
EDITORIAL

Introduction: Two Kinds of Proportion

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The subject of architectural proportional systems in the history of architecture, the topic of this special collection of essays in *Architectural Histories*, has long been characterized by a fundamental ambiguity: the word and concept of proportion simultaneously signify two unrelated and in some ways opposite meanings. Proportion can refer to ratios, or it can refer to architectural beauty. In this introduction to the papers that follow, Matthew A. Cohen proposes a simple clarification of this ambiguity as a framework for continued discussion of this subject: that whenever scholars use the word proportion, they specify whether they intend 'proportion-as-ratio' or 'proportion-as-beauty'.

The frequent blending of these meanings today, Cohen argues, is a survival of attitudes toward proportional systems in architecture that were prevalent as long ago as the early Renaissance. Cohen proposes an alternative to Rudolf Wittkower's paradigmatic 'break-away' theory of the history of proportional systems, according to which virtually everyone accepted proportional systems as sources of universal beauty in architecture until the mid-eighteenth century, and after that time virtually everyone believed that beauty and proportional systems were matters of individual preference. Rather than a long period respectful of tradition followed by a long period skeptical of it, Cohen argues, based in part on a new interpretation of Claude Perrault's 1683 codification of the notion of positive beauty, that architects and others have always had access to two parallel strands of thought pertaining to proportional systems: a skeptical-pragmatic strand and a respectful-metaphysical strand. This new historical and historiographical interpretation of the problem of architectural proportional systems, and the new vocabulary with which to discuss it critically presented herein, helps to separate aesthetic from historical considerations.

Introduction

The diverse collection of essays presented in this special collection of *Architectural Histories*, written by leading scholars in the field of architectural history, grew out of the international conference 'Proportional Systems in the History of Architecture', held in Leiden in March 2011 (**Fig. 1**).¹ The conference was scheduled to commemorate the sixtieth anniversary of the last international conference on proportional systems in the arts, held in Milan in 1951 and titled 'De divina proportione', which similarly gathered leading thinkers of its day (**Fig. 2**).² This recent anniversary thus offers a valuable opportunity to reflect on where the study of proportional systems has gone over the past sixty years, and where it might most productively go from here. Although the premises of the two conferences were fundamentally different from one another – the Milan conference promoted the contemporary use of proportional systems in the arts for the aesthetic and spiritual betterment of society, while the Leiden conference promoted the historical study of specifically architectural proportional systems for the advancement of scholarly knowledge – certain noteworthy attitudes toward the subject of proportional systems manifested in the Milan conference are still prominent today.³ On the bright side,

both conferences together demonstrate a sustained recognition of the importance of the multidisciplinary study of proportional systems as integral parts of human culture across time and geography. Less productively, while sympathy with the overtly mystical beliefs that drove the Milan conference is substantially more subdued in the scholarly community today, a fundamental ambiguity inherent in the concept of proportion that enabled those beliefs to flourish in 1951 continues to characterize much scholarly thinking about this subject today: when architectural historians use the word 'proportion', whether they intend it to signify a ratio, architectural beauty, or both simultaneously, is often unclear to author and reader alike.

In this introduction I will explore this ambiguity, and propose a clarification of it to serve as the common thread tying together the two editorial premises of this special collection of essays: first, that there is no causal relationship between proportional systems and the aesthetic qualities of architecture; and second, that proportional systems, as non-visual bearers of meaning and objects of belief, contributed to the rhetorical rather than visual structure of architecture prior to the advent of modern structural engineering, which Rowland Mainstone (1968: 303) dates to 1742–1743.⁴ Proportional systems during this long period may thus be understood to have served no practical or visual purposes, but nevertheless to have played critical roles in distinguishing architecture from mere building.⁵ After 1742–1743 a limited, nostalgic strain of

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Fig. 1: Matthew A. Cohen (left) with Mark Wilson Jones (right), at the conference 'Proportional Systems in the History of Architecture', Leiden, 17 March 2011. Photo: anonymous gift.



Fig. 2: Rudolf Wittkower addressing the Milan conference 'De divina proportione', as part of the Ninth Triennale, Milan, September 1951. By permission of Fondazione La Triennale di Milano.

pre-engineering, or what I call ‘belief based’, proportional systems (such as Le Corbusier’s Modulor and Hans van der Laan’s ‘plastic number’), continued this non-practical tradition into the 20th century, ignoring the appearance of what I call ‘certainty-based’ proportional systems (such as structural engineering specifications and urban building regulations), which reflect modern scientific thinking and succeed in fulfilling practical purposes.⁶

I do not expect that all of our contributors or readers will necessarily agree with these premises, but hope that these premises will inspire productive discussion and debate. Indeed, these premises can be difficult to understand and controversial because they contradict a set of assumptions so widespread and deeply ingrained in contemporary thought as to constitute a paradigm.⁷ I call it the ‘Wittkower paradigm’, in acknowledgement of Rudolf Wittkower’s critical role in promulgating it by synthesizing various strands of 19th- and early 20th-century thought in a series of influential publications after World War II (Wittkower 1949; Wittkower 1953; Wittkower 1960; Cohen 2013: 36–51).⁸ Paradigms are not easily overturned, but in this introduction I will at least confront this one, in order to propose some guidelines to help navigate the inherent ambiguities of this subject. I will continue this process in the conclusion to this special collection, where I present ten principles derived from the essays gathered here and other sources, to serve as a proposed framework for future discussions.

The beauty problem

During my numerous conversations between sessions at the Leiden conference I found that many of the conference participants tacitly believed, quite strongly, that proportional systems contribute beauty to architecture. Indeed, as far as I have been able to determine there and in other venues, such beliefs are held, at least to some degree, by an overwhelming majority of scholars and architects today.⁹ Evidently these beauty-in-proportion believers believe that beauty generated by proportional systems emanates from great buildings of the past, causing all people to experience visual aesthetic pleasure. Indeed, many of these believers also believe that scientific principles underlying such beauty-causing emanations will soon be identified through future studies involving psychologists, neuroscientists and brain-scanning technology.¹⁰ The most recent evidence of such beliefs in a scholarly publication that I am aware of are the comments by Wittkower from 1960, quoted below. This belief thus seems to be rather casual and not fully worked out among scholars today, active in thought and conversation but not publication, though it remains widespread and influential in some situations.¹¹

Productive discussion of the historical issues pertaining to proportional systems is today often limited by a general lack of consensus over basic assumptions about the relationship, or lack thereof, between proportional systems and architectural beauty. This lack of consensus can have important negative consequences for the study of architectural history. It can create, for example, what I

have termed ‘us/them ambiguity’, which occurs when the belief that proportional systems create beauty in architecture directs scholarly attention toward *us* – i.e., toward our perceptions today – rather than toward *them*, or, the people in history whose products, activities and beliefs are ostensibly the subjects of architectural history (Cohen 2013: 24). *Us* and *them* cannot be considered unified when dealing with the subject of beauty because assessments of beauty are not universal across time and geography, as beauty-in-proportion believers assume, but always subjective. *Us/them* ambiguity thus creates uncertainty as to whether an investigation is a work of architectural criticism or history; a commentary on current, or on past, interpretations of architecture.

To refute the notion that proportional systems have visible – and invariably favorable – aesthetic influences on architecture, I have previously presented a logical, five-point argument (Cohen 2013: 281–287). For example, point number one: proportional systems are mental, not visual constructs. Thus, you cannot see the numerical ratios expressed in terms of the local unit of measure in use at the time a particular proportional system was designed. You can only recognize these ratios and their historical significance after studying measurement data, the history of local units of measure, and other related information.¹² That which is not visible, therefore, cannot be visually beautiful.¹³

Sometimes you can see geometrical relationships, but only approximately. For example, you cannot distinguish between a root-2 rectangle and a slightly stretched one, though you may think you can (**Fig. 3**); and in any case, why should a geometrical figure for which we have a name be more visually valued than figures for which we have no names?; a question that invokes point number three: proportional relationships have no intrinsic beauty.¹⁴ Thus, a root-2 rectangle cannot have more intrinsic beauty than a slightly stretched one, because neither of them have any beauty at all. It follows, therefore, even from this abbreviated argument, that a proportional system *per se*, which is but a set of proportional relationships, cannot contribute beauty to architecture.¹⁵

I do not aim to spoil anyone’s personal aesthetic experiences of architecture, nor do I have any illusions that in one essay I could ever disrupt a beauty-in-proportion belief system that is at least three centuries old. Indeed, the beauty-in-proportion belief system can co-exist with rigorous scholarship, as long as the two are kept separated. In this introduction I will propose what such a separation might look like, first by continuing to shed a critical light on the beauty-in-proportion belief system, its modern dissemination in particular in the work of Wittkower, and its origins in the conceptual ambiguity built into the very word and concept of proportion at least since the 15th century. Second, I will propose that the word proportion be broken down into its incongruent component meanings, ‘proportion-as-ratio’ and ‘proportion-as-beauty’, and that one of these meanings hereafter be specified whenever scholars use this word, either through the use of the preceding terms or in the context of the discussion.

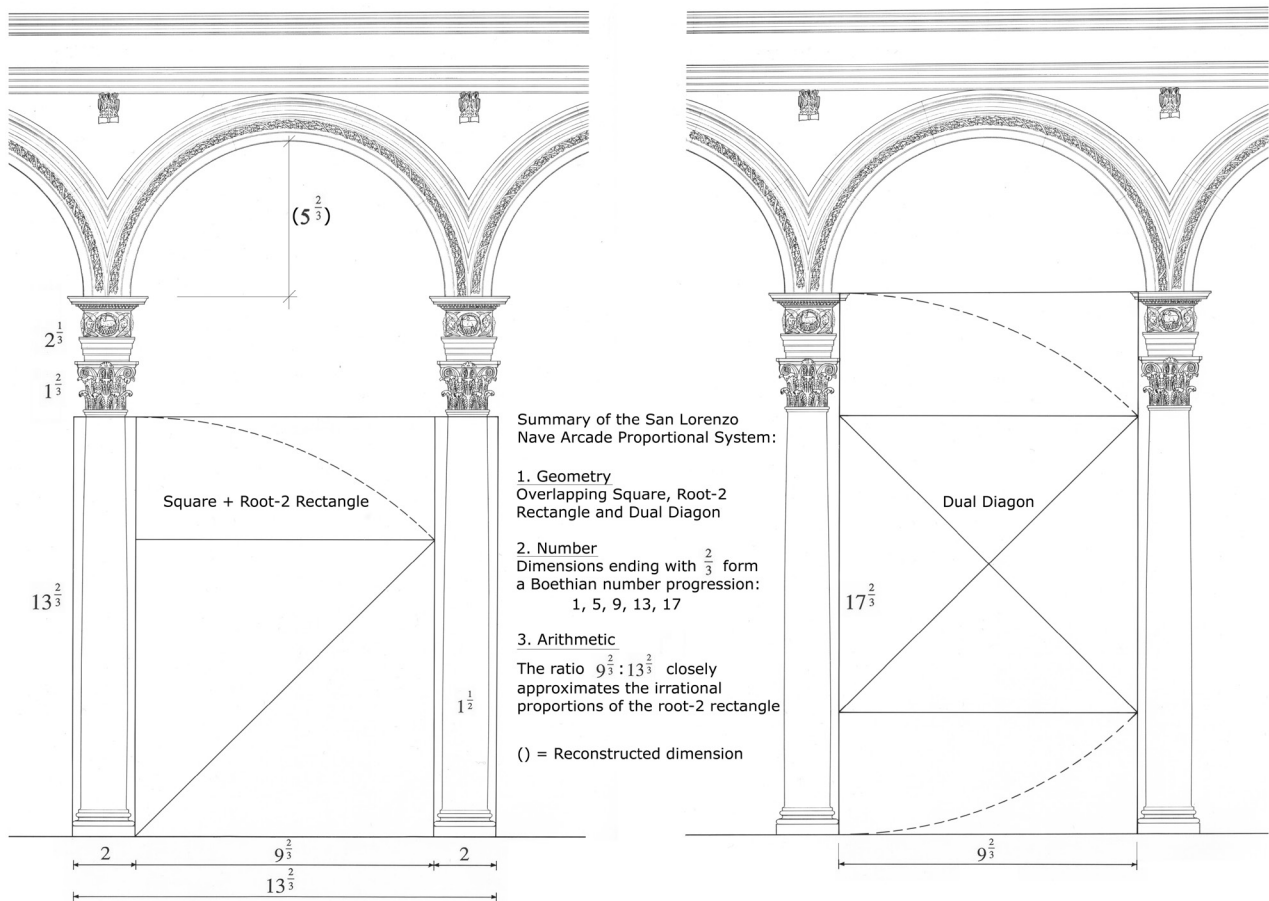


Fig. 3: Summary of the San Lorenzo nave arcade bay proportional system (spread between two drawings for clarity). Source: author.

