Digital Etching

An Alternative Approach to Drawing

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This paper explores an analog method of intaglio etching via digital/computational means. It qualifies an alternative approach to digital representation through the development of a narrative based architectural expression. The project, entitled Weerkas, was undertaken as an open call for the International Architecture Biennale Rotterdam 2014. The drawings used a combination of 3D computational modelling and AutoCAD drawing to explore emerging drawing technique derived from historical drawing methods. These digital drawings were photo-transfered and etched using a polymer intaglio plate to produce the final set of drawings. While analog/digital connections have been increasingly explored in architecture, it is rarely used to re-create past modes of production. While this paper counters a nostalgic approach to representation, it is anecdotal evidence of a pluralistic method in combining three-dimensional and two-dimensional drawing technique as an emerging form of architectural expression.

**Keywords:** Architectural Representation, Etching, Narrative Drawing

**PROJECT NARRATIVE**

The Weerkas project was completed for an open call to the 6th International Architecture Biennale Rotterdam 2014 (IABR 2014). The twelve etchings were developed over a six months by the author and a project assistant. The theme of the biennale "Urban by Nature" was used as the primary narrative for the project. Each composition is a vignette of a speculative architectural structure, acknowledging a specific weather condition located in a physical, recognizable place in the Dutch landscape. Furthermore, the twelve drawing represents one month in one of the twelve provinces. Therefore, the project is located throughout the country and the seasons, deviating from the conventional Dutch focus on the urbanity of the Randstad (the dense urban corridor from Amsterdam to Rotterdam) spreading the project across a variety of physical conditions.

The narrative of the project is a commentary on changing weather patterns and its latent affects on the socio-cultural milieu of the Netherlands. The project tile - Weerkas - loosely translates to 'Weatherhouse'. This is not a house in a domestic sense (huis), the interiority of which is also a common Dutch theme, but a translation of a greenhouse (kas), a place where weather and interior climate is tightly
controlled. The underlying narrative noted that while the Netherlands is overly accomplished at exerting control and management of its land, water and the internal climate of their intensive agricultural economy. Over the course of the coming decades the external weather will be increasingly more variable and difficult to both predict and control. Therefore, the small interventions act as a didactic 'follies', narrating the increasing disparity between historic, normative climate cycles and emerging weather conditions. Given the homogenous geography of the Dutch landscape, these weather anomalies will have a dramatic affect on Holland's economic and cultural future. The expression of each architectural intervention oscillates between structured research and formally expressing these issues through irony, humour and subversion. Therefore, it is critical to note that the follies do not attempt to resolve the issues relating to changing weather patterns. They act as mechanisms by which these changes can be recognized - they are a climatic datum.

The etching technique referenced historic landscape etchings produced in Holland's Golden Age of art in the 17th Century, tying the contemporary narrative of climate change to historic expressions of the Dutch landscape. The function and didactic validity of each structure is underscored through textual research of academic journal articles in particular the archives and data of the KNMI (Koninklijk Nederlands Meteorologisch Instituut - Royal Netherlands Meteorological Institute). Three examples from the set of twelve drawings include changes in water level either due to increased spring run-off or summer drought and its affects on shipping in Rotterdam (Waterkas - Waterhouse) (figure 1), changing precipitation patterns in Haarlem (Regenkas - Rain house) or decreased cloudiness in the province of Friesland (Wolkenkas - Cloud house). As aforementioned, the follies do not attempt to solve the problem per se as these issues are very large, complex and global. The follies merely express the disparity of historic climate to current conditions and attempt to establish a relationship of architecture, landscape and public to acknowledge this incremental, but pervasive, change.

**DRAWING DEVELOPMENT**

The research sought to explore both the notion of 'conventional' drawing in AutoCAD and how one would develop an intaglio etching technique through digital modes of design.

