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**Javier-Alfonso Bono-Cremades**
Architect and part-time lecturer at the Universitat Politècnica de València in the Graphic Expression Department, and researcher at the Valencian Research Institute for Artificial Intelligence. His work combines teaching, research, and professional practice, with a focus on parametric design, digital modelling, prototyping, and digital technologies applied to architecture and urbanism

**Daniel Martín-Fuentes**
Phd. Architect and Professor at the Universitat Politècnica de València in the Graphic Expression Department. He has carried out research stays at CRENAU (Nantes) and at the Università Luigi Vanvitelli (Naples) with a grant from the Italian ministry. He develops his work using mixed reality as a tool for communication and for research in spatial perception and design strategies.

**Pedro M. Cabezos-Bernal**
Phd. Architect and Professor at the Universitat Politècnica de València in the Graphic Expression Department. His research line is focused on new representation tecniques such as 3D modelling, virtual reality, immersive photography, photogrammetry SfM (Structure from Motion) and ultrahigh resolution photography.

**Javier Molinero-Domingo**
Architect, designer and educator. His work combines architecture, design, public engagement and knowledge dissemination, with a focus on collaborative processes, participation, digital and physical prototyping, and the relationship between people, space and landscape. Cofounder of Mixuro and Badallar Estudi, he develops projects across architecture, urbanism, design and cultural production.

# Graphical practices for fabrication-driven temporary structures: The Burning Man Temple 2025 as an integrated design-to-construction case study

Ephemeral architecture developed under extreme environmental and logistical conditions requires design methodologies capable of integrating spatial, structural, and constructional constraints within a unified and adaptable framework. This paper investigates the role of parametric geometric modelling as an operative infrastructure for the design and construction of ephemeral architecture, focusing on its capacity to mediate between design intent, technical resolution, and on-site assembly processes.
The study presents a parametric workflow developed in Rhinoceros and Grasshopper and applied to the design and construction of an ephemeral architectural installation for the Burning Man Festival. The proposed method integrates geometric consistency, material constraints, fabrication logic, and assembly sequencing within a single generative model, enabling continuous feedback between design decisions and construction requirements.
Through the analysis of the design process and the resulting built artifact, the paper demonstrates how parametric modelling can function not merely as a form-generation tool, but as a cognitive and operative structure that supports decision-making, coordination, and adaptability in contexts characterized by uncertainty and temporality. The results highlight the suitability of parametric geometric models for managing complexity in ephemeral architecture, particularly when conventional BIM-based workflows prove insufficient.

Keywords:
Parametric design; ephemeral architecture; design-to-construction workflow; complex geometry; geometric modelling


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## INTRODUCTION AND STATE OF THE ART

I Contemporary graphical sciences are increasingly defined by a displacement of drawing from representation toward operative modelling. In architectural practice, drawing no longer functions only as a medium for describing an already defined object, but also as a system for generating geometry, encoding construction constraints, coordinating fabrication data and controlling assembly processes. This transformation is particularly relevant in non-standard architecture, where geometric complexity, short construction times and the absence of conventional typological elements require graphic procedures capable of linking design, analysis, fabrication and construction within the same workflow.

The problem is not limited to the use of digital tools. It concerns the disciplinary status of graphical practices when the drawing becomes a procedural infrastructure. In such contexts, the model is not only a visual artefact or a documentation device. It becomes a technical environment in which form, structure, material dimensions, joints, fabrication constraints and assembly sequences are progressively defined. This condition expands the traditional role of architectural representation and requires a methodological reading of digital modelling as part of the construction process itself.

Parametric and computational design provide a specific framework for this transformation. Their relevance lies in the possibility of defining relationships between geometric elements rather than modelling isolated objects. Caetano, Santos, and Leitão (2020) distinguish parametric, generative and algorithmic design as different but related modes of computational design, all of which depend on the explicit formulation of rules, dependencies and procedures. In architectural production, this allows changes to propagate through a model and enables design information to be updated through controlled relationships rather than through manual redrawing. In the case of complex temporary structures, this capacity is critical because the model must absorb continuous adjustments while preserving geometric coherence.

Wortmann and Tunçer (2017) identify digital workflows in contemporary architecture and construction as differentiated processes in which parametric design cannot be reduced to formal variation. Their analysis is relevant here because it frames parametric modelling as a workflow condition, not only as a geometric technique. The value of such workflows depends on how digital models organize information across design phases and how they support decisions related to performance, fabrication and construction. In this sense, graphical practices based on parametric modelling extend the scope of drawing toward coordination and operational control.

The relationship between computation and architectural geometry has also been developed through performance-driven approaches. Turrin, von Buelow, and Stouffs (2011) show how parametric modelling and genetic algorithms can support the exploration of performance-driven geometry in architectural design. Evins (2013) reviews computational optimization methods applied to sustainable building design, confirming the increasing role of algorithmic procedures in design decision-making. Although the present article does not focus on optimization, these studies establish a relevant background: computational models can integrate geometric definition with evaluative processes, allowing design decisions to be tested within the modelling environment.

This integration has become visible in environmental design. Giaveno, Osello, Garufi, and Razo (2021) examine the relationship between computational design and environmental product declarations in the evaluation of embodied carbon and embodied energy scenarios. Kamel, Pittau, Dal Verme, Scatigna, and Iannaccone (2024) propose a parametric integrated design approach for life-cycle zero-carbon buildings. Wai, Tariq, Chau, Muttil, and Jamei (2024) analyse the impact of parametric design on outdoor thermal comfort and urban overheating through simulation-based methods. These contributions show that parametric workflows can operate as analytical environments, linking geometry with environmental assessment. For an open structure placed in desert conditions, this capacity is relevant because the model must support not only construction decisions, but also the evaluation of exposure and outdoor thermal comfort.

The relationship between computational modelling and BIM defines another necessary framework. BIM is widely associated with design coordination, conflict analysis and construction simulation. Sampaio, Gomes, and Gomes (2024) describe BIM design coordination as a process that enables conflict analysis and construction simulation. Seghier et al. (2025) review the transition from BIM to computational BIM, emphasizing the increasing use of visual programming in building research. Semjén and Szép (2025) identify the integration of generative and parametric design with BIM as a field marked by persistent challenges and research gaps. These studies are relevant because they show both the strength and the limits of BIM-based coordination when confronted with computational or non-standard design processes.

The case examined in this article is situated precisely within that tension. Conventional BIM workflows are effective when the architectural object can be organized through standardized categories, typological elements and long-term asset information. However, their usefulness becomes more limited when the project consists of a one-off, geometrically specific, fabrication-driven structure whose components