One example of the ambiguity that can result when the two meanings of the word proportion are not separated is found in a published address by Nikolaus Pevsner to a meeting of the Royal Institute of British Architects held in 1957. When Pevsner refers to ‘laws of proportions’, ‘fixed proportions’ and ‘proportional canons’, he is clearly referring to proportions-as-ratio; but when later in the same address he contends that the west front of St. Paul’s Cathedral ‘is without doubt badly bungled in its proportions’, he now uses the same word, proportion, to refer to proportion-as-beauty, and thus reveals his assumption that some particular selection of proportional ratios caused the west front to lack beauty (Pevsner 1957: 456–457). Pevsner, however, provides no exposition of which particular ratios he finds offensive. His belief that the west front is unbeautiful due to its proportions is perhaps metaphysical (for example, a belief that the assumed proportional ratios in the west front fail to conform to some indistinct notion of assumed ideal ratios), or perhaps empathetic (a seemingly *felt* comparison between the west front and the human body and its states, as in the towers seeming too large for the nave, like arms too large for a body), or perhaps some ambiguous combination of the two. Either way, his confusion between imagined ratios and lack of beauty could have been avoided had he simply noted that he found the west front to be unbeautiful (or ‘badly bungled’), without any unqualified reference

to proportions. Separating the two meanings of proportion, alternatively, would have forced Pevsner to confront his beauty-in-proportion preconceptions, and made his criticism of the west front more acute.¹⁶

Before exploring in more detail the double meaning of the word proportion, I need to clarify my use of another multivalent word in this introduction, ‘aesthetic’. Mostly I will use this term to refer to judgments of beauty based on relationships between sense perception and taste.¹⁷ In architecture, the sense perceptions of primary concern are usually visual. This use of the term aesthetic with an emphasis on sense perception was appropriated into German from the Greek *aisthesis* (meaning ‘perception’ or ‘sensation’) in 1750 by Alexander Gottlieb Baumgarten, who considered aesthetics to be a ‘science of perception that is acquired by means of the senses’ (Harrison, Wood and Gaiger 2000: 489).¹⁸ Since the 19th century the term has typically carried the more general meaning: ‘Of or pertaining to the appreciation or criticism of the beautiful’, whether manmade or natural.¹⁹ Aesthetics, however, can also refer to theories of what beauty is and how it arises. Finally, aesthetics can refer to the philosophical discipline that explores the cognitive basis of beauty, with fundamental texts by Baumgarten, Kant, Hegel, Schelling and others. I find Baumgarten’s insistence on sense perception as a central concern of aesthetics, if not his conception of aesthetics as a science, to be a useful tool for grounding discussions of the question of

causation between proportional systems and architectural beauty, because it directs our attention toward the physical properties of architecture and away from vague notions of emotional satisfaction that could have any cause, related to architecture or not.

The ‘beauty problem’ discussed here may indeed be that many scholars today are to varying degrees distracted from important areas of scholarly inquiry by the belief that proportional systems contribute beauty to architecture, but some readers may now be wondering where beauty in architecture – at least of the orderly-looking variety – comes from, if not proportional systems. The answer to this question will not be found in this special collection of essays, the focus of which is architectural history rather than criticism. Indeed, no definitive answer will ever be found, because beautiful, orderly-looking buildings can only be so when someone believes them to be. I find education and empathy theory to provide more useful explanations for architectural beauty than proportional-system metaphysics, but this opinion requires a different venue for discussion.²⁰

The Wittkower paradigm

The modern study of proportional systems in the history of architecture may be said to have started with the publications of James S. Ackerman’s (1949) “‘Ars sine scientia nihil est’: Gothic Theory of Architecture at the Cathedral of Milan”, and Wittkower’s (1949) *Architectural Principles in the Age of Humanism*. Both of these works demonstrated that valuable insights into the meanings associated with proportional systems by architects and other thinkers of the past could be derived from the scholarly study of historical texts. Prior to these publications, studies of architectural proportions-as-ratio were almost exclusively aesthetic, attempting to determine why Gothic and classical architecture looks the way it does either through geometrical and modular reconstructions, or through mystical ruminations.²¹ Although Ackerman’s study remains a landmark in the scholarship of Gothic architectural theory and practice, it has remained singular because of the uniqueness of the Milan archives on which it is closely based. Wittkower’s study, by contrast, with its broad theoretical generalizations and citations from a wide variety of primary sources, created a new school of thought pertaining to proportional systems in the medieval and Renaissance periods.²²

Despite Wittkower’s stated intention in publishing *Architectural Principles*, “‘to dispose, once and for all, of the hedonist, or purely aesthetic, theory of Renaissance architecture’”, he instead replaced one aesthetic theory with another.²³ Indeed, the word ‘purely’ in this passage suggests that he did not object to all aesthetic interpretations of Renaissance architecture, but only those that treated it as ‘art-as-such’, independent of any theoretical, social, practical or other considerations.²⁴ For Wittkower, architectural aesthetics contained meanings as well as feelings. His notion of aesthetics is thus more inclusive than Immanuel Kant’s definition of ‘Taste as the faculty of judging of that which makes universally communicable,

without the mediation of a concept, our feeling in a given representation’ (Kant 1914: 173).²⁵ For Wittkower, a mediating concept is necessary for any notion of aesthetics worthy of a thinking person’s attention.²⁶

The most easily recognizable component of the Wittkower paradigm is the theory that I call ‘medieval geometry vs. Renaissance number’.²⁷ It is based on two premises, one historical and the other aesthetic. Wittkower (1953: 15) summarizes the historical premise as follows: ‘two different classes of proportion, both derived from the Pythagoreo-Platonic world of ideas, were used during the long history of European art, and [...] the Middle Ages favored [...] geometry, while the Renaissance and classical periods preferred the numerical, i.e. the arithmetical side of the tradition’. Wittkower, however, is not the originator of this premise. As early as 1867, Joseph Gwilt, in his popular *Encyclopedia of Architecture*, had already characterized the history of Western architectural theory as a contrast between geometrical ‘medieval proportion’ and numerical or grid-based classical architectural proportion, and Gwilt had merely compiled these notions from earlier sources.²⁸ Wittkower infused this 19th-century formulation, which may have originally carried implicit aesthetic undertones, with an explicitly aesthetic premise by associating it with Alois Riegl’s concept of *Kunstwollen* (Cohen (2013: 47)).²⁹ Thus he claims that ‘the Renaissance attitude to proportion was determined by a new organic approach to nature, which involved the empirical procedure of measuring, and was aimed at demonstrating that everything was related to everything by number’ (Wittkower 1953: 16). By contrast, he claims, ‘the mediaeval quest for ultimate truth behind appearances was perfectly answered by geometrical configurations of a decisively fundamental nature; that is, by geometrical forms which were irreconcilable with the organic structure of figure and building’ (Wittkower 1953: 17). Thus according to Wittkower, the kinds of proportional systems used in each period can be interpreted as aesthetic reflections of the worldview of each period.

The historical premise of this theory, considered independently of the aesthetic premise, at best represents an oversimplification of available evidence, which indicates that during both the medieval and Renaissance periods geometry and number served as equal partners in architectural theory and practice (Cohen 2013: 36–51 and ch. 6). The aesthetic premise presents a very different problem. Consider Wittkower’s statement: ‘I think it is not going too far to regard commensurability of measure as the nodal point of Renaissance aesthetics’ (1953: 16). One cannot logically propose a causal relationship between the dimensional properties of a proportional system and an assessment of architectural aesthetics, any more than one can attribute dimensional qualities to an idea, except metaphorically. Yet Wittkower is not writing metaphorically here – he is conveying his genuine belief that a causal relationship exists between the quantitative and the qualitative; between numbers and opinions about architectural beauty. It is a metaphysical belief that, when observed in mid-20th-century and later contexts, I call ‘proportional aesthetic mysticism’. As a modern phenomenon it thrives

in part due to the high-volume, Wittkower-influenced textbooks that continually shape the thinking of new generations of art and architectural historians worldwide (Cohen 2013: 17–18, 281–287). The persistence of this type of mysticism owes more, however, to its deep roots in Western culture. In proportional aesthetic mysticism the association of numbers with beauty exploits a cognitive ambiguity reflected in the very languages that help millions of people form their thoughts. When speakers of at least English and the Romance languages say the word ‘proportion’, two contradictory meanings fire off simultaneously in their minds, and seem to meld together: the concepts of ratio and beauty become unified.

Two kinds of proportion

Proportion technically denotes a ratio, but in common usage it usually connotes a broader meaning that appears to have entered the English language, with all its current ambiguity, with Ephraim Chambers’s 1723 translation of the French *Traité d’architecture* of 1714 by Sébastien Le Clerc: ‘By Proportion I don’t here mean a Relation of Ratios as the Geometricians do; but a Suitableness of parts, founded on the good Taste of the Architect’ (Le Clerc, 1723–1724, 1: 29).³⁰ The term thus embodies what I call ‘quantitative/qualitative ambiguity’ because the first meaning, which I call ‘proportion-as-ratio’, is an abstract quantitative comparison, while the second, which I call ‘proportion-as beauty’, is a qualitative aesthetic assessment of an identified object.³¹ The former cannot bring about the latter, any more than the latter can result from the former, because objective numerical relationships cannot *cause*, predictably and repeatedly, specific subjective emotional responses such as the opinion that a building is beautiful. When the beauty-in-proportion belief system originated centuries ago, however, the notion of beauty was not always considered to be a subjective product of human emotion.

Antecedent to Le Clerc’s dualistic description of proportion is Claude Perrault’s similar observation, in the preface to his *Ordonnance* of 1683, that ‘there are two kinds of proportion’. The first, which Perrault notes is difficult to perceive, describes ‘the magnitudes that the various parts [of a building] have in relation to each other or to the whole’, while the second, which he notes is called *Symmetrie* [sic] in French, consists of ‘the relationship of all the parts together [... and] is a very apparent thing, [for ...] it never fails to make apparent the defects’ in a building (Perrault 1993: 50–51).³² Thus, according to Perrault, the first kind of proportion consists of a series of quantitative relationships that are difficult to see with the unaided eye and presumably can only be revealed by measuring instruments, while the second is a relationship among the parts of a whole that is universally distinguishable by all human beings as either aesthetically correct or defective. We need only observe, however, that as an example of one of the defects that the second kind of proportion purportedly reveals, Perrault describes the interior of the Pantheon – ‘the bands of the dome do not correspond with the windows below, causing disproportion and a lack



Fig. 4: The Pantheon, Rome, interior view. Photo: Emilio Labrador.

of *symmetrie* that everyone can readily recognize’ – to confirm that aesthetic judgments are ever subjective from time to time, place to place, and individual to individual.³³ Indeed, just over three centuries later, Howard Burns, in his university classes, often singled out this very misalignment as one of the aesthetically *successful* features of the Pantheon, because, he contended, it makes the dome appear detached from the cylinder and freely rotating, as if floating (Fig. 4).³⁴

Perrault’s inability to understand the second of his two kinds of proportion as a subjective aesthetic assessment, rather than as a universal ‘that everyone can readily recognize’, was his blind spot, and helps to explain why the distinction he also made between two kinds of beauty, arbitrary (i.e., learned) and positive (i.e., universal), according to which he controversially associated architectural proportional systems with the former, created no significant impediment to the continuation of the beauty-in-proportion belief system into the present day. His theory, though radical in his day, did not attack the core of the beauty-in-proportion belief system. Indeed, it was never his intention to undermine the very notion of positive beauty, but only the belief that proportional systems could be sources of positive beauty in architecture.³⁵

Perrault’s notion of positive beauty – i.e., beauty as an objective entity not unlike a mathematical principle,

unreliant on subjective human judgment for its existence but universally recognizable as beauty by all human beings – happens to be the necessary precondition for the belief that particular proportional systems create beauty in architecture, or, the very belief that he developed the notion of arbitrary beauty to combat.³⁶ Perrault could very well claim that the proportional systems of the past, and for that matter his own new proportional system for the orders presented in the main body of the *Ordonnance*, only create beauty arbitrarily, through the familiarity of custom; but his affirmation of the existence of positive beauty has only affirmed the core belief of beauty-in-proportion believers from his day to our own: that a metaphysical well of ideal beauty exists somewhere outside of architecture, and that architects can learn various ways in which to tap into it in order to create works of universal appeal. Perrault attacks the efficacy of one of those ways – the use of proportional systems – but not the core of the belief itself.

Perrault's notion of positive beauty is similar to Leon Battista Alberti's notion of innate beauty, and might strike the modern reader as a contradiction in terms, for beauty, it would seem, can never be positive.³⁷ All assessments of beauty are arbitrary aesthetic opinions – at least, this contention could not be disproven based on logical argument or scientific demonstration. Perrault's conception of positive beauty is based on a blending of quantitative and qualitative architectural qualities, or 'convincing reasons', that to him signal the presence of positive beauty. He provides four examples of such qualities: 'richness of materials, the size and *magnificence* of the building, the precision and cleanness of the execution, and *symmetrie*'. The first and third of these examples can be interpreted either as measurable qualities or subjective judgments. The second combines a measurable quality, size, with a subjective judgment, *magnificence*, and is thus best interpreted as a pair of words referring to the subjective quality of *magnificence*. Perrault describes his fourth example, *symmetrie*, as the same as his second kind of proportion, or, a quality that produces 'an unmistakable and striking beauty' ('une beauté évidente & remarquable') that all people recognize.³⁸ Thus Perrault's positive beauty would seem to consist of but a series of arbitrary aesthetic assessments.

