Abstract
This article makes extensive use of undated archived sketches and drawings as key primary materials for studying Alvar Aalto's design process. Expanding on previous work focused solely on Vuoksenniska Church, three of Aalto's churches from the 1950s are examined here, namely those in Seinäjoki, Vuoksenniska, and Wolfsburg. Aalto's sketches and drawings are first reviewed and then carefully organized to provide an approximate representation and overview of the design process for each project. A comparison of key sketches in the early stages of the design process for each church shows a noticeable similarity, where the sketches from one project could easily belong to another. While previous writing has already stressed Aalto's tendency to reuse and repeat design elements, Aalto's sketches show not only what, but how specific forms and ideas could be reprised from one project to another, and then subsequently varied and modified. Trapezoidal, fan-shaped, and bentwood forms are subsequently identified as Aalto's basic design elements. The process of reprising and then adjusting and synthesizing these elements establishes a continuity in Aalto's way to design, and also echoes Aalto's ability to establish continuity across different scales.

Keywords: Alvar Aalto; design process; church; drawings; scale

1. Introduction
An architect's design process and architectural ideas are perhaps best understood through their sketches and drawings. Within the substantial body of literature related to the Finnish architect Alvar Aalto, however, the approximately 100,000 sketches and drawings archived in the Alvar Aalto Museum have been used to limited effect. Garland's published series (Schildt and Aalto, 1994) of Aalto's sketches and drawings covered the period from 1917-1939, but many of the architect's important works were designed later, especially in the 1950s. For example, three of Aalto's well-known churches, in Seinäjoki, Vuoksenniska, and Wolfsburg, were all designed in the 1950s. The archived materials for these and other later projects have only recently been catalogued. As a result, previous research on these churches and Aalto's later work has been based primarily on the buildings themselves, with references to other important sources: Aalto's various presentations and written articles (Aalto, 1998), the architect's official three-part biography by close friend Göran Schildt (1984; 1986; 1991), interviews with Aalto's friends, family, and acquaintances (Lahti, 2001); or interviews with former Aalto Studio staff (Charrington and Nava, 2011). The present article offers a new perspective by examining Aalto's design process for the three aforementioned churches based on archived sketches and drawings. In studying Aalto's design process primarily through sketches and drawings, we can better understand and represent Aalto's design approach. At the same time, we can also find new insights and deeper meaning in Aalto's architecture.

Previous studies on Aalto (Kim, 2009; Chiu et al., 2017) in the Journal of Asian Architecture and Building Engineering have addressed the architect's more general humanist aspects. The subject of the present article is Aalto's design process, with the purpose to illustrate not only what, but also how Aalto designed. Aalto's Seinäjoki, Vuoksenniska, and Wolfsburg Church (Fig.1.) are used as illustrative examples, as they have already been widely discussed in general Aalto literature, but usually as distinct projects (Brülls, 1999). By considering three churches, the present article is a natural extension of recent research that focused solely on the design process for Vuoksenniska Church (Ando, 2016). The present article further builds upon previous studies that addressed Aalto's various buildings in Seinäjoki (Charrington, 2008) and in Wolfsburg (Müller, 2008). With an understanding of Aalto's design process for a limited number of projects in the first instance, we can begin to
identify the architect's basic design elements, and the interconnected nature of Aalto's broader design process for architecture, furniture, and interior products.

2. Background

The three churches examined in this study are Lutheran churches, but have different contexts, backgrounds, and origins in their realization. For example, Seinäjoki Church, located in western Finland and officially named Lakeuden Risti (Cross on the Plains), began as a competition entry in 1951 (Suhonen and Cedercreutz, 1952). The Seinäjoki project, however, was actually built much later from 1957-9, including parish hall facilities and a prominent bell tower. Significant time was needed to raise funds and organize donations after the initial competition (Aaltonen, 2005). Vuoksenniska Church or Kolmen Ristin Kirkko (Church of the Three Crosses), on the other hand, was commissioned as a subsequent project after the Aalto Studio developed a masterplan for the region around Imatra in eastern Finland. Vuoksenniska Church, its bell tower and nearby vicarage were designed from 1955-6 and built thereafter from 1956-8. (Aalto, 1959). Vuoksenniska Church was therefore designed after, but constructed and completed before Seinäjoki Church.

In the case of Wolfsburg Church in northwestern Germany, which is officially named Heilig Geist Kirche (Church of the Holy Ghost), Pastor Erich Bammel of Wolfsburg contacted Aalto personally in the summer of 1958 after seeing the recently completed church in Vuoksenniska (Müller, 2008). The design process for Wolfsburg Church spanned from 1958-61, including the church's bell tower and town hall buildings. Construction also started in 1961 and lasted until the official opening in 1962. These three churches examined together provide examples of Aalto's design process and built work throughout the 1950s, including design work for both competitions and commissions. With each church having a different context, background, and scale of design, the projects can be studied individually in a straightforward manner. Yet despite their differences, the churches share a common aspect as they were all realized during times of general urban expansion and growth. The different but interrelated nature of the three projects' origins foreshadows how early ideas in the design process for each project could also be interrelated and connected.

