World Academy of Science, Engineering and Technology
International Journal of Computer and Information Engineering
Vol:13, No:11, 2019

Understanding New Zealand's 19th Century Timber Churches: Techniques in Extracting and Applying Underlying Procedural Rules

Authors : Samuel McLennan, Tane Moleta, Andre Brown, Marc Aurel Schnabel

Abstract : The development of Ecclesiastical buildings within New Zealand has produced some unique design characteristics that take influence from both international styles and local building methods. What this research looks at is how procedural modelling can be used to define such common characteristics and understand how they are shared and developed within different examples of a similar architectural style. This will be achieved through the creation of procedural digital reconstructions of the various timber Gothic Churches built during the 19th century in the city of Wellington, New Zealand. 'Procedural modelling' is a digital modelling technique that has been growing in popularity, particularly within the game and film industry, as well as other fields such as industrial design and architecture. Such a design method entails the creation of a parametric 'ruleset' that can be easily adjusted to produce many variations of geometry, rather than a single geometry as is typically found in traditional CAD software. Key precedents within this area of digital heritage includes work by Haegler, Müller, and Gool, Nicholas Webb and Andre Brown, and most notably Mark Burry. What these precedents all share is how the forms of the reconstructed architecture have been generated using computational rules and an understanding of the architects' geometric reasoning. This is also true within this research as Gothic architecture makes use of only a select range of forms (such as the pointed arch) that can be accurately replicated using the same standard geometric techniques originally used by the architect. The methodology of this research involves firstly establishing a sample group of similar buildings, documenting the existing samples, researching any lost samples to find evidence such as architectural plans, photos, and written descriptions, and then culminating all the findings into a single 3D procedural asset within the software 'Houdini'. The end result will be an adjustable digital model that contains all the architectural components of the sample group, such as the various naves, buttresses, and windows. These components can then be selected and arranged to create visualisations of the sample group. Because timber gothic churches in New Zealand share many details between designs, the created collection of architectural components can also be used to approximate similar designs not included in the sample group, such as designs found beyond the Wellington Region. This creates an initial library of architectural components that can be further expanded on to encapsulate as wide of a sample size as desired. Such a methodology greatly improves upon the efficiency and adjustability of digital modelling compared to current practices found in digital heritage reconstruction. It also gives greater accuracy to speculative design, as a lack of evidence for lost structures can be approximated using components from still existing or better-documented examples. This research will also bring attention to the cultural significance these types of buildings have within the local area, addressing the public's general unawareness of architectural history that is identified in the Wellington based research 'Moving Images in Digital Heritage' by Serdar Aydin et al.

Keywords : digital forensics, digital heritage, gothic architecture, Houdini, procedural modelling
Conference Title : ICDH 2019 : International Conference on Digital Heritage
Conference Location : London, United Kingdom
Conference Dates : November 18-19, 2019