Perrault did not consider qualities such as *magnificence* and *symmetrie* to be subjective aesthetic judgments, even though today we have no other way to characterize them because their properties cannot be confirmed with the predictability and repeatability that the scientific method requires. Indeed, he based his assumptions not on scientific standards of verifiability, but on the then seemingly irrefutable approbation of expert opinion – the widespread consensus among those who had the education and training to judge art and architecture. Another century would pass before Kant would state that

there is no Science of the Beautiful, but only a Critique of it [...]. For [...] if it could be decided scientifically, *i.e.* by proofs, whether a thing was to be regarded as beautiful or not, the judgment upon

beauty would belong to science and would not be a judgment of taste. (Kant 1914: 185)³⁹

Perrault did not have the benefit of the fully mature Scientific Revolution to help him sort out these distinctions, but no matter, because the concept of beauty-in-proportion, which depends on the illogical and unscientific assumption of a causal relationship between proportion-as-ratio and proportion-as-beauty, ignored the Scientific Revolution in its uninterrupted passage from Perrault's day to our own.⁴⁰

By codifying the notion of positive beauty, and thus the positive/arbitrary beauty dichotomy, Perrault's writings may have contributed to maintaining the beauty-in-proportion belief system in subsequent centuries as much as those of François Blondel.⁴¹ In Part V of the *Cours d'architecture* of 1683, Blondel replies to Perrault's denial, in Perrault's preface to the *Ordonnance*, that proportional systems can be sources of beauty with what Anthony Gerbino calls a 'defense of proportion'.⁴² Blondel's defense focuses on 'harmony' (*harmonie*), an adjunct to the word and concept of proportion that for architectural theorists had carried the ambiguous double signification of proportion-as-ratio and proportion-as-beauty since at least 1485, when Alberti published his celebrated promulgation of harmonic architectural proportions in Book IX of *De re aedificatoria*.⁴³ Thus in one sentence Blondel uses both of these terms, proportion and harmony, first qualitatively, to describe the beauty of 'old and modern buildings [...], [and] the beautiful proportions that their parts have between them [...] which have [...] an agreeable harmony that gives so much pleasure to the eyes'; and, in another sentence on the following page, quantitatively, in reference to the beautifying qualities of musical-numerical proportions of a specific building as 'a continual harmonic proportion' (Blondel, 1675–1683, vol. V, 738–739).⁴⁴

Blondel emphasizes his belief that an inherent beauty of harmonic ratios in music is directly transferable to architecture in an unobvious graphic comparison between the horizontal lines of a column base, annotated with numerical dimensions that form harmonic ratios, with the lines of a musical staff. The staff poignantly includes a bass clef (**Fig. 5**; Blondel, 1675–1683, vol. V, 759).

Blondel's claim that musical harmonies contain inherent beauty that can be transferred to architecture is not fundamentally different than Perrault's claim that *magnificence* and *symmetrie*, for example, serve as vehicles for transferring positive beauty to architecture, for both authors believe that great works of architecture somehow access a metaphysical well of ideal, universal beauty. Perrault's skeptical approach toward the traditional notion of proportional systems as tools capable of tapping into that well did not extend to the notion that such a well, which he calls positive beauty, existed in the first place. Thus, in the aftermath of the highly visible Perrault-Blondel debate, Perrault's skeptical approach to the traditional association of proportional systems with positive beauty did not win out over Blondel's respectful approach. Perhaps it was not

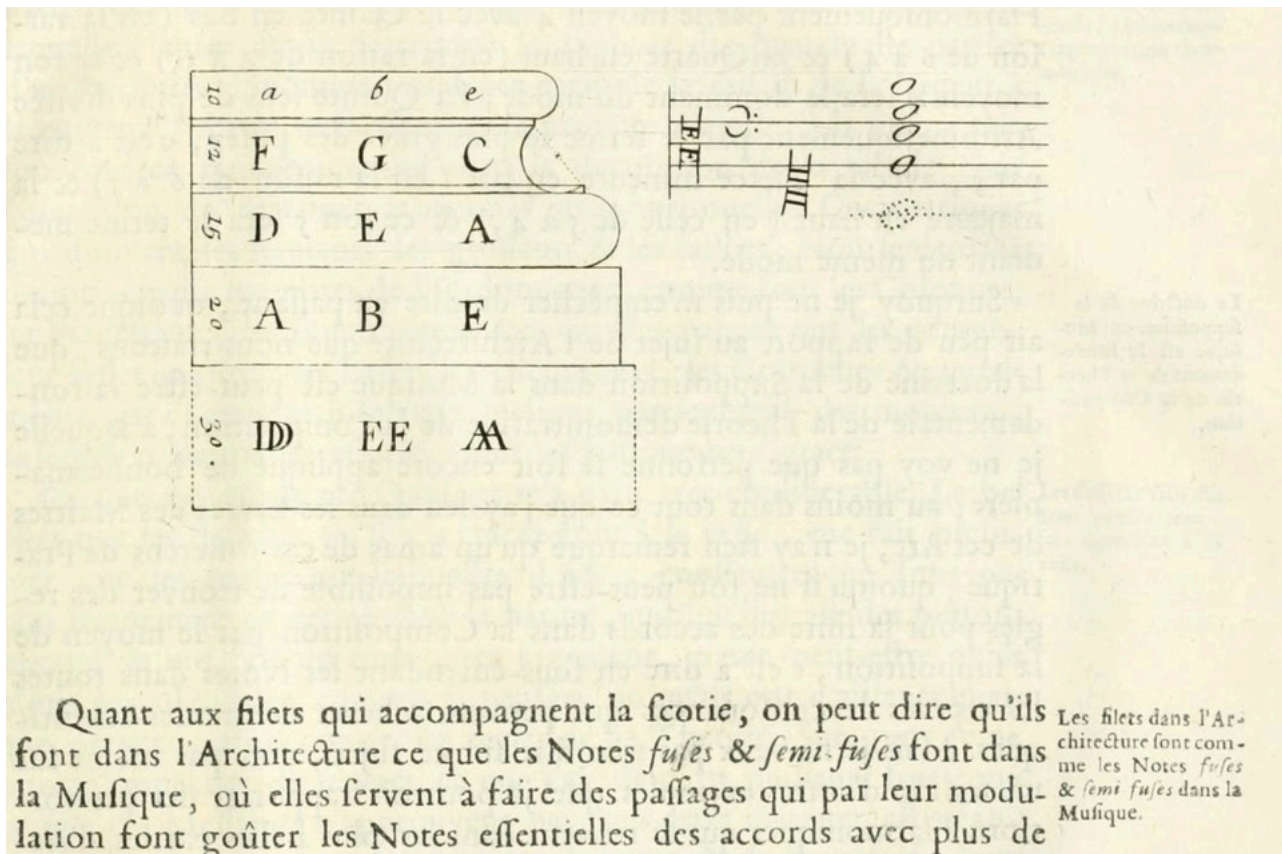


Fig. 5: François Blondel, column base and musical staff comparison. *Cours d'architecture* V.vii, 759.

different enough from Blondel's approach, or perhaps the beauty-in-proportion belief system, then as now, was impervious to any logical counter argument, including those parts of Perrault's counter argument that are indeed extremely logical.⁴⁵ Instead, these two general approaches – skeptical and respectful – continued into subsequent centuries as parallel, sometimes mutually antagonistic developments of architectural culture.

Wittkower surveys the European literature that reflects these parallel developments from the 17th through the early 20th centuries – though rather than concurrent developments of two different approaches Wittkower sees a transition from one to the other – in a section of *Architectural Principles* titled 'The Break-away from the Laws of Harmonic Proportion in Architecture' (1949 and 1952b: 124–135; 1962 and 1971: 142–154). The literature he surveys is wonderfully varied, ranging from the analytical to the whimsical, and most of it highlights the notion of harmony.⁴⁶ An important shortcoming of Wittkower's overall quite useful survey, however, is his conclusion that beginning in England in the late 18th century, 'the whole structure of classical æsthetics was overthrown from the bottom', and that

in this process man's vision underwent a decisive change. Proportion became a matter of individual sensibility and in this respect the architect acquired complete freedom from the bondage of mathematical ratios. [Footnote 4:] However, mathematical ratios survived in a degenerated form as a teaching expedient for architectural students and

without any connection with their original meaning. (Wittkower 1949 and 1952b: 131 and 134; 1962 and 1971: 150 and 153)

Wittkower's freedom/bondage dichotomy appears to be overstated, for pre-18th century architects appear to have had more proportional freedom than Wittkower acknowledges, and while later architects may indeed have acquired the option of freedom from belief-based proportional systems (see below), not all of them opted for it; and of course architects were not the only interested parties in the history of architectural proportional systems. For some 18th-century and later thinkers, proportional systems continued to carry the same general payload of metaphysical meanings that they had carried for some thinkers of preceding centuries. Thus it may be more useful to think of the history of architectural proportional systems as characterized by two continuous, parallel strands of thought – a skeptical-pragmatic strand and a respectful-metaphysical strand – rather than a transition from one way of thinking to another, characterized by an 18th-century sea change separating a long period of universal obedience to proportional system metaphysics from a modern period of liberation.

Wittkower's denial of pluralism in European attitudes toward architectural proportional systems during the centuries in question is reflected in his survey selections. The earlier works included in Wittkower's survey tend to reflect the respectful-metaphysical strand, while his later selections mostly reflect the skeptical-pragmatic strand. Wittkower brings his survey only as far as Archibald Alison's

Essays on the Nature and Principles of Taste of 1790 and his follower Richard Payne Knight's *An Analytical Inquiry into the Principles of Taste* of 1805, before proclaiming victory for the skeptics. He then provides proportion-skeptical quotations from two subsequent works, John Ruskin's *The Seven Lamps of Architecture* of 1849, and Julien Guadet's *Éléments et théorie de l'architecture* of 1901–1904, as examples, he claims, of the 'general feeling' prevailing from Knight's day 'down to our own days' (Wittkower 1949 and 1952b: 134; 1962 and 1971: 154). He neglects to acknowledge, however, that many other works from the 19th and early 20th centuries reflect a broad range of vigorous alternative views.⁴⁷

Perhaps fueled by an enduring tradition of occultism, which had flourished in England with particular fervor during the late 17th and 18th centuries, English beauty-in-proportion believers in the mid-19th century appear to have been very active, the legacies of the influential, proportion-skeptical writings of William Hogarth (1753), David Hume (1739 and 1757), and Edmund Burke (1757) cited by Wittkower notwithstanding.⁴⁸ Thus Edward Lacy Garbett, in his *Rudimentary Treatise on the Principles of Design in Architecture*, published in London in 1867, decries the 'immense abuse' he attributes to the beauty-in-proportion believers of his day, in a passage that he subsequently supports with quotations from Alison's aforementioned *Essays*. Garbett writes,

A proper understanding of the nature of physical harmony, whether in sound or colours, will guard the reader against the immense abuse which mystics make of this plain commonsense principle, in the theories of what is called *proportion* in architecture; — a sort of beauty made easy, an artistic philosopher's stone, by which baser productions are to be transmuted into works of art [...] only by applying arithmetical rules. (Garbett 1867: 38–39)

John Pennethorne's impressive work, *The Geometry and Optics of Ancient Architecture* of 1878, indicates that Garbett's mystics were not relegated to the fringes of English society. Pennethorne pairs his archaeological observations, which are still important today, and which he presents in rigorous, large format measured drawings and lucid verbal descriptions, with extensive metaphysical reflection. His first mention of optical corrections in ancient Greek temples as being necessary 'to produce an apparent harmony between all the members of the executed design' seems to refer to harmony as visual beauty in a casual, non-metaphysical way (Pennethorne 1878: 4). He continues, however, in the universalizing first person plural ('we'), to claim that rather than perceiving harmony in universally appreciated works of art merely with our eyes, we *feel* it through an occult sympathy with the 'constitution of our minds', which contains 'an original impression' of the inherent structure of the universe. Thus he claims, as part of a lengthy metaphysical declaration strongly reminiscent of Morris's *Lectures* from 150 years earlier, that when we (i.e., all human beings)

are able to perceive the harmony and the exact proportions in which the several parts of the Universe are linked together, we feel an intellectual pleasure, arising perhaps from an original impression on our minds of what appear to be the essential attributes of a perfect work. (Pennethorne 1878: 45)⁴⁹

Another expression of belief in the intangible, beneficial properties of proportional systems evident in mainstream, 19th-century English architectural theory will be discussed below, in relation to Gwilt's *Encyclopedia*.

The ambiguous, metaphysically driven melding of the two kinds of proportion discussed in this section, proportion-as-ratio and proportion-as beauty, have found four main categories of expression in the art and architectural literature from Alberti to the present. Two of them, we have seen, are the terms 'proportion' and 'harmony'.⁵⁰ Indeed, today scholars and architects still commonly refer to 'harmony and proportion' without understanding specifically what these words mean, or realizing that by using them they are perpetuating an ambiguity that traces back at least as far as the early Renaissance. The third category is the notion of regulating lines, which along with harmony Blondel also promotes in his *Cours* (Fig. 6; Blondel, *Cours*, V.ix.752). The fourth, the virtual cult of the golden section, originated in Germany in the mid-19th century, and is only superficially related to the occasional and probably often inadvertent appearance of this ratio (1:1.618...) in medieval architecture.⁵¹

These four categories of expression blended with particular fervor in France during the second decade of the 20th century, in the discussions of several avant-garde groups composed of artists and others, including Section d'Or (Golden Section; also called Groupe de Puteaux), Les artistes de Passy, and Art et Liberté. Among the various members and officers of these groups were August Perret, Paul Valéry, Amédée Ozenfant, Gino Severini, Pablo Picasso and Charles-Édouard Jeanneret-Gris, the future Le Corbusier (Laurent 1998; Loach 1998; Jeunes Peintres ne vous frappez pas! 1912).⁵² Out of this early 20th-century French cultural context, augmented by German and other influences, eventually emerged Le Corbusier's Modulor, a proportional system of the 1940s that combined all four of the above-noted categories of expression of the ambiguously quantitative/qualitative notion of proportion.⁵³ Out of this context also belatedly emerged, in 1951, the Milan conference, which for some of the older participants such as Severini and Le Corbusier must have carried a rather nostalgic air of reunion, albeit in a dramatically different, post-war world (Fig. 2).⁵⁴

The legacy of the Milan conference

Dominated by the conspicuous participation of Le Corbusier and Wittkower, and given augmented prestige by the contributions of other leading intellectuals including Sigfried Giedion, Matila Ghyka, Pier Luigi Nervi, Andreas Speiser and Bruno Zevi, the 1951 conference gave voice to a spiritual yearning on the parts of the organizers and participants for the development of a unified, orderly basis for the arts and sciences as a pathway toward