3. Materials and Methods

Upon visiting the Alvar Aalto Museum and archives in 2009, approximately 800 sketches and drawings for Vuoksenniska Church had become recently available for research purposes. The archival cataloguing process for Seinäjoki and Wolfsburg Church was completed slightly later in 2012, with roughly 600 and 370 sketches and drawings for each project, respectively. As Aalto only realized seven churches throughout his career, a preliminary survey was also made of all the sketches and drawings available for Aalto's churches, alongside a broader collection of projects. Based on the apparent quality and sheer number of design sketches and drawings available for Vuoksenniska, Seinäjoki, and Wolfsburg Church, they were selected for more detailed study.

In the case of each project, Aalto's design sketches are considered as actual working illustrations in a design process, instead of as old visual artifacts. The sketches represent an active flow and development of ideas and parallel strands within a design process for a particular building or project. In the case of Wolfsburg Church, Müller (2008) considered Aalto's many undated design sketches too difficult to sort and analyze, and instead focused on Aalto's archived letters with Pastor Bammel. Charrington (2008) also noted the difficulty in working with Aalto's travel sketchbooks in studying projects in Seinäjoki. Although Aalto's undated design sketches require more effort and time to carefully analyze, it is also noted that they can be approximately sorted by considering the design process as a whole (Ando, 2016). Different design sketches can be seen in relation to one another and also in relation to Aalto's dated drawings for a project's intermediate and final design stages. Kim and Blundell Jones (2004) followed a similar approach for their study on the
Fig. 2. The Approximate Timeline of the Design Process for Seinäjoki Church Showing Aalto’s Most Important Sketches and Drawings
Fig. 3. The Approximate Timeline of the Design Process for Vuoksenniska Church Showing Aalto’s Key Sketches and Drawings
Fig. 4. The Approximate Timeline of the Design Process for Wolfsburg Church Showing Aalto's Significant Sketches and Drawings
earlier Villa Mairea, and also made computer-based models for each design stage of the project. Instead of focusing on a single project or place, however, the purpose of this study is to highlight the interrelated aspects in Aalto's design process for different projects. Therefore only a general overview of the design process for each church is discussed herein.

4. Design Process Overview for Three Churches

After a preliminary analysis of the archived materials for the three churches, a basic selection of roughly thirty of the most important sketches and drawings for each project were identified for more detailed study. Figs. 2. to 4. represent overviews of the approximate design processes for Seinäjoki, Vuoksenniska, and Wolfsburg Church. For clarity, in each project the design process has been organized into four terms: the first term involving basic concepts, ideas, and forms, the second and third terms showing important updates and subsequent modifications, and the completed drawings before construction making up the fourth and final term. Before comparing interrelated ideas and sketches in the design processes from the three projects, a general overview with the key themes, motifs, and ideas for each design is discussed to highlight their significance for each project.

The design process for Seinäjoki Church began with simple sketches of a girl. The girl's outline was represented in plan with three basic trapezoidal forms side-by-side. This three-part plan was then adapted to a simpler trapezoidal plan with repeated spaces along the entire church space (Fig. 5.). At the same time as these initial repetitions in plan, the vaulted section and unique side windows of the church were also sketched and repeated (Fig. 5.). With the building oriented roughly along an east-west axis, the trapezoidal plan was then further developed with a general courtyard layout (Fig. 2.). Although not achieved in the final building, the original design intention was to open the back wall to extend the church space into the courtyard for open-air ceremonies (Charrington and Nava, 2011). A trapezoidal plan is well suited to this design intention, as the plan's form can be inherently repeated or extended to larger scales. Apart from a change in the church's facade material, from black granite to white plaster, no other significant changes can be seen in the church's design after the first term of the design process and initial competition.

Like the final design for Seinäjoki Church, Vuoksenniska Church began with an early site drawing involving a simple trapezoidal plan (Fig. 3.). Just like the early sketches for Seinäjoki (Fig. 5.), the trapezoidal plan for Vuoksenniska was also repeated threefold, but later combined with curved, fan-shaped elements (Fig. 6.). Based on several first term sketches (Fig. 3.), providing moveable partitions for dividing the church into three separable religious or social spaces was a key priority for Aalto. The threefold repetition of elements was coherent throughout the church and its design process, from the church space, bell tower, and interior details such as lighting fixtures. Throughout the design process, acoustics were also often checked with quick sketches of sound rays radiating from the pulpit (Fig. 3.). As the church is roughly oriented along a north-south axis, section sketches showed several variations for the southern-facing skylight, with sketches of natural light focused directly on the altar area (Fig. 3.). Although Seinäjoki and Vuoksenniska Church share common trapezoidal plans in their earlier design stages, the latter underwent much more gradual development in the second and third terms of the design process.

