by the Chartered Institute of Architectural Technologists (CIAT) who advocate that,
"The Chartered Architectural Technologist, MCIAT, will be able to analyse, synthesise and evaluate design factors in order to produce design solutions, which will satisfy performance, production and procurement criteria. This will be achieved through the design, selection and specification of material, components and assembly and the management, coordination, communication, presentation and monitoring of solutions which perform to the agreed brief and standards in terms of time, cost and quality". (http://www.ciat.org.uk/)

The challenge for all professions allied to the production of buildings is to make meaningful connections that encourage the dialogue and the desire to find and utilise the necessary 'evidence'.

Myths

Myths in this instance have been taken to mean stories and anecdotes that are acknowledged as being fictional yet involve, reveal or illustrate a fundamental philosophical principle or truth. The value of myths therefore is not in the surface content but in the message they convey; not as fable or fiction but in the underlying truth. Taylor et. al. in an article pondering the conflict between structure and ornament

suggest, '....myth, unlike history with its necessary intellectual detachment from matters in the present, is a living presence supplying models for human behaviour and, by that very fact, giving meaning and value to life.' (Taylor et. al. 2000). The role of myths in this sense is fundamental to much architectural theory where theorising may start off as abstract thinking or speculation but once subjected to the process of time and scrutiny, becomes myth.

To illustrate this point the comments of Charles-Édouard Jeanneret, Le Corbusier in 1929 provide an example of a statement that in a literal sense is nonsense but as intellectual stimulation has profound meaning, when he declared that, 'Architecture is not building. Architecture is that cast of synthetical thought in response to which the multiple elements of architecture are led synchronically to express a purpose. And as this synthetical purpose is absolutely disinterested, having for object neither to make durable, nor to build rapidly, nor to keep warm, nor to promote sanitation, nor to standardize the domestic usefulness of the house, I would say, since it is above any utilitarian objective, it is an elevated purpose. Its objective is to bring us benefits of a different nature from those of material usefulness; its aim is to transport us to an inspired state and thus bring us enjoyment' (cited in Braham & Hale 2007).

Corbusier's very helpful comments have previously been used to illustrate a defining feature of architectural technology, the pursuit of the *utilitarian objective* and therefore to characterise a difference between the professions of architecture and architectural technology (Wienand 2011b); here it gives substance to the value of architectural myth as a formative driver in architectural design. It does little to venerate the contribution of technical design however.

Frank Lloyd Wright in 1901 made his views of the Renaissance very clear by suggesting 'It is the setting sun which we mistake for dawn' and that 'with the beginning of the sixteenth century, the malady of architecture is visible. It becomes classic art in a miserable manner; from being indigenous, it becomes Greek and Roman; from being true and modern, it becomes pseudo-classic. It is this decadence which we call the Renaissance' (cited in Braham & Hale 2007). His views here represent one side of an argument that could be explored further and are therefore not quite as literally nonsensical as those of Corbusier's. However they are evidence that an architect can have quite unusual and individual interpretations of historical events where the value to the subsequent architecture is in that of inspiration and all that matters is what 'thinkers **believe to be true** as opposed to being provable'(Wienand 2011b).

Taylor et.al. continue with the observation that, "In the context of architectural design, though, myths are as progenitors of the most real, are resurrected, mined and constantly retold" (Taylor et. al. 2000) and with Mies Van de Rohe's immortal words in 1959 claiming that 'less is more' we can fully appreciate the value of myth to architectural design. Mies goes a step further however in stating in the same interview that 'god is in the details' and helpfully, as he must have been alluding to architectural details, allows a transference of the myth concept to architectural technology as well. The apparently simple concept of architectural detailing can however come up with some surprising interpretation when examined closely. An interesting observation from Del Favero suggested that separate disciplines can be distinguished by the way they present themselves and particularly by 'seeing things differently when they look at the same phenomena' (Del Favero 2011).

The author's experience suggests that when considering the 'phenomena' of architectural detailing, the disciplines of architecture and architectural technology tend to see architectural detailing very differently. Mies's 'God is in the details' comment can now be considered from the architect's perspective as referring to 'the surface details that make up the architectural narrative of the building' or regarded as alluding to 'the technical design of joints that is mostly hidden and shapes the critical narrative around buildability' (Wienand 2012), as it would be interpreted by most architectural technologists. The essential value of myth here is that it can accomplish both.

The particular myths as examined so far, clearly have much value as inspiration for individual architects and architectural technologists but do not appear to offer much on the role of mythology as inspiration in defining architectural technology specifically. However, another inspirational myth for both disciplines in western culture comes from the observation that the concept of the Master Builder, so important to the building and cultural history of the Middle Ages, also offers a powerful historical precedent. Both would be instantly familiar with the all embracing roles of designer, manager, builder and engineer as would be the requirement for collaboration with fellow craftsman using verbal communication and full-scale layout in the field (Barrow 2004). The compelling architectural legacy that is the Gothic era is celebrated extensively elsewhere for its impact on the history of western architecture, however the pure technical design genius involved and the depth of understanding required is often overlooked and that is where this myth has particular influence for architectural technologists. The Master Builders were the ultimate technical designers before all else and the current professional discipline of architectural technology could therefore claim very firm roots in the Middle Ages (Wienand 2012).