At the beginning of the project it was imperative to develop a viable mode of drawing in AutoCAD. Therefore, traditional etchings were researched to understand general landscape composition, conventional line work, hatching technique and line weighting. A number of techniques were explored including Wacom tablets, and various AutoCAD commands. In the end the author concluded that working using the mouse and polyline tool offered the highest speed, accuracy and drawing intention. Ultimately, this was a personal preference.
To summarize the general process, the development of each drawings occurred over a three-week period. A number of drawings were developed concurrently to ensure completion of the project and similitude within the drawing set. The first phase of each drawing was the locational and weather research to develop an underlying narrative for the structure. After a suitable location was found a background image would be collaged together to ensure a recognizable location for the folly thereby grounding the project in a physical place. This background was attached in an AutoCAD file and the drawing process would begin (figure 2). The drawings were developed using the polyline tool both tracing and drawing a background to form a cohesive composition. Due to the scale and complexity of the drawings it was necessary to gauge the density of lines to ensure one drawings was tonally comparable to its

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Figure 2
The general drawing development of the Regenkas, Haarlem
neighbouring drawing. It was critical that each drawing had comparable line density to create a composition both within the page, and within the set of twelve drawings. Once the base layout of the background was established the three-dimensional modelling of the folly would commence. The design of each folly used a number of modelling software. Projects were developed in Rhino, Rhino Grasshopper and 3D Studio Max. After the structure was digitally modelled the file was imported into Rhino in order to use the contour and Make2D function. These resultant line drawings could then be exported as a dwg file and integrated into the AutoCAD background image. After the placement of the ‘flattened’ structure within the AutoCAD background the drawing was completed, with a series of iterative prints made to determine areas that needed additional work to complete both the drawings and the set. After a drawing was finished the dwg file was exported to Adobe Illustrator to check the line weights. This step occurred later in the project when the Illustrator files were sent to the plate maker for printing.

Specific areas of the process that required consideration were the correct alignment of the perspectival angle of the three-dimensional model with the surrounding background drawing. Alignment of the perspective angle of the structure to the background was achieved in one of two ways. One method was to import the original background image into the Rhino file and align the angles in the perspective view however this was cumbersome. While it did achieve satisfactory results it was not exact. A second method was to include a small cube in the Make 2D drawing from which perspective lines could be extracted to determine the horizon line and this could be aligned to the horizon of the background image. While this method was exact in the placement of objects vertically, it did on occasion shift things horizontally and at times required adjustment. This was time-consuming given the nature of the Make-2D function and the complexity of a number of the Rhino models.

Solar consistency was achieved through the drawing and aligning the folly to existing shadows within the original background image. After determining the correct sun position the model was rendered in grey-scale to determine the shaded planes/parts of the folly and the shadows cast on the surrounding landscape. This render was exported as a jpeg and imported into Adobe Photoshop. This file was broken into a series of layers using the range tool. This would determine the darkness of the shadow and therefore the number of hatching layers required to achieve a comparable tonality. By this method it was easy to determine if a part of the folly needed one hatching layer (light) or multiple hatching layers (dark).

What is relevant is the relative ease with which three-dimensional modelling was integrated with two-dimensional drawing. The process of digitally modelling the architectural follies whilst simultaneously drawing the background line drawing is an interesting mode of drawing development. This is not image making in the sense of rendering, but an understanding of the dimensional connection between modelling in perspective view and drawing in a perspective view and aligning these two modes in a fixed drawing. What is important to note however is how these two modes of working are still very much separate. The shadows in one mode of working have no bearing on the other; modelling in Rhino has no implication on drawing in AutoCAD. These conditions need to be judiciously resolved if not by hand, then by eye.

PRINTING DEVELOPMENT

Originally it was intended that the author print the work using conventional plate making techniques. A series of plates were purchased in cold and hot rolled steel, aluminium and brass for testing. Additionally a series of transfer methods were employed to determine the most efficient and reliable method of transfer. While it was possible to purchase photo-transfer plates for circuit boards the size of the final drawings (360 x 510mm) made this method financially unviable, as the plates were too large. Other preliminary methods included using silkscreen emulsion, which
was partially successful on aluminium but the emulsion did not sufficiently adhere to the surface to produce a reliable transfer. Another method using steel worked in covering the plate with resist and using the laser cutter to score the drawing through the resist and into the steel. The acid was then used to deepen the cut to improve the line weight when printing. After these initial tests it was determined that the complexity of the printing would require professional assistance. The final set of intaglio plates were produced by Mark Herschede of Haven Press Studio. In early correspondence Mark suggested a polymer plate to render the drawings. Polymer plate maintained the high level of detail required for the project with low toxicity. Photo-responsive polymer hardens when exposed to a specific bandwidth of light. The plate was exposed to a photo-positive to make the intaglio matrix. The remaining unexposed, plate was washed away leaving the recessed intaglio surface. The plate used in printing the etchings was .73mm thick. The image was RIP transferred to a 2400 dpi imagesetter film and exposed to the polymer plate. The final images were printed on dampened Arches Cover 250 gsm paper using Portland black ink on a Takach Etching Press (E-mail. Message to: Herschede, M. 5th June 2014).