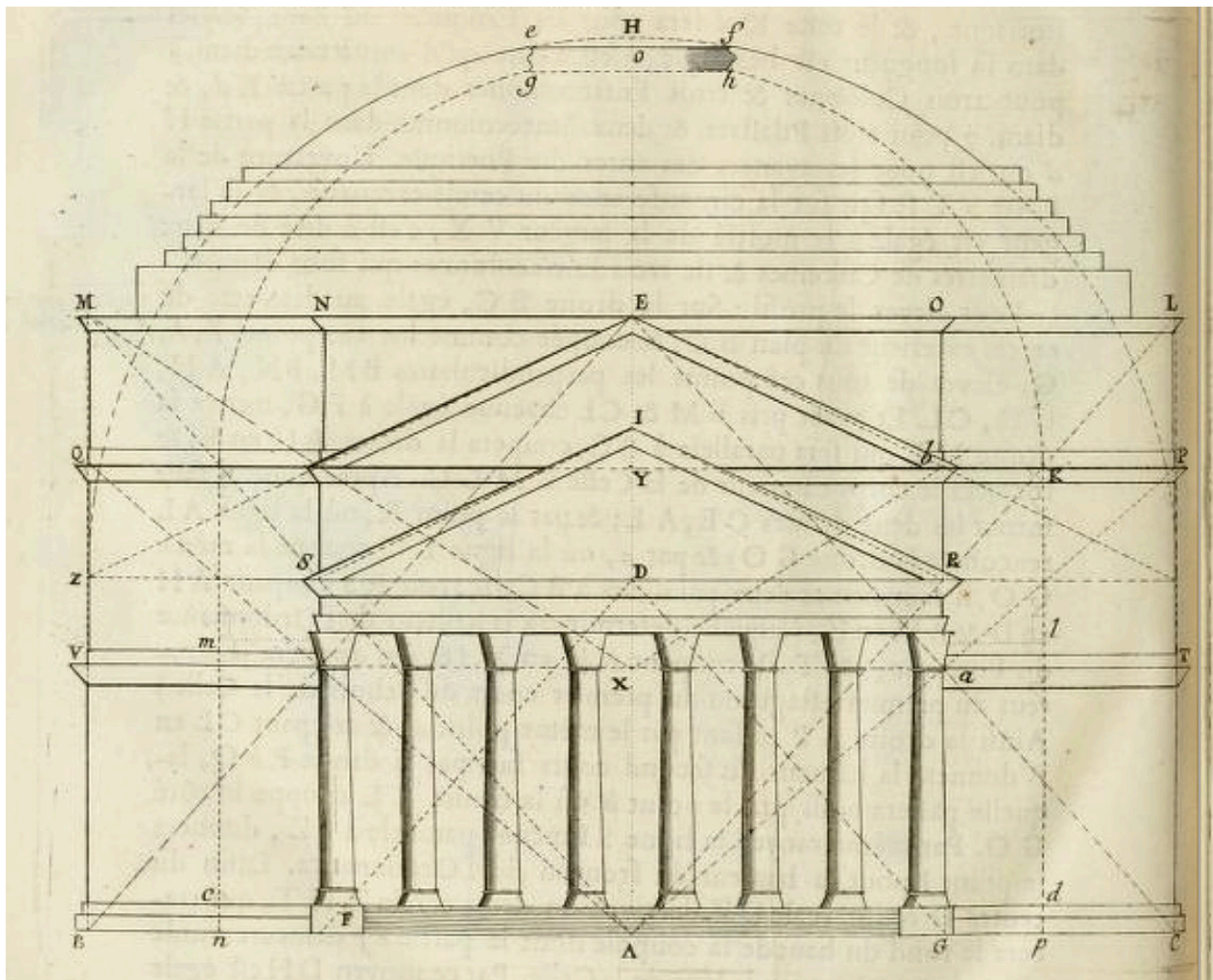


Fig. 6: François Blondel, the Pantheon, Rome, exterior with overlaid regulating lines. *Cours d'architecture*, V.ix.752.

the reformation of society, and ultimately, recovery from the trauma of World War II.⁵⁵ In his introduction to the recently published proceedings of the conference, Fulvio Irace describes this yearning as follows:

In 1951 the conference *De Divina Proportione* was proposed as an ecumenical council of men of arts and sciences, convened to determine the rules of the spirit that were to govern the new areas of the reconstruction of democracy. (Cimoli and Irace 2007: 17)⁵⁶

In the same publication James S. Ackerman – today the only living contributor to the 1951 conference and also a contributor, via video interview, to the 2011 Leiden conference – similarly notes a spiritual dimension to the conference:

The interest that arose in 1951 was perhaps born, in a Europe that was still searching to recover from the devastation of the war, from a desire to return spirituality to the arts and to life through the geometry of a pure architecture, free of ornament and consisting of rectangular surfaces and openings. (Cimoli and Irace 2007: 34)⁵⁷

Ackerman later notes that the manner in which the conference participants approached their subject, if not the idealism that motivated them, marked the beginning of a new scholarly seriousness in the study of proportion:

Before that time [1951] it [proportion] really hadn't become a reliable [area of] study. There was a lot of mysticism around it. Some of the mystics were part of the conference too, which is only fair, but it was really the end of the mystical phase and the [beginning of the] effort to set it onto reliable, academic, practical grounds.⁵⁸

Only tangentially, however, did the conference engage the academic study of the history of proportional systems. Those contributors who incorporated historical observations with supportive textual references into their presentations, in particular Wittkower and Giedion, only did so in support of the overwhelmingly mystical, reformist agenda of the conference, which Giedion rather grandiosely described as 'revolutionary' ('Il tutto e la parte nell'architettura contemporanea', in Cimoli and Irace 2007: 75). Wittkower, one of the conference organizers, justified that agenda in his opening remarks by decrying

as ‘an illusion’ what he saw as the predominant contemporary attitude toward artistic production based on ‘the nineteenth century idea that the artist, in his creative act, should be guided only by his personal intuition’. On the contrary, he declared, ‘the search for harmony and order is a basic part of human nature’ (*Finalità del Convegno*, in Cimoli and Irace 2007: 47). Such harmony and order, he believed, transcended the individual, and had the potential to be perceived collectively, by all human beings.

Indeed, for Wittkower and the other conference participants, a general notion of proportional order, which could be manifested in proportional systems and which they called the *divina proportione* (the divine proportion), after Luca Pacioli’s 16th-century book of that title (1509), constituted a kind of demiurge, existing independent of human culture but occasionally interacting with it. Seemingly endowed with agency and thus more assertive than a passive set of Platonic ideals, the *divina proportione*, these participants believed, periodically appeared in history, demanding expression in the arts and compelling human beings to serve as its sometimes unwitting collaborators toward some mysterious but ultimately beneficent purpose. Thus Giedion provocatively asked in his conference paper, ‘Can we state that the *divina proportione* has made its appearance again?’ and obliquely answered in the affirmative, citing as examples Le Corbusier’s Modulor and ‘the difference between the static proportions of the past and the dynamic proportions of the present epoch’ (Giedion, in Cimoli and Irace 2007: 73–74).⁵⁹ Even the thirty-two-year-old Californian and recently discharged US Army enlistee James S. Ackerman got into the spirit of the conference, alongside his elder European colleagues, concluding his summary analysis of the Cathedral of Milan proportions by interpreting the various geometrical schemes documented in the cathedral archives as medieval expressions of ‘the “Divina Proportione”’ (Ackerman, ‘Le proporzioni nell’architettura gotica: Milano, 1400’, in Cimoli and Irace 2007: 51).⁶⁰

Wittkower shaped the conference around the goal of identifying an appropriate expression of the *divina proportione* in the arts for the modern age. Since ‘the artist reflects the culture in which he lives’, he posited, the central objectives of the conference were, first, to answer the question ‘What is the character of our culture?’ in light of ‘the substitution of the absolute measure of space and time with the new dynamic space-time relationship’ introduced by Einstein; and second, to determine what effect this substitution ‘has and will have on proportion in the arts’ (Wittkower, ‘Finalità del Convegno’, in Cimoli and Irace 2007: 47). Thus, at the Milan conference Wittkower played the role of the activist-historian, applying his historical knowledge toward the purpose of influencing rather than merely studying history. Through the conference he strove to encourage artists and architects of the time to develop new proportional systems that would reflect the contemporary modern condition, to use those proportional systems in their creative works, and to see themselves as the torch bearers of a dynamic, centuries-long tradition of proportional exploration that had been,

in his view, temporarily interrupted by misguided 19th-century attitudes toward creative production.⁶¹

In his 1960 essay ‘The Changing Concept of Proportion’, Wittkower reveals his disappointment with the 1951 conference, lamenting that it had failed to advance its reformist agenda with tangible results. He also reveals his belief that proportional systems constituted not merely opportunities for aesthetic expression, but moral imperatives. The Milan conference, he notes, ‘brought together philosophers, painters, architects, musical historians, art historians, engineers and critics from many countries’. These thinkers and practitioners had gathered because, he continues, ‘they agreed on one point: that some kind of controlling or regulative system of proportion was desirable’. The conference nevertheless ‘fizzled out’, he claims, ‘without making an appreciable impact on the younger generation’ (Wittkower 1960: 210). The true depth of his disappointment, however, becomes apparent as his essay continues.

‘The bankruptcy of the Milan meeting’, Wittkower inveighs, ‘was publicly sealed at a historic meeting of the Royal Institute of British Architects [...] where a debate took place on the motion “that systems of proportion make good design easier and bad design more difficult” — a motion that was defeated with forty-eight voting for and sixty voting against’ (Wittkower 1960: 210; Pevsner 1957a).⁶² This ‘bankruptcy’ was for Wittkower not merely intellectual, but moral. In the essay he appeals for a return to the high ideals of the failed conference, advocating adherence in contemporary art and design to ‘absolute’ and ‘universal’ values based in ‘thought’ rather than ‘sensations’, lest modern society succumb to ignoble pragmatism and opportunism. Wittkower continues:

In most periods of history artists were convinced that their specific system of proportion had universal validity. These systems derived their all-embracing character from thought processes rather than from sensations. It is now two hundred years since the belief in absolute values was shaken, perhaps for all time; it can surely not be won back by an act of majority decision. As long as a broad foundation for a resurrection of universal values is lacking, one cannot easily predict how the present dilemma can be resolved. The very formulation of the motion put before the R.I.B.A. meeting shows that we have left far behind the realm of the absolute, and are submitting to pragmatic and opportunistic motivations. (Wittkower 1960: 210)

With the emphasis of military and religious metaphors (‘won back’ and ‘resurrection’, above), Wittkower here presents a moral choice between good and bad: design with proportional systems is based on thought and thus reason, and is therefore good; design without proportional systems is based on aesthetic judgments that are in turn based only on stimuli received by the senses in the absence of thought, and is therefore bad. He goes on to lament the ‘quick rise and easy victory of abstract expressionism’,

which he deprecates as ‘splash-and-dribble style’, and the ‘absolute subjectivism’ that he felt characterized the state of society nearly a decade after the Milan conference, and that he considered antithetical to the use of proportional systems (Wittkower 1960: 210).

With these comments Wittkower takes his place in a long line of like-minded thinkers. He might have fit in comfortably, for example, with those who, in 1750, Alexander Gottlieb Baumgarten anticipated might raise objections to his proposed new field of aesthetics on the basis that ‘impressions received from the senses, fantasies, emotional disturbances, etc., are unworthy of philosophers and beneath the scope of their consideration’ (Baumgarten, ‘Prolegomena’ to his *Aesthetica*, translated and quoted in Harrison, Wood and Gaiger 2000: 490).⁶³ In earlier centuries Wittkower might have found sympathetic company with François Blondel or Daniele Barbaro. This tendency to think of proportional systems, and the buildings that contain them, as good because they are based on mathematics, and the absence of proportional systems as less good, if not outright bad, because it leaves the architect’s whims unfettered, is still common today. Indeed, this tendency, along with the proportional aesthetic mysticism of which it is a symptom, carries the risk of encouraging moral aesthetic judgments of architecture, along the lines of Wittkower’s above-quoted comments of 1960 pertaining to the Milan conference. If buildings that contain proportional systems are good according to beauty-in-proportion believers, can buildings that lack them ever be as good, of equal overall value, and more than merely ‘pragmatic’ and ‘opportunistic’? Such proportional aesthetic mysticism could lead some scholars to believe that all good buildings must necessarily have interesting proportional systems, and to insist on finding them even where they do not exist. As my study of the Old Sacristy of San Lorenzo suggests, however, many good buildings may very well lack interesting proportional systems, and that lack constitutes valuable historical information rather than grounds for censure (Cohen 2013: 140–145).