The Industrial Revolution provided another opportunity for historical myths in support of architectural technology with the now familiar concept of *technology transfer*. Following on from the Gothic Era and missing out the Renaissance to some degree, it was during the Industrial Revolution and thanks to the engineering profession that building technology as a driving force for architecture again came to the fore. The new technologies inspired the architectural developments of the period and can also be likened to our current epoch where much cutting edge architectural design is clearly *technology enabled*. The value of myth here is in the perceived associations because as James Strike suggests in the historically significant work, *Construction into Design*, the relationship between the spirit of innovation and the potential for failure involved the very capricious world that governs the adoption of new technologies. Citing the considerable time periods from the inventions of cast iron (Abraham Darby smelting iron in 1709) and concrete (Joseph Aspdin with Portland cement in 1794) and their common use in building, Strike observes a visible pattern, suggesting that, 'the story line for each material or technique is never identical, but the recurring stages often include: inception of the idea, testing of prototypes, trial use, failure, gestation on the shelf, reinvention, retrial, success through the construction of a seminal building, adoption, misuse, rejection due to failure or a change of fashion, introduction of legislation to control its use, gradual improvement of the material or technique, and finally general acceptance.' (Strike 1991). In other words, the mythical concept of *technology transfer* in the legacy of the

Industrial Revolution is a much more complicated and haphazard process than the historical myth would suggest.

Legends

A very narrow meaning of the word legend is used here and it is not intended to be synonymous with the usual discourse around myths and legends as the previous section might suggest. Instead a meaning derived from the Oxford Dictionary's description of *legendary* as being 'remarkable enough to be subject of legend'. In other words, individuals who have become legends in their field as in the phrase claimed to originate with Giles Lytton Strachey where he describes Florence Nightingale as 'a legend in her lifetime'. The focus here is on individual protagonists as inspiration rather than the ideas held within myths.

Abraham Darby and Joseph Aspdin are clearly very important historic figures in the development of technologies that contribute to architecture but it is difficult to give them direct credit for inspiring architectural technology. Instead we have to look to the early adopters as pioneers of these technologies. Although it difficult to be historically precise about how and when cast iron first entered the field of architecture, Sir Christopher Wren's name appears with frequency in the early days (Strike 1991). The iron fixings in his timber truss for the Sheldonian Theatre in Oxford (1669) and the cast iron chains in the dome of St Paul's Cathedral (1710) were initial phases of what led successfully to a system of large scale building that would now rely on more than just gravity. Cast iron does not display high tensile strength but its development led the way for the progress towards steel and the rest is building history. Wren's name is also writ large in that history and as such identifies him as a significant legend in the field of architectural technology.

With concrete, a similar lengthy early experimental phase eventually took a major step forward with the structural work of Francois Hennebique and the systematic use of steel reinforcement. Hennebique, the builder would stand out as a legend for architectural technologists because of the technical consistency of his outputs (Strike 1991) whereas August Perret with his significant architectural contributions including 25 bis Rue Franklin in Paris (1903) and the church of Notre Dame du Nancy (1922) may be the more legendary, particularly for the discipline of architecture. The bridges of Swiss engineer, Robert Maillart at Tavenasa (1905) and Salginatobel (1929), are clearly pivotal pieces of work for all construction disciplines and can therefore be described as the work of a legend as can the work of Santiago Calatrava, a living legend. What is becoming clear here is that legends inspire others, initially through their work but eventually just through their presence.

The material examples above and the previous section point to the considerable time span between the invention of new technologies and their eventual transfer into mainstream building. Another living legend in the field of technical architecture is Sir Norman Foster and the story of his Willis Faber Dumas Headquarters building in Ipswich (1975) is an example of a project that managed to overcome the normal resistance to change very quickly. Speaking about the project in 2007, Foster explained that he himself had written, 'But we don’t have the time, and we don’t have the immediate expertise at a technical level' (Foster 2007). In challenging the technical boundaries current at the time and fully aware of the risks, perhaps with pure

genius or maybe an excellent design process, the Pilkington Glass spider connector (planar system - http://www.pilkington.com/) was created. The design process that led to this success was clearly a major contributing factor.

The contribution of legends to the discipline of architectural technology appears very similar to that for architecture but does start to diverge when it comes to more specific examples. What is apparent however is that there a very few, if any, whose legendary reputation is built solely on their contribution to architectural technology.

Conclusion

Endeavouring to demonstrate the significance of a theoretical base to the technical design of architecture has led to the observation that allied disciplines can offer very helpful precedents, having each gone through an examination of their design processes. In addition it has been suggested that the technical design process should be considered as very different to that which is normally labelled as design in architecture. The enterprise aiming to create form is very different to that aiming to secure function and in recognising that, has permitted the more expansive understanding of architectural technology as a design concept.

In summary, the intrinsic value of myths and legends to the design process is as design drivers providing the inspiration and motivation without having to be factual. A satisfactory theoretical framework should aim to include at least some cognisance of this feature but also recognise the difficulty in resolving the ambition to be precise and highly functional with the desire also to be truly creative. None of this thinking should be described as fully developed but taken to represent the initial steps on the road to establishing a theoretical foundation for the discipline of architectural technology. This review may go some way towards initiating a discourse and in particular points to the need for further research into the concept of technical design in architecture as a discrete and very distinctive practice.

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