PROJECT SIGNIFICANCE - ALTERNATIVE DRAWING

The project makes a series of contributions to digital drawing both in process and the resultant mode of production. Additionally, the etchings are unique in connecting emerging drawing technique to past modes of architectural expression. This historic link was used to establish a coherent narrative, connecting place and theme to a deeper cultural context.

The drawing process is critical to the project. Drawing is a speculative act, it contains concurrent to its execution an act of representation but also, as Errol Barren notes in his essay 'Drawing in the Digital Age' research and analysis (Trieb, 2008). The research imbedded into the work is therefore a layering of different speculations. Firstly, the research regarding the project narrative, what each folly is and how it works. This work is derived from the textual research from the KNMI research papers. Secondly is the research of how each structure is formally articulated and how it embeds into the landscape, and lastly and most importantly, the research developed a larger 'meta' question - how to complete the drawings in the first place. Questions that arose early in the project process included how does one etch using Rhino and AutoCAD? Do these drawings look like historic copies or do they come into their own as something else? And lastly, what is the implication of digital etching, is it merely a broadening of an ever-expanding palette of representational techniques or does it lead to other computational questions?

The speculative technique of iterative three-dimensional modelling, drawing in AutoCAD, and connecting to intaglio etching is novel. This mode of production required a rethinking of the conventional approach to both modelling and drafting software. One anecdote of how one etches using AutoCAD and Rhino is rethinking how to achieve a suitable depth in the composition of the drawing through line weight. In etching it is possible to achieve changing line thickness by adding pressure when drawing with the stylus. This is not possible to achieve in conventional AutoCAD drawing. Therefore, it was determined, early in the process, for all lines to have the same line thickness. Density and depth were henceforth achieved through the close adjacency and/or overlapping of line, not from pressure. This caused issues when using the Make 2-D function in Rhino to ‘hatch’ the three-dimensional models. A sufficient contour distance was determined to develop the necessary darkness, to express the desired depth. These lines were often times augmented to achieve the necessary results. An additionally issue was that the contour function could be visually problematic when placed in perspective view. Contouring vertically typically was correct but contouring from right/left or front/back could have odd perspectival implications - either lines would double up or disappear making a tartan pattern rather then a consis-
tent hatch. Therefore a large number of hatch lines were amended after contouring was completed to integrate the image into the background and better express the perspectival angle in the architectural intervention. Another differentiation between traditional etching and AutoCAD drawing was the fluidity of the line. Initial difficulties arose when drawing in splines in that they were not particularly accurate, difficult to offset and not as stable when the drawing was converted to an Adobe Illustrator file. While these problems could have been mitigated to offer surety only Polylines were used in the drawings. The resultant process developed a fundamentally different line type from the hand. In using the polyline tool, a line perceived as curved from a distance was actually segmented into a series of straight lines on closer inspection. Therefore, these segments scale the drawing, as one inspects the minutiae of the work, a tree leave as oppose to its trunk, they discover smaller and smaller segments of straight lines composing the curves (figure 3). What is extrapolated from these anecdotal conditions is that they undermine the criticism lodged at the digital as a drawing tool. While one could continue to discuss the possible disconnect of the hand to eye connection, what is critical to note is that when the intention is to draw, any mode of production is legitimate, they simply offer different representational outcomes.