Wolfsburg Church in turn followed suit from some of the early sketches for Vuoksenniska Church, and was based on a fan-shape form in plan and section (Fig. 7.). For Wolfsburg Church, Aalto's key concerns...
in plan were the aisle location and baptismal area. Aalto again sketched several variants for the aisle location, including both symmetrical and asymmetrical plans (Fig.7.). Furthermore, just like in Seinäjoki, a courtyard site layout was also planned for outside the church (Fig.4.). Inside, the baptismal area was defined in the vicinity south of the altar (Fig.7.) instead of the customary location near the church entrance. Apart from an articulated skylight over the baptismal area and minor structural changes, the overall design process for Wolfsburg Church mirrored the limited development in Seinäjoki. Pastor Bammel and the church committee members simply accepted Aalto's design relatively early on (Müller, 2008). Major changes to the church were not needed later.

5. Reprise and Continuity
Comparing a selection of Aalto's early sketches from each project in relation to one another (Figs.5.-7.) reveals noticeable similarities. Aalto's early sketches from each project could be easily exchanged for each other, or thought to belong to any of the three separate design processes. In the three projects examined, Aalto's sketches display a consistent tendency to reprise and repurpose similar trapezoid and fan-shaped elements in the early stages of a design process. These elements could be modified, repeated, or adjusted in scale, without constraining or predetermining the end result of the design. Their reprise in the early stages of Aalto's design process establishes continuity across the three distinct projects. These elements represent a common point of departure that could later open up new possibilities in Aalto's way to design.

Section sketches of the rear wall behind the altar in each church suggest another common element in Aalto's design process. Sketches for Vuoksenniska and Wolfsburg Church (Fig.8.) show explicitly how these curved wall surfaces were first sketched as a grained wood structure. Previous discussions also highlight a connection between the design process for Vuoksenniska Church and one of Aalto's bentwood sculptures from the 1950s. For example, Ando (2016) noted how an early fan-shaped plan for Vuoksenniska Church was closely related to a sketch of Aalto's bentwood sculpture from the 1950s. Further, Menin and Samuel (2003) also discussed how the curvature of the rear wall in Vuoksenniska Church was simply an extrapolation of Aalto's bentwood sculpture. The sketches (Fig.8.) and interior detailing of Wolfsburg Church show how the extrapolation could be extended even further, from the scale of furniture and sculpture, to a wall or an entire church, or across different projects. Aalto's design elements therefore were not fixed forms, but malleable and highly adaptable for addressing different design situations.

6. Discussion
The reprise and continuity seen in Aalto's design sketches seems relatively straightforward and simple. The idea of Aalto effectively repeating elements or borrowing and reworking previous ideas has also been a common point of criticism and discussion in previous literature. For example, previous studies (Charrington, 2008) noted that the competition entry for Seinäjoki Church was closely based upon a previous competition design for a church in Lahti, suggesting an expanded scope for future studies. Radford and Oksala (2007) further studied the entire range of Aalto's design output, from glass items to tables, door handles, and buildings, throughout the architect's career. They argued that Aalto's general tendency for the repetition of forms creates a recognizable style, but also achieves an expression of
discontinuity or incompleteness, namely to represent ruin and fragmentation. This latter discussion was based on general observations and without reference to specific instances in the architect's sketches and drawings. The present article uses these primary materials to illustrate Aalto's approach to designing. Rather than following a determined design process fixed on a consistent end expression or goal, Aalto's design process is opened and at the same time grounded in the use of basic design elements. For Aalto, basic design elements like the trapezoidal, bentwood, and fan-shaped form might be akin to cells in organically growing forms. They result in flexible combinations and variations that are never schematic (Aalto, 1998). Aalto's basic design elements are simple forms in themselves, but can be combined, adapted, or synthesized in complex ways through sketching and drawing to solve a broad range of design problems across different scales.

7. Conclusions
This study has made extensive use of Aalto's sketches and drawings to provide a general overview of the design process for three churches from the 1950s. As a somewhat overlooked but important primary source material, Aalto's sketches are complementary to existing Aalto research based on more conventional materials such as archived letters, texts, and interviews. Aalto's sketches and drawings, however, illustrate more clearly how and not just what the architect designed. In the three examples of Seinäjoki, Vuoksenniska, and Wolfsburg Church, a comparison of early design sketches from each project shows significant similarities, despite the final buildings being noticeably distinct. Aalto's sketches show a key process of reprise, with the subsequent modification of basic design elements for different projects and architectural situations. For the three churches examined here, Aalto's design process is characterized by a continuity and reprise of basic design elements, with a careful adaptation, adjustment, and synthesis in realizing a unique and final design.

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References