Belief-based proportional systems

Prior to the advent of modern structural engineering, architects and builders used proportional systems to determine key dimensions of their works in terms of local units of measure. They did so in the belief, which could never be based on the certainty of verifiable outcomes, that proportional systems would confer upon their works certain desirable but unmeasurable qualities.⁶⁴ Such qualities included a general condition of order that was integral to pre-engineering notions of structural stability, beauty and overall correctness, which in Italy was called *ordine*.⁶⁵ After the advent of engineering new kinds of proportional systems arose based on the measurable, scientifically verifiable certainty of guaranteed outcomes, while examples of the old kinds based on uncertain, unscientific beliefs continued to flourish, though to a lesser extent, alongside them. In acknowledgement of this variety, we may define an architectural proportional system as

a set of geometrical, numerical or arithmetical correspondences between important dimensions throughout a building or major part thereof, intended by the architect to imbue built form with desirable qualities, physical or otherwise.⁶⁶

Note that in order to satisfy this definition, either kind of proportional system must consist of a set of *intentional* correspondences. This definition thus excludes complex geometrical constructions that historians might overlay onto drawings, photographs or computer models of buildings, unless those overlays can be convincingly demonstrated, through building measurements combined with other evidence, to represent the architect’s intentions.⁶⁷ This definition thus furthermore assumes that proportional systems cannot wander into architecture of their own volition, without the architects’ knowledge, as for example golden sectionists have tended to believe.⁶⁸ Since unintentional patterns of geometry and number can always be found in architecture, the preceding definition distinguishes between mere physical description of the object, which might include such patterns, and the scholarly identification and analysis of the creative intentions of the architect.⁶⁹

The use of architectural proportional systems continues to be standard practice today, in the forms of structural engineering size specifications (which must be combined with specifications for materials, techniques and other construction factors), standardized sets of dimensions for building components (in terms of the meter or the foot), zoning regulations (such as floor area ratio) and other conventions, but these are not the kinds of proportional systems of primary interest to us here.⁷⁰ Engineering specifications, dimensional standardization and zoning formulae are designed to guarantee measurable, practical outcomes, repeatedly and predictably. The proportional systems of primary interest to us here are decidedly impractical and not founded on the certainty of guaranteed outcomes.⁷¹ These proportional systems either date to the pre-engineering period prior to 1742–1743, or if later, retrogressively retain the technological innocence of that earlier period, together with some degree of the metaphysical orientation that characterized much of the thinking of that long period. I will call them ‘belief-based’, as opposed to ‘certainty-based’, proportional systems.⁷²

The differences between belief-based and certainty-based proportional systems can be rather subtle. For example, upon first consideration one might think that the San Lorenzo nave arcade bay proportional system (Fig. 3), which is a pre-engineering proportional system, guarantees the outcome that a root-2 rectangle will be inscribed in the space between the column shafts, and that therefore at least in this respect it is no different than any typical engineer’s specification from the post-1742–1743 period. Upon closer consideration, however, we can see that this proportional system is thoroughly belief based rather than certainty based, for two reasons. First, it does not in fact guarantee the physical presence of the root-2 rectangle in the nave arcade bays – indeed,

this rectangle is not physically present there at all – and second, this root-2 rectangle could serve no practical purposes whether it were present or not. This rectangle only exists as *an idea* in the minds of observers who understand that the horizontal distance between the column plinths, and the intended height of the column shafts, not including the astragals (which in this basilica are physically integral with the capitals), together correspond to the proportions of an *imagined* root-2 rectangle. To mentally perceive this rectangle observers have to understand that they must disregard not only the notable gaps between the column shaft surfaces and the sides of this imaginary rectangle (**Fig. 3**), but also the construction error that caused the column shafts to have been made slightly too tall to mark the top of this imaginary rectangle (Cohen 2013: 104–111; 2008: 33–37).

Furthermore, the root-2 rectangle in question could not have *guaranteed* any of the outcomes that the architects, probably both Dolfini and Brunelleschi, might have hoped to achieve by specifying it, which was surely more than simply creating a root-2 rectangle as an end in itself.⁷³ These architects could very likely have intended, for example, that it would confer *ordine*, specifically including structural stability (see above). Today, however, we know that it is scientifically impossible for a root-2 rectangle *per se* to establish structural stability in architecture; and neither *ordine* nor other notions of beauty, being subjective qualities, can ever be guaranteed. Engineering or zoning specifications, conversely, being based on immutable scientific and municipal laws (the latter being immutable at least for the duration of construction), guarantee predictable and measurable outcomes such as structural stability (when used in conjunction with other specifications, as noted above) or conformance with established building codes.

An illuminating example of an early conflict between belief-based and certainty-based proportional systems is found in the 1867 edition of Gwilt's *Encyclopedia*. Gwilt promotes what he calls the 'interaxal system', a grid proportional system that he acknowledges having borrowed from Durand's *Preçis des leçons d'architecture* of 1802–1805. Durand's proportional system still represented the belief-based approach, and Gwilt defended it against the then-new engineering technology of cast iron, which threatened to deprive Durand's system of the structural justification with which Gwilt associated it (Durand (1802–1805).⁷⁴ Gwilt writes,

Not the least important of the advantages resulting from the method of designing just submitted to the reader is the certain symmetry it produces, and the prevention, by the use of these interaxal lines on each floor, of the architect falling into the error of false bearings, than which a greater or more dangerous fault cannot be committed, more especially in public buildings. The subterfuge for avoiding the consequence of false bearings is now a resort to cast iron, a material beneficially enough employed in buildings of inferior rank; but in those

of the first class, wherein every part should have a proper point of support, it is a practice not to be tolerated. (Gwilt 1867: 894–895)

Thus, according to Gwilt, not only does the interaxal system provide a 'certain symmetry', by which Gwilt evidently means a kind of comprehensive beauty similar to Perrault's *symmetrie*, but it ensures that walls and columns will always be stacked directly atop other walls and columns, in a system of structural support that Gwilt finds more satisfactory than one that uses columns and transfer beams of cast iron, even though the two systems could be made equally strong. Similar to Wittkower's above-quoted objections of 1960 to any neglect of belief-based proportional systems in favor of artistic intuition, Gwilt considers the replacement of a belief-based proportional system with an engineer's certainty-based one (i.e., the mathematical specifications for the cast iron members) to be morally unacceptable. The interaxal system, Gwilt says, provides structural support that is 'proper', while cast iron provides the same degree of support but only through 'subterfuge'. For Gwilt, the engineer's cold calculations, which merely satisfy the practical objective of making a building stand up, can never distinguish architecture – i.e., buildings of 'the first class' – from mere 'buildings of inferior rank', or for that matter, from pure works of engineering such as bridges.⁷⁵ Gwilt's protestations notwithstanding, 19th-century engineers indeed succeeded in robbing belief-based proportional systems of their one ostensibly practical purpose, that of ensuring structural stability, by fulfilling that purpose effectively and reliably using proportional systems based on the science of physics, which the old proportional systems based on the mysticism of metaphysics never could do.

The advent of engineering, however, brought about only a partial demise of belief-based proportional systems in architecture. Since such systems, like those used in the designs of the Cathedral of Milan and the basilica of San Lorenzo, never had any more influence over structural stability than prayer or luck, the advent of engineering merely proved what many architects already knew – that in determining the sizes of crucial structural members an architect could use all the proportional systems he wanted, but in the end, in the words of the 16th-century Spanish architect Rodrigo Gil de Hontañón, he could only use 'his own judgment [...] and dare to have confidence' (quoted in Kubler 1944: 146).⁷⁶ The advent of engineering thus robbed belief-based proportional systems of their always-questionable claims to have helped ensure structural stability, but did not touch the only purpose that such proportional systems have ever fulfilled successfully – that of imbuing buildings with meaning. Some of that meaning may be considered aesthetic, for example, when observers thought about proportional systems in order to help themselves make sense of sense perception (Van Eck, 'The *Composto Ordinato*' in this special collection), or when architects used proportional systems to establish certain forms like entasis that they considered to be beautiful; and some may be considered metaphysical but

not necessarily aesthetic, such as when observers thought about proportional systems to help themselves imagine architecture as a reflection of a larger, macrocosmic order that, in the words of Alfred W. Crosby (1997: 46–47), ‘lay beyond the scrim of reality’.

Belief vs. practice

Contemplation of the macrocosmic order that lay beyond the scrim of reality was not for everyone, and most pre-engineering architects probably used belief-based proportional systems without associating them with beliefs that were nearly as metaphysical as the kind Crosby describes above, who addresses a more general context not specifically focused on proportional systems. Indeed, Anthony Gerbino and Konrad Ottenheim both independently conclude that in the 17th century and earlier periods architects probably had little interest in, nor much understanding of, such beliefs, and instead thought of proportional systems as practical design tools integral to long-established architectural practices.⁷⁷ Palladio and Vignola, for example, in their extremely limited comments on possible analogies between proportional systems and musical harmony, merely indicate a general awareness of such matters, and that others of their day had studied them, but devote the vast majority of their own attention to more earthly concerns of architectural practice.⁷⁸ In Vignola’s case one of those concerns is his attempt to use proportional systems to establish architectural beauty through *correlation* – that is, by recording the proportions of selected ancient Roman buildings widely considered beautiful in his day, and encouraging his contemporaries to use those proportions in their own works (Da Vignola 1562: Prefazione, n.p.). Vignola’s belief in the power of proportional systems to contribute to architectural beauty is illogical, for it fails to acknowledge the myriad factors that together contribute to perceptions of architectural beauty, perhaps including certain acceptable ranges of proportions-as-ratio for particular architectural elements as determined by custom.⁷⁹ His belief is not fully metaphysical in character, however, unlike Alberti’s stated belief in the powers of proportional systems to create architectural beauty through *causation*, or, through the sheer metaphysical power of numbers.⁸⁰

Thus as an alternative to Wittkower’s monolithic interpretation of architectural theory, according to which virtually everyone in any given period thought in exactly the same way, and according to which the extreme views of non-architect mystics such as Francesco Giorgi can serve as reliable stand-ins for the views of pragmatically inclined architects such as Palladio, Vignola, Serlio and Alberti (considering *De re aedificatoria*, Books I to XIII and X), I have proposed above that at any given time in history two rather loosely defined, parallel strands of belief pertaining to proportional systems can be identified, one more pragmatic in character and the other more metaphysical (Wittkower 1949 and 1952b: 90–102, 136–138; 1962 and 1971: 102–116, 155–157). In the pragmatic strand are the beliefs that proportional systems contributed various degrees of structural stability, beauty and *ordine* to architecture – beliefs held, for example, by the aforementioned

three Renaissance architects, plus Alberti, depending on how we think about him.⁸¹ In the more metaphysical strand are the beliefs that proportional systems link architecture to the macrocosm or the divine, such as, continuing with Renaissance examples, those of Barbaro, Giorgi and Alberti, considering *De re aedificatoria*, Book IX. Indeed, the beliefs of most pre-engineering architects and builders can probably be identified with the pragmatic strand, while those of unusually learned architects, clerics and other intellectuals, with the metaphysical strand. As noted above, furthermore, some extraordinary thinker-practitioners such as Alberti and Le Corbusier can be interpreted as occupying both strands, depending on which aspects of their work we consider.

Of course, the character of the various beliefs within each strand can be expected to have varied considerably across time and geography. Thus Pennethorne’s beliefs, for example, were no doubt quite different from Giorgi’s, though both contributed to the metaphysical strand. Nevertheless, Pennethorne’s may be considered more closely related, through a continuous succession of metaphysically oriented thinkers from the 19th back to the 16th centuries, to Giorgi’s beliefs than to Palladio’s, whose more pragmatic orientation associates him with the pragmatic strand that also stretches from the Renaissance into the 19th century, but was manifested by more pragmatically oriented thinkers such as Alison and Knight.⁸²

And so the parallel strands of belief continued, progressing out of the 19th century and into the 20th. In September 1951 the metaphysical strand passed forcefully through Milan, though the pragmatic strand was also present.⁸³ In June 1957 both strands passed through the RIBA meeting moderated by Pevsner, though we have seen that the pragmatic strand appears to have been slightly more vigorous, at least in light of the 60–48 vote against the beauty-in-proportion belief. When interpreting strands of belief we must exercise due caution, for there is reason to question the depth of beliefs to be found among those thinkers we may associate with the metaphysical strand. The British architectural journals from the late 1950s, after all, despite the sizable minority of the RIBA vote, are not flooded with articles about proportional systems in practice. In architecture the demands of practice have always tended to hold esoteric beliefs in check, which is why most practitioners in history have tended to associate with the pragmatic strand.

Today, while a majority of architects seem to believe that proportional systems contribute beauty to architecture of the pre-engineering period, very few of them use belief-based proportional systems, at least of the old-fashioned varieties such as those involving regulating lines, harmonic numbers or the golden section, in their own work as supplements to the certainty-based proportional systems that everyone uses.⁸⁴ To believe that the Parthenon is beautiful due to some secret proportional systems of the ancient Greeks may be entertaining and satisfying enough, but for an architect today to attempt to use such proportional systems in his or her own work would not only require more specific knowledge about those systems than is currently available, but more importantly, would require the

motivation to use them in the real-world context of architectural practice. Cast in the stark terms of billable hours – time and money – the beauty-in-proportion beliefs held by most practitioners today appear to be rather casual.

While the parallel strands continue today, metaphysicians who search for today's *divina proportione* in the geometry and mathematics of all manner of architectural design strategies constitute a small minority of practitioners. New developments in computational design capabilities, however, are opening what may be a new phase in the history of proportional systems that could cause the parallel strands to become increasingly intertwined. Computational design is increasingly allowing architects unprecedented control over certainty-based proportional systems that for the past 150 years have been the domains of engineers and other specialists.⁸⁵ Parametric modeling and other design methods are now allowing architects to solve complex problems of design, custom fabrication of building components, and construction, while simultaneously exploring new avenues of aesthetic expression. Formal exploration and creative problem-solving can play variously dominant roles in these computational design processes.⁸⁶ These new certainty-based proportional systems are essential to the design process, rather than mere corrective appliqués like regulating lines, because to ever-increasing degrees they *are* the designs. The metaphysical strand of belief-based proportional thinking may yet be reinvigorated in this new design environment that is so steeped in complex geometrical and mathematical operations that encourage the production of new kinds of architectural forms that have few historical precedents.⁸⁷

Architects have always had the artistic license to explore whatever pragmatic or metaphysical inclinations they may choose, but scholars need to strive for objectivity in order to interpret this creative production accurately. The study of proportional systems in the history of architecture presents a rich variety of subject matter, very important among which is the exploration of the meanings they communicate. Scholars have to take care to examine these meanings as historical artifacts – not to believe them themselves, nor to create new meanings of their own invention. Most of the following essays examine belief-based proportional systems composed of proportions-as-ratio, or, sets of proportions as measurable, verifiable products of artistic production. Some examine proportion-as-beauty, from historical or historiographical viewpoints. When authors touch on proportion-as-beauty as their own beliefs, however, such explorations constitute forays into architectural criticism. It is my hope that the distinction between proportion-as-ratio and proportion-as-beauty outlined in this introduction can help readers distinguish between these various approaches to the historical phenomenon of proportional systems, which is the subject of this volume.

Notes

¹ 'Proportional Systems in the History of Architecture: An International Conference Hosted by Leiden University, 17–19 March 2011', organized by Matthew A. Cohen, Eelco Nagelsmit and Caroline van Eck. Speakers: James S. Ackerman (pre-recorded video interview),

Francesco Benelli, Robert Bork, Lex Bosman, Howard Burns (keynote), Jean-Louis Cohen, Matthew A. Cohen, Mario Curti, Krista de Jonge, Elizabeth den Hartog, Francesco P. Di Teodoro, Sara Galletti, Anthony Gerbino, Jeroen Goudeau, Gerd Graßhoff, Volker Hoffmann, Frederique Lemerle, Emanuele Lugli, Stephen Murray, Werner Oechslin, Konrad Ottenheim, Andrew Tallon, Marvin Trachtenberg, Caroline van Eck, Caroline Voet and Mark Wilson Jones.

² The conference had two titles: 'Il Primo Convegno Internazionale sulle Proporzioni nelle Arti', and the subtitle 'La divina proportione'. It was held from 27–29 September 1951 as part of the ninth Triennale di Milano, in the Palazzo dell'Arte. Published documentation of the conference is incomplete and inconsistent. Three publications report the contents of the conference: Wittkower (1952a), an anonymous article titled 'Il primo convegno internazionale sulle proporzioni nelle arti' (1952), and Cimoli and Irace (2007). Of them, 'Il primo convegno' names the most speakers and other contributors, but Cimoli and Irace publish the largest selection of texts of the papers, many of them abridged. Out of a total of thirty-two *relazioni* and *comunicazioni* presented at the conference, Cimoli and Irace publish twenty-five, while 'Il primo convegno' publishes fourteen. The following list of participants, arranged in alphabetical order, is derived from the latter. It retains all spellings as published, and the Italian titles when provided, though many of the participants pursued multiple professions: James Ackerman, Arch. Cesare Bairati, Arch. Max Bill, Luigi Cosenza, Prof. Dekkers, Dott. Gillo Dorfles, Prof. Giusta Nicco Fasola, Scultore Lucio Fontana, Dott. Charles Funck-Hellet, Arch. Ignazio Gardella, Prof. Matila Ghyka, Prof. Sigfried Giedion, Mad. Carola Giedion-Welker, Prof. Hans Kayser, Arch. Mario Labò, Le Corbusier, Arch. Carlo Mollino, Gino Levi Montalcini, Ing. Pier Luigi Nervi, Prof. Roberto Papini, Prof. Giovanni Ricci, Prof. Salvatore Caronia Roberti, Arch. Ernesto N. Rogers, Arch. Alfred Roth, Arch. Piero Sanpaolesi, Pittore Gino Severini, Prof. Andreas Speiser, Prof. Eva Tea, Dott. Adrien Turel, Pittore Georges Vantongerloo, Prof. Rudolf Wittkower and Arch. Prof. Bruno Zevi. The following participated in a panel discussion on the third day of the conference, but did not present papers: Arch. Annoni, Prof. Caronia (same as Salvatore Caronia Roberti?), Ing. Enrico Castoldi, Dott. Melino, Arch. Moretti (Luigi Moretti?), Arch. Pasqué, and Arch. Sotsas junior. At the end of the conference the following were nominated and unanimously elected to serve on the 'Comitato internazionale di studio sulle proporzioni nelle arti' (in the order listed in 'Il primo convegno'): Le Corbusier (President), Arch. Phillip Johnson, Arch. Ernesto N. Rogers, Arch. Josè Luis Sert, Prof. Andreas Speiser, Prof. Rudolf Wittkower, Scultore Berto Lardera, Dott. Mario Melino and Signora Carla Marzoli ('Il primo convegno', 1952: 119–121). According to Wittkower the name of this committee was the 'Comité internationale pour l'étude et l'application des proportions dans les arts et l'industrie contemporains', and its purpose was to organize a second conference on proportion in the

- *arts, to be held in New York in 1953, though this second conference never took place (Wittkower 1952a: 55). For additional comments and references pertaining to the Milan conference, see Mattei (2013).
- ³ The announcement for the Leiden conference stated: 'The purpose of this conference is to frame a rigorous new scholarly discussion of this subject [proportional systems in the history of architecture], and in the process, to help define appropriate methods, standards and limits for it. The conference will explore this subject during any period, and from both historical and historiographical points-of-view'. For the stated purposes of the Milan conference, see Wittkower's opening comments quoted below.
- ⁴ According to Mainstone, 'The first recorded application of [...] [the present theories of equilibrium, deformation and strength] in structural practice in 1742–43 may be said to mark the birth of the present art of structural design'. This comment is in reference to a structural analysis undertaken in those years of cracks in the dome of St. Paul's Cathedral in London.
- ⁵ I paraphrase here the opening paragraph of Pevsner (1957b: 23 and 25): 'A bicycle shed is a building; Lincoln Cathedral is a piece of architecture. [...] [T]he term architecture applies only to buildings designed with a view to aesthetic appeal', though I expand upon Pevsner's formulation, even beyond his concluding sentence that the history of architecture is a history 'primarily of spatial expression', by proposing that a defining quality of architecture is its capacity to communicate iconographically.
- ⁶ The prescribed proportions of streets and lots that, according to Friedman (1988), were imposed by the governing authorities of Florentine new towns, are different than modern urban design guidelines for building morphology in two important respects: they appear to have been intended neither to produce practical outcomes such as health and safety, nor to be extensive enough to meet the definition of proportional systems presented below. At least the latter assessment also appears to apply to the urban design guidelines for the architecture of late medieval Florence noted by Trachtenberg (1997).
- ⁷ My use of the term 'paradigm' here follows the fourth definition in *Oxford English Dictionary Online*, which generalizes Thomas S. Kuhn's (1970: 10) definition to apply to non-scientific disciplines, such as architectural history, as well as scientific ones. The *OED* defines 'paradigm' as 'a conceptual or methodological model underlying the theories and practices of a science or discipline at a particular time; (hence) a generally accepted world view'. See also Cohen (2013: 36 note 41).
- ⁸ My use of the term 'Wittkower paradigm' is independent of Payne's undefined reference to 'Wittkower's paradigm' (1994: 332; 2011: 46–50).
- ⁹ For example, some scholars have found difficult to accept my contention that the San Lorenzo proportional systems have no influence on the visual aesthetic value of that basilica. See Cohen (2013; 2008).
- ¹⁰ Both in method and result, my anecdotal observations of common opinions today about beauty and proportional systems are similar to those reported by Claude Perrault (1683: v–vi; 1684: 105 note 7; 1993: 49–50). On the risks of this method, see Gerbino, 'Were Early Modern Architects Neoplatonists?', in this special collection. For Wittkower's remarks during the 1951 Milan conference about ongoing research into *Gestalt-psychologie* and the human brain, see Wittkower, 'Finalità del convegno' in Cimoli and Irace (2007: 47). More recently, Di Dio, Macaluso and Rizzolatti (2007) used functional magnetic resonance imaging (fMRI) to observe localized regions of brain activity in test subjects who were shown sets of proportionally manipulated photographs of canonical works of classical and Renaissance art and asked to judge them aesthetically. Although the fMRI images and scientific language lend the study a superficial appearance of scientific validity, these tools are used in combination with a limited understanding of art history and aesthetic theory. Although interdisciplinary in subject matter, the study was apparently not conducted by an interdisciplinary research team. It is thus compromised at the outset by the authors' questionable, insufficiently-supported assumptions that 1) 'it is [...] rather implausible to maintain that beauty has no biological substrate and is merely a conventional, experientially determined concept' (p. 8); 2) test subjects who are 'naïve to art criticism' would also be naïve to other cultural factors that might subjectively influence their opinions about art, or indeed about this particular experiment itself (p. 1); and 3) the golden section 'is considered to represent the ideal beauty' (pp. 1 and 8). The authors associate the latter assumption with linear overlays that they have applied to a photograph of the Greek Doryphoros sculpture by Polykleitos, dividing the height of this figure at the navel into two main parts, the relative proportions of which they claim correspond to the golden section (p. 2). The authors thus bring 19th-century pseudo-scientific golden-sectionism into a 21st-century, peer-reviewed scientific journal. These and other methodological shortcomings provide ample reason to doubt the authors' conclusion that the brain activities observed by their fMRI scans affirmatively answer their main research question of 'whether there is an objective beauty, i.e., if objective parameters intrinsic to works of art are able to elicit a specific neural pattern underlying the sense of beauty in the observer' (p. 8). This study serves as both an example of the difficulty, and perhaps futility, of applying scientific tools to the study of the inherently unscientific subject of aesthetics, and a reminder that scientific training is not necessary for the critical evaluation of such studies. For the popular dissemination of this study, see 'Is the Beauty of a Sculpture in the Brain of the Beholder?' in the 24 November issue of *Science Daily* (Public Library of Science 2007). For similarly golden-sectioned images of classical sculpture see Zeising (1854: especially 282, Fig. 188); Hagenmaier (1949: 29); and Doczi (1985: 104–105). Le Corbusier based his Modulor in part on

the similar division of a male figure (1950: ch. 2). On the 19th-century origins of aesthetic claims pertaining to the golden section, see van der Schoot (1998) and Frings (2002).

- ¹¹ Note that in his 1980 film conceived for general audiences, 'Palladio: The Architect and His Influence in America', James Ackerman remarks over a view of the interior of the central hall of Villa Poiana, 'In Palladio's work, it is the refinement of proportions — a fixing of precise ratios of length to width to depth and height — that gives one a sense of equilibrium in and around his buildings' (Ackerman and Terry 1980). Similarly explicit characterizations of this belief, however, are not found in Ackerman's scholarly works.
- ¹² Thus, in the example of the San Lorenzo nave arcade bays, several dimensions, when expressed in terms of the 15th-century Florentine *braccio*, when separated out from the rest imply the Boethian number progression 1, 5, 9, 13, 17. These numerical relationships are not visible, but can only be understood mentally. See Cohen (2013: 52–111; 2008).
- ¹³ Cf. Herrmann's quotation of François Blondel quoting Claude Perrault, probably from one of the latter's unpublished *mémoires*, 'that proportions "cannot be seen, and therefore, cannot be the cause of a sensible effect such as the pleasure which beauty gives us"' (1973: 133–134).
- ¹⁴ Cf. Perrault's assertion that 'in architecture there are, strictly speaking, no proportions that are true in themselves' (1993: 54); see also Perrault (1683: xiv): 'de proportions véritables en elles-mêmes'. For additional discussion, see Cohen (2013: 281, 284–285).
- ¹⁵ See also the discussion below on the limitations of correlation, as in the belief that measurements of the proportions of buildings considered to be beautiful can be used in the designs of new buildings in order to create similar beauty.
- ¹⁶ Pevsner urges a 'cautious' response to Wittkower's harmonic interpretation of Palladio's buildings, thus demonstrating that beauty-in-proportion preconceptions and critical thinking about other issues pertaining to architectural proportional systems are not mutually exclusive (1957: 467).
- ¹⁷ I refer here to the definition of taste in *Oxford English Dictionary Online* ('taste, n.1', entry 8a) as 'the sense of what is appropriate, harmonious, or beautiful; especially: discernment and appreciation of the beautiful in nature or art; specifically: the faculty of perceiving and enjoying what is excellent in art, literature, and the like'. This definition merely implies the notion of *sensus communis* (common sense, or communal assent), which is explicit in the definition by Kant (1914: 169–170), quoted below (see note 25). Like Kant's definition, this one emphasizes taste as a judgment rather than merely a pleasurable sensory experience.
- ¹⁸ Cf. *Oxford English Dictionary Online* ('aesthetic', heading A.1): 'Of or pertaining to sensuous perception, received by the senses'. This definition is accompanied by a single example of usage, from the late 18th century.
- ¹⁹ *Oxford English Dictionary Online* ('aesthetic', heading A.2): This definition is accompanied by four examples of usage from the 19th century.
- ²⁰ On empathy theory, see Vischer (1873: 102–112), Wölfflin (1994: 167–171), Scott (1914) and Langfeld (1920).
- ²¹ See, for example, Billings (1840); Penrose (1851); Henszlmann (1860); Cresy (1867); Pennethorne (1878); Thiersch (1883); Von Stegmann and Von Geymuller (1885, 1: 18); Marquand (1894); Gardner (1925); Borisavliévitch (1925); and Hambidge (1967, a reprint of the ed. 1926, based on lectures delivered around 1916 and published in the journal *The Diagonal* in 1919 and 1920). Mystically inclined studies also continued after 1949; for example, Bairati (1952); Borisavliévitch (1952); Des Corats (1957); Funck-Hellet (1951); Jouven (1951); and Doczi (1985). For an approach to proportion that focuses on the concept of stability, or *résistance*, see Lebrun (1807: 19–23; 1809). For an extensive but not comprehensive bibliography of literature pertaining to proportion up to 1958, see Graf (1958). For an addendum to Graf's bibliography, see Borsi (1967: 119–155).
- ²² Wittkower continued to develop and promote these theoretical generalizations in subsequent publications; in particular, Wittkower (1953; 1960; 1962: Appendix 4, which was retained in the 1971 and 1988 editions).
- ²³ Wittkower quoting Kenneth Clark's review of *Architectural Principles*. Wittkower (1962: Preface, v; 1971: Introduction, n.p.) refers to this passage as his 'intention in a nutshell', while Clark (1951: 65) had merely called it a 'result' of Wittkower's book.
- ²⁴ See Abrams (1985); *Oxford English Dictionary Online* ('aesthetic', B.4): 'Of or pertaining to a late 19th-century movement in England of artists and writers who advocated a doctrine of "art-for-art's-sake", also known as the "aesthetic movement"'.
- ²⁵ And later on the same page: 'Taste is then the faculty of judging *a priori* of the communicability of feelings that are bound up with a given representation (without the mediation of a concept)'. Kant's stipulation that taste involve judgment of 'universally communicable' qualities of feelings is related to his notion of 'Taste as a kind of *sensus communis*', or 'common sense' (1914: 169–170). *Sensus communis* for Kant is not a form of universal, metaphysical beauty (nor 'positive beauty', discussed below), which would contradict the notion of judgment, but rather a presupposition that renders judgments communicable to others. 'The common sense', John Hicks explains, 'must be assumed [in order] to be able to agree about what the feeling is in the first place' (2012: 111). Regarding Kant's stipulation that taste involve judgment 'without the mediation of a concept', Hicks observes: 'Kant [...] asks us to approach artworks formally, on their own terms, and resists interpretations that would instrumentalize their content for the purposes of cultural critique, politics, or philosophy itself' (2012: 110).

²⁶ See, for example, Wittkower's reaction to the Milan conference, discussed in this paper.

²⁷ For my identification of a three-part Wittkower paradigm, see Cohen (2013: 36–51).

²⁸ For classical proportions, see Gwilt (1867: 893–921, which is Book III: Practice of Architecture, Chapter II: Principles of Proportion); and for Gothic proportions, Gwilt (1867: 963–1020, which is Book III: Practice of Architecture, Chapter IV: Medieval Proportion, Section 6).

²⁹ Wittkower's use of the *Kunstwollen* concept in this context appears to have been inspired by Panofsky's 1921 study of human proportions (cited in Cohen 2013: 47).

³⁰ Cf. Le Clerc (1714: 39): 'Par proportion, on n'entend pas ici un rapport de raison à la maniere des Geometres; mais une convenance de parties, fondée sur le bon goût de l'Architecte'. For a similar use of this term in Italian from the sixteenth century, see Van Eck's quotation of Cosimo Bartoli in 'The *Composto Ordinato*' in this special collection.

³¹ For a more detailed discussion of these definitions see Cohen (2013: 21–24).

³² Cf. Perrault (1683: vii): 'car il y a deux sortes de proportions, dont l'une qui est difficile à appercevoir consiste dans le rapport de raison des parties proportionnées, tel qu'est celuy que les grandeurs des parties ont les unes aux autres ou avec le tout, comme d'etre la septième, la quinzieme ou la vingtième partie du tout. L'autre proportion qui s'appelle Symmetrie en françois, et qui consiste dans le rapport que les parties ont ensemble à cause de l'égalité & de la parité de leur nombre, de leur grandeur, de leur situation, & de leur ordre, est une chose fort apparente, & dont on ne manque jamais d'appercevoir les deffauts, ainsi qu'il se voit au dedans du Pantheon, où les bandeaux de la voute ne rapportant pas aux fenestres qui sont au dessous, causent une disproportion, & un manque de symmetrie que chacun peut aisement connoitre'. Cf. Vitruvius (1914: 14): 'Symmetry is a proper agreement between the members of the work itself, and a relation between the different parts and the whole general scheme, in accordance with a certain part selected as standard. Thus in the human body there is a kind of symmetrical harmony between forearm, foot, palm, finger, and other small parts; and so it is with perfect buildings' (*De architectura* 1.2.2).

³³ See the preceding note.

³⁴ As in, for example, a lecture by Howard Burns that I attended at the Harvard University Graduate School of Design in 1989.

³⁵ Herrmann (1973: 138–139) notes that 'if Perrault had not gone further than making a distinction between positive and arbitrary qualities of beauty, there would hardly have been much opposition', for no one at the time questioned the existence of positive beauty. The part of his theory that 'was unheard of, Herrmann continues, was his inclusion of proportions in the category of arbitrary beauty. Note that Perrault's remark:

'beauty has hardly any other foundation than *fantaisie*' appears to have been made in the context of the immediately-preceding words 'in buildings', thus: 'les veritables regles du beau & du parfait dans les Edifices: car la Beauté n'ayant guere d'autre fondement que la fantaisie' (Perrault 1673: Preface, v). Indeed, eleven years later he refers to beauty independent of buildings that has a positive foundation and that 'does not depend on *fantaisie*': 'une beauté qui ait un fondement tellement positif [...] qui plaisent à cause d'une proportion certaine et immuable, qui ne dépend point de la *fantaisie*' (Perrault 1684: 106 note 12). Cf. the quotations of these passages, though with incorrect citations, in Herrmann (1973: 31, 40). So strong was the beauty-in-proportion belief system in Perrault's day that Perrault's radicalism, such as it was, according to Herrmann provides one explanation for Perrault's lack of influence on contemporary architectural theory, apart from the lively debates his ideas engendered. Herrmann (1973: 140) notes: 'Perrault's unorthodox opinions were brushed aside' by his contemporaries, who greeted them with 'incredulity'. He furthermore notes that Perrault's inclusion of proportions in the class of arbitrary beauty was as 'futile' as Edmund Burke's claim, seventy years later, 'that "proportions are not the cause of beauty"' (Herrmann 1973: 139, quoting Burke 1757: 91). Thus according to Herrmann's interpretation, it would seem that no serious challenge to the beauty-in-proportion belief system ever had a chance of making it out of either the 17th or 18th centuries with any significant following.

³⁶ In his *Ordonnance* (1683) Perrault occasionally seems to struggle to reconcile his own distinction between arbitrary and positive beauty in relation to architectural proportional systems, as in his comments regarding ancient Roman proportions: 'ancient usage is not so much pleasing in itself as pleasing because it is linked to other positive, natural, and reasonable beauties that make it pleasing by association, so to speak' (Perrault 1993: 54). Cf. Perrault (1683: xiii): 'les beaux Ouvrages des Anciens [...] dans lesquels aussi cette maniere ne plaist pas tant par elle-mesme que parce qu'elle est jointe à d'autres beautez positives, naturelles & raisonnables, laquelles, s'il faut ainsi dire, la font aimer par compagnie'; and in his comments regarding his own proposed proportional system for the orders that is based on the arithmetical means of comparative measurements of ancient Roman examples: 'even though in architecture there are, strictly speaking, no proportions that are true in themselves, it still remains to be investigated whether it is possible to establish probable mean proportions that are founded on positive reasons but that do not stray too far from those that are accepted and in current use' (Perrault 1993: 54–55), cf. '& que par consequent il n'y a point, à proprement parler, dans l'Architecture de proportions veritables en elles-mesmes; il reste à examiner si l'on en peut établir de probables, & de vray semblables fondées sur des raisons positives, sans s'éloigner

beaucoup des proportions reçues & usitées' (Perrault 1683: xiv). In his footnotes to his translation of Vitruvius published in 1684, Perrault similarly struggles to reconcile these two kinds of beauty, as in his claim that even though most architects of his day believe that the proportions of the orders presented by Vitruvius are 'something natural' ('quelque chose de naturel'), he believes these proportions are established 'by a consent among architects' ('par un consentement des Architectes'), and are preferred not because they possess positive beauty, 'but only because these proportions are found in works that have other kinds of positive and convincing beauty, such as those of material and correctness of execution, and thus these proportions are approved and appreciated even though they contain nothing positive themselves' (Perrault 1684: 105 note 7: 'mais seulement parce que ces proportions se trouvoient en des ouvrages, qui ayant d'ailleurs d'autres beautez positives & convaincantes, telles que sont celles de la matiere & de la justesse de l'exécution, ont fait approuver & aimer la beauté de ces proportions, bien qu'elle n'eust rien de positif'). He makes a similar comment in a later footnote, using the term 'veritable beauté' (Perrault 1684: 80 note 16). Thus Perrault seems reluctant to separate the arbitrary beauty that he associates with architectural proportions completely from positive beauty. Cf. Pérez-Goméz (1993: 33); and Herrmann (1973: 132).

³⁷ See Alberti's comments: 'But judgment[s] with regard to beauty are not determined by opinion, but rather by an innate faculty of the mind. [...] For there is in the forms and figures of buildings certainly a natural excellence or perfection that excites the spirit and is immediately felt' (Alberti 1485: IX.v, opposite fol. y: 'Ut vero de pulchritudine iudices, non opinio, verum animis innata quaedam ratio efficient. [...] Est enim in formis profecto et figuris aedificiorum aliquid excellens perfectumque natur. quod animum excitat evestigioque sentiatur'). This innate or natural beauty is among the factors contributing to Alberti's notion of *conciinnitas*, which according to Van Eck (1998: 286, in reference to *De re aedificatoria* 9.15) Alberti introduces 'as a work of research, selection, and inquiry into the factors that produce beauty, both in nature and in art'.

³⁸ Perrault (1993: 50): 'I call beauties based on convincing reasons those whose presence in works is bound to please everyone, so easily apprehended are their value and quality. They include the richness of materials, the size and magnificence of the building, the precision and cleanness of the execution, and symmetry, which in French signifies the kind of proportion that produces an unmistakable and striking beauty'. Cf. Perrault (1683: vi–vii): 'j'appelle des beautez fondées sur des raisons convaincantes, celles par lesquelles les ouvrages doivent plaire à tout le monde, parce qu'il est aisé d'en connoistre le merite & la valeur, telles que sont la richesse de la matiere, la grandeur & la magnificence de l'Edifice, la justesse & la propreté de l'exécution, & la symmetrie qui signifie en françois

l'espece de Proportion qui produit une beauté evidente & remarquable'. Cf. note 36, above.

³⁹ See also note 25, above.

⁴⁰ On Perrault's interest in, applications of, and contributions to the developing scientific knowledge of his day see Gerbino (2010: 118–147), Herrmann (1973: 70–94, 193–198) and Picon (1988: 29–102).

⁴¹ Although the degree of Perrault's influence would be difficult to ascertain, it is notable that in 1952 Louis Hautecœur, in his 'Préface' in Borissavliévitch (1952: pp. 5–6), described an active, ongoing debate in his own day about architectural proportional systems 'between defenders of objective beauty and defenders of subjective beauty' ('débat entre défenseurs de la Beauté objective et défenseurs de la Beauté subjective'), or terms that correspond to Perrault's positive and arbitrary beauty, respectively. Objective beauty, Hautecœur notes, is 'independent of man himself' ('indépendant de l'homme même') while subjective beauty is 'a creation of man' ('une création de l'homme'). Herrmann (1973: 150) notes that discussions of Perrault's 'dual nature of beauty' actively continued in the 18th century often under different names than Perrault's positive and arbitrary beauty, such as *idées* as opposed to *sentiments*, but always with the aim of saving absolute beauty from being undermined by the growing notion of the relativity of taste. Consistent with both this practice and the terms of the debate Hautecœur reports, Picon (1988: 153) interprets Perrault's distinction between arbitrary and positive beauty on an elemental level, as a difference between an appeal to the senses (arbitrary) and to reason (positive): 'L'ordonnance d'une façade peut en effet parler aux sens ou à la raison selon son raffinement plus ou moins grand et le degré de culture du spectateur qui la contemple'. The recent study of Di Dio, Macaluso and Rizzolatti (2007) indicates that interest in this debate is still active today. See note 10, above.

⁴² Anthony Gerbino, 'Were Early Modern Architects Neoplatonists? The Case of François Blondel', in this special collection.

⁴³ On Blondel's defense, see Gerbino (2010: 148–165 and 173–178); and Herrmann (1973: 131–145).

⁴⁴ 'Ces beaux Edifices anciens & modernes nous peuvent encore servir de regles pour ce sujet, par les belles proportions que leurs parties ont entr'elles & à leur tout, & qui sont, comme nous avons dit, cette agreable harmonie qui donne tant de plaisir aux yeux' (Blondel, *Cours*: V.v.738); and 'Et ces trois grandeurs, sçavoir la largeur du tout, la hauteur sous le toit & la largeur de l'avant-corps sont en continuelle proportion Harmonique suivant ces nombres 6, 4, 3' (Blondel, *Cours*: V.v.739).

⁴⁵ Such as, for example, Perrault's argument (1683: i–v; 1993: 47–49) against any analogy between visual and musical beauty in part because pleasing architectural proportions are more variable than pleasing musical proportions. For Herrmann's assessment that Per-

- rault's *Ordonnance* was 'not generally a success' in achieving what it set out to do, see Herrmann (1973: 130–189); and note 36, above.
- ⁴⁶ In contrast to the serious academic tones of Perrault and Blondel, for example, Robert Morris cannot contain his excitement in the second volume of his *Lectures*, occasionally asking forgiveness as he digresses into 'a kind of poetick Rhapsody', as in his poem that begins (italics are Morris's): 'Proportion! when I name that pleasing Word, // In silent contemplative Raptures lost, // All Nature seems to start, and say, 'Tis here' (Morris 1734–1736, 2: 221, also 184–186, 188–191, 200, 205–207, 209, 210–212, 215–216, 221–223).
- ⁴⁷ See for example the works listed in note 21, above.
- ⁴⁸ A phenomenon manifested in part by the Cambridge Neo-Platonists, and the Neo-Palladian Lord Burlington group with which Robert Morris was associated (see note 46 herein). Monod (2013); Wittkower (1949 and 1952b: 131–132; 1962 and 1971: 150–151).
- ⁴⁹ Cf. Morris's comment (1734–1736, 1: Dedication): 'Wherever Harmony resides, either in Numbers, or Nature, it immediately strikes the imagination, by some Attractive or Sympathizing Property'.
- ⁵⁰ Another common term that often accompanies 'harmony' is 'symmetry'.
- ⁵¹ The almost religious devotion that the golden section has sometimes inspired since the 19th century is evident in *The Society of the Golden Section Newsletter*, published in Chicago from November 1975 to May 1983. The eponymous, now-defunct organization promoted the golden section philosophy and drawings of the Swiss-born, American architect Abel Faigy, a self-described follower of Jay Hambidge, Matila Ghyka and Le Corbusier. According to the society's executive director, Diana Faigy, in the first issue of the newsletter, the society was formed 'to promote specific knowledge of the golden section and encourage employment of its disciplines, so that a new order, harmony and symmetry may pervade the design fabric of man's needs and the total environment become a symphony of harmonic spatial relationships, a Unity achieving ultimate coherence within a mathematical order' (Faigy 1975: 1; for Abel Faigy's biographical information, *ibid.* pp. 1–2). For a similar attitude toward the golden section, see Doczy (1985).
- ⁵² I thank Judi Loach for sharing her insights on these groups with me.
- ⁵³ On these German and other influences, see Jean-Louis Cohen, 'Le Corbusier's Modulor and the Debate on Proportion in France' in the present special collection. Note that the name Modulor combines the contemporary interest in modules with the French name for golden section, *section d'or*.
- ⁵⁴ A similar conference but with a more general focus was held in Paris in 1937. For the proceedings containing 150 abstracts and papers, see *Deuxième congrès international d'esthétique et de science de l'art* (1937). In his review of these proceedings in the *American Journal of Sociology* of 1939, John T. Mueller (1939: 153) notes that while provocative as a series, 'many of the papers do not justify their scientific appellation'.
- ⁵⁵ See note 2, above.
- ⁵⁶ 'Nel 1951 il convegno De Divina Proportione si era proposto come l'ecumenico concilio degli uomini delle arti e delle scienze chiamato a deliberare le regole dello spirito che avrebbero governato le nuove aree della ricostruzione democratica' (Fulvio Irace, 'La difficile proporzione', in Cimoli and Irace 2007: 17)
- ⁵⁷ 'L'interesse che suscitò nel 1951 forse nacque, in un'Europa che cercava ancora di riaversi dalle devastazioni della guerra, dal desiderio di restituire spiritualità alle arti e alla vita attraverso le geometrie di un'architettura pura, priva di ornamenti e costituita da superfici e aperture rettangolari' (James Ackerman, 'Ricordi della Nona Triennale, De divina proporzione', in Cimoli and Irace 2007: 34)
- ⁵⁸ James S. Ackerman and Matthew A. Cohen, 'Proportional Systems in the History of Architecture: A Conversation with James S. Ackerman', in this special collection.
- ⁵⁹ Le Corbusier uses the term 'divina proportione' in this manner in his 1927 essay 'Un livre opportun', published in this special collection as an appendix to Jean-Louis Cohen, 'Le Corbusier's Modulor and the Debate on Proportion in France'.
- ⁶⁰ In 2007 Ackerman noted that, due to his young age and the authoritativeness of the middle-aged men who dominated the conference, he 'felt like a sergeant assisting in a meeting of generals' (Ackerman, 'Ricordi della Nona Triennale', in Cimoli and Irace 2007: 22).
- ⁶¹ Thus Wittkower noted at the end of his conference paper, which addressed historical issues pertaining to the medieval and Renaissance periods: 'This examination of a purely historical character can, I believe, provide a wise lesson for current problems' ('Questa disamina di carattere puramente storico può, credo, impartire una saggia lezione sui problemi attuali') (Wittkower, 'Alcuni aspetti della proporzione nel Medioevo e nel Rinascimento', in Cimoli and Irace 2007: 49).
- ⁶² Wittkower's dismissal, based on the results of this vote, of the beauty-in-proportion belief system as a significant cultural phenomenon of the time is another example of his denial of pluralism in European attitudes toward architectural proportional systems (noted above), for a 60–48 vote against the belief that proportional systems create beauty in architecture indicates that nearly half of the RIBA meeting participants were beauty-in-proportion sympathizers, if not believers. The 1957 RIBA meeting had a notable parallel, though a different outcome, in two meetings of the Académie d'Architecture in January 1672, during which members considered the question of 'whether a positive rule for it [proportion] existed or whether it was arbitrary', and a majority voted to affirm that 'a positive beauty existed in architecture' (Herrmann 1973: 32).
- ⁶³ To this hypothetical objection Baumgarten replies in part 'that the philosopher is a man amongst men and

it is not good for him to think that so great a part of human perception has nothing to do with him’.

- ⁶⁴ By associating the word ‘certainty’ with verifiable outcomes, I distinguish it from Ackerman’s reference to ‘classical certainty’, which implies confident yet unverifiable certainty. Thus, belief-based proportional systems led to ‘classical certainty’ because the adherents of belief-based proportional systems were certain in their convictions, even if those convictions were based on unverifiable and unscientific beliefs. See James S. Ackerman and Matthew A. Cohen, ‘Proportional Systems in the History of Architecture: A Conversation with James S. Ackerman’, in this special collection.
- ⁶⁵ The concept of *ordine* appears to be similar to the concept of *Gerechtigkeit* (‘correct proportions’) that the master mason Matthes Roriczer uses in his discussion of the proportions of a Gothic pinnacle (Shelby 1977: 32–33). For a more detailed discussion of *ordine*, see Cohen (2013: 270–276).
- ⁶⁶ In this definition, ‘numerical’ correspondences are the numerical qualities of integers as revealed, for example, in number progressions, while ‘arithmetical’ correspondences are relationships between numbers that are revealed through simple calculation. In response to the different contexts in which they appear, I have provided here a slightly modified version of my previous definition of proportional system, as ‘a set of geometrical, numerical or arithmetical correspondences between important dimensions throughout a building or major part thereof, conceived prior to the advent of modern structural engineering in the mid-18th century, and intended by the architect to imbue built form with desirable qualities, physical or otherwise’ (Cohen 2013: acknowledgements page and 22).
- ⁶⁷ For additional criteria for distinguishing intentional proportions from coincidental ones, see Cohen (2013: 59–60; 2008: 19–21); and Fernie (1990).
- ⁶⁸ See for example the comment of Emma C. Ackermann (1895: 263): ‘Whenever, in the products of art or manufacture, there is no equal division, (symmetry), the artist or workman unconsciously employs the proportions of the golden section. Irregular inequality and capricious division is disagreeable to both eye and hand; and the proportion[s] of the golden section seem to be the only acceptable ones’.
- ⁶⁹ Since even consistent, deliberate-looking proportional patterns can be coincidental, distinguishing intentional proportions (proportions-as-ratio) from coincidental ones may be considered one of the central challenges of the study of architectural proportional systems. Indeed, coincidental occurrences of highly ordered structures must be expected in architecture, as in geometry and mathematics. This phenomenon is aptly illuminated by Arnheim (1971: 37), who notes, ‘only in a world based exclusively on the chance combination of independent elements is an orderly pattern a most improbable thing to turn up; in a world replete with systems of structural organization, orderliness is a state universally aspired to and often brought about’.
- For a mathematical analysis of this phenomenon, see Fischler (1981: 406–410).
- ⁷⁰ See note 6, above.
- ⁷¹ For an identification of six purposes of belief-based proportional systems, none of which may be considered practical, see Cohen (2013: 25–35).
- ⁷² On the significance of 1742–1743, see note 4, above. Thus, to clarify four of the new terms presented in this introduction, there are two kinds of proportion: proportion-as-ratio (quantitative) and proportion-as-beauty (qualitative); and two kinds of proportional systems: belief-based (metaphysical) and certainty-based (scientific). Belief-based proportional systems can be based on either proportions-as-ratio or proportions-as-beauty, singly or in combination – these are the ‘anything goes’ proportional systems. Certainty-based proportional systems are only based on the verifiability of proportions-as-ratio. Note that Le Corbusier worked with engineers who used various certainty-based proportional systems (such as engineering specifications for concrete and steel construction), in order to ensure the structural stability and code compliance of his buildings, and that those engineers probably ignored his belief-based Modulor.
- ⁷³ On my conclusion that the church prior Matteo Dolfini appears to have designed the San Lorenzo nave arcade bay proportional system but died before he could realize it, and that Brunelleschi inherited it from him, and modified it to varying degrees for use in both the basilicas of San Lorenzo and Santo Spirito, see Cohen (2013: 185–207), which substantially expands upon Cohen (2008: 41–44).
- ⁷⁴ Whether or not Durand himself believed that his grid-based proportional system assisted in establishing structural stability, he advocated the system in the *belief* that the grid was somehow beneficial to architecture, a belief for which there can be no scientific basis. I thus consider it to be a belief-based proportional system.
- ⁷⁵ Cf. Pevsner’s remarks in note 5, above.
- ⁷⁶ ‘su solo albedrio [...] por ciertas líneas ortogonales lo hacen y se osan encomendar a ello’. This comment was made in the context of determining the proportions of a Gothic buttress. On the ineffectiveness of proportion-as-ratio in establishing structural stability, see also Curti, ‘Canons of Proportion’, in this special collection.
- ⁷⁷ Anthony Gerbino, ‘Were Early Modern Architects Neoplatonists? The Case of François Blondel’ and Konrad Ottenheim, ‘Dutch Seventeenth-Century Proportional Design Systems’, both in this special collection.
- ⁷⁸ See Da Vignola’s comment (1562: Prefazione, n.p.): ‘just as every one of our senses delights in this proportion, and the displeasing things fall outside of it, as the music theorists have well and judiciously proven in their science’ (‘quanto ogni nostro senso si compiaccia in questa proporzione, e le cose spiacevoli essere fuori di quella, come ben provano li musici nella loro scienza sensatamente’); and Palladio’s similar com-

ment: 'just as the proportions of voices are harmony to the ears, so those of measurement are harmony to the eyes, which according to their habit delights to a great degree, without it being known why, apart from those who study to know the reasons of things' ('perciocchè, secondo che le proportioni delle voci sono armonia delle orecchie così quelle delle misure sono armonia degli occhi nostri, la quale secondo il suo costume sommamente diletta, senza sapersi il perchè, fuori che da quelli che studiano di sapere le ragioni delle cose', as transcribed in Zorzi 1967: 88; and with slight differences in Palladio 1988: 123). Cf. Palladio's similar comments in Palladio (1570: iv). For additional discussion, see Cohen (2013: 33–35).

⁷⁹ An example of one of these myriad factors is cultural association, as when government buildings from the Fascist period in Italy are considered by some to be unsightly due to their historical associations, their classical proportions-as-ratio proportions notwithstanding.

⁸⁰ Regarding Alberti's belief in causation, see his comment that those 'numbers by means of which the harmony of voices is very pleasing to the ear, are the same numbers that please the eyes and the spirit' ('Hi quidem numeri, per quos fiat ut vocum illa concinnitas auribus gratissima reddatur, hidem ipsi numeri perficiunt, ut oculi animusque voluptate mirifica compleantur') (Alberti 1415: IX.v, yii [verso]). I thank Darin Griechen for suggesting the causation/correlation couplet as a tool for discussing certain qualities of proportional systems.

⁸¹ In the pre-engineering period, the notions of structural stability, beauty and *ordine* all overlapped. Since structural stability constituted such a pressing, pragmatic need that at best could be satisfied only some of the time, primarily through the experience and skill of the builders, availability of high-quality materials, and luck, the then-interrelated notions of structural stability, beauty and *ordine* can in this context be considered to have had pragmatic intentions. Proportional systems did not contribute to structural successes, but most architects and builders probably thought they did. The motivations of architects who have used belief-based proportional systems during the post-engineering period, conversely, may be assumed to have been more mystically oriented, because with the availability of modern structural engineering to ensure structural stability, the motivations for using such proportional systems cannot have been pragmatic.

⁸² My observation of parallel strands of belief that linked groups of thinkers across the centuries, one strand more metaphysical and the other more pragmatic in relation to each other, is consistent with Wittkower's observation (1949 and 1952: 127; 1962 and 1971: 145), for example, that while Briseux, in his *Traité du Beau essentiel dans les arts* of 1752, defends Blondel's principles against Perrault, Briseux nevertheless reveals a 'shift of emphasis from universally valid to psychologically conditioned standards'. According to my interpretation, however, this shift of emphasis

occurred within the metaphysical strand, and this strand continued into later centuries, by contrast with Wittkower's interpretation that Briseux's views represented a dying mode of thinking. Both Blondel and Briseux may be considered to have contributed to the metaphysical strand, each in his own way.

⁸³ See Ackerman's interpretation of the Milan conference as 'the end of the mystical phase' of the study of proportional systems, and the beginning of the 'effort to set it onto reliable, academic, practical grounds' (Cohen and Ackerman, 'Proportional Systems in the History of Architecture: A Conversation with James S. Ackerman', in this special collection).

⁸⁴ I report this observation anecdotally, from my own experience. Cf. note 10, above.

⁸⁵ See Robin Evans's (1995) analysis of the shift in the locus of geometrical innovation from architecture to engineering, where it has remained until very recently.

⁸⁶ Thus in their survey of recent developments in the use of mathematics in architecture, Jane Burry and Mark Burry (2010: 13) note of the projects they present: 'there is a natural division between those in which the primary mathematical constituent is an idea, and those where mathematics is first and foremost positioned as a problem-solver. In some, the two roles are balanced or combined, and in all, the mathematical idea or problem-solver is also instrumental in the design process and to the form of the architectural outcome'.

⁸⁷ Two excellent sources for sampling the great variety of attitudes and approaches to the uses of geometry and mathematics in architecture today are the journals *Architectural Design* (London) and the *Nexus Network Journal* (Turin).

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