The significance of the narrative aspect of the project is more difficult and subjective to adjudicate. It is therefore necessary to underscore a series of tentative assumptions. CJ Lim states that the, "modern age has been unkind to narrative architecture" (Lim & Liu, 2011) this is true for contemporary digital modes of expression as well. In relation to the use of narrative in contemporary architectural speculation, these comments are not a critique of the digital per se but the overarching preference of computation to fabrication and production; the precision of making superseding the craft of a 'story'. Additionally it stems that narrative often pulls from history. Something the current pace of the digital is steadily
outrunning. In respect to the Weerkas, the drawings had to express a response to the issues in the landscape. Embedding them in a specific time and space. This is very different from the clarity of the diagram. Each intervention is a continual layering of simultaneous histories from past modes of art, evolving cultural practice, emerging formal expressions and current digital practices. This approach towards narrative allows for multiple engagements, the drawings offer varied topical entry points that connect a series of related dialogues. These topics include but are not limited to: weather with cultural practice, historic climate in relation to current weather, public engagement through architecture, didactic architecture and a questioning of both urban practice and nature - particularly in the Netherlands. Narrative drawings offer a nuanced oscillation between concurrent issues; a drawing set allows issues to ebb and flow, reinforcing certain points in one drawing, and others in adjacent drawings. While this is at once the success of the project, it is also its main criticism. Drawings are experientially layered but not always exceedingly clear. This became apparent in the biennale opening where the short annotation beside each drawing was critical for its understanding. However, this should not negate its validity. Narrative offers an opportunity for digital practice to express the complexity of its condition; to allow the process percolate through the drawings. In this sense, all work contains a narrative, however a common critique in relation to digital work, is that the work rarely reveals its prowess. Furthermore, in moving forward with digital discourse, narrative is not a total divergence of a growing facet of current computational thinking. It is merely a re-definition of what research intends to express. If 'responsiveness' in all its guises is resultantly didactic, it too will form a narrative. How this narrative connects to cultural context will in part determine how successful it embeds into the evolving milieu.

CONCLUSION
Drawing remains a critical discourse in architecture. However, digital projects are typically focused on three-dimensional modelling in relation to emerging construction techniques. It is rarely used as a means to explore new modes of two-dimensional drawing techniques. This is important because it can clarify the current misunderstanding between renderings as image making as oppose to drawing. While both processes deliver a visual expression, the two modes are fundamentally different. Additionally, when digital software is used for two-dimensional drawings it is focused on technical working drawings or the diagram as oppose to a place of exploration. This prevents the narrative aspects of architecture from entering into the design development process. Working in the digital offers us the opportunity to ask meta-questions on all facets of architectural conventions. Using digital programs we are able to question the very essence of a line. Tim Ingold (2007) discusses how lines can be differentiated into multiple categories, the most relevant to architecture being defined as either a thread or a trace. Conventionally architecture has drawn traces on the page, the surface being inscribed by a drawing utensil. Changes occurring through erasure as oppose to deletion. But in the digital we work with threads, like a fishing line cast into a pond. These lines are not necessarily outlines; on occasion they are merely guides, giving only the slight definition to generate form. Therefore, unlike the trace, which only has a front, the digital line has a back, top/bottom and left/right. It is not a line on a surface but a line in space. We can move through these lines, connect them with surfaces, or extrude to define form. It is a place of inhabitation that we can walk through, view and experience. Whether we pin this down on paper, either through printing or press, or animate it into continuous movement our opportunities to explore drawing have exponentially increased. The digital is not the end of drawing, but a rewriting of the conventions that have traditionally defined drawing. Therefore, this is an acknowledgement of a plurality of expression, not one of replacement but one of in-addition-to. As Mario Carpo (2014) relates, as we become more attune to a specific set of digital skills these skills lead to a particular
way of digital making. This project expresses an alternative approach. The digital remains one of the great architectural platforms for free expression, as it becomes normative in architectural pedagogy and profession, collectively we should strive for plurality to ensure we build our digital modes of production on the widest possible foundation. The plurality is not only found in the iterative process of complex computation but also in the historic modes, which have since fallen by the wayside. Again, this is not a historicist approach for histories sake, but an acknowledgement that when conducive to the overarching framework of the project, historic modes of representation can engage a deeper cultural context. Furthermore, what is significant is that it undermines the conventional critique lodged to drawings produced ‘on the computer’. If we consider Elizabeth Grosz (2001) position that the computer is yet another virtuality, similar to writing or drawing we note that as the computer becomes more nuanced we are able to inscribe greater intention in the process of the work. In rectifying this position our ability to produce work becomes even more varied and individualized, countering the concern raised by Carpo’s observation. The ability of software to reconcile varying dimensions in drawing, oscillating between drawing and modelling is a benefit that validates its purpose. What is interesting in the Weerkas project undermining the conventional use of both drafting and modelling programs is the opportunity to reflect-process through amendment not autonomous iteration. The digital offers many opportunities to pursue greater efficiency. Its improved connection of design to fabrication is established practice and pedagogy. However, the digital also offers a point of reflection, an exploration of alternative modes of architectural production that travel a slower, bumpier road. Digital modes of production will invariably overshadow and surpass many analog modes of making, redefining craft and its procurement, but it should not be nihilistic. As we find new modes to establish our evolving cultural milieu, periodically checking back might prevent the cultural alienation alluded to in previous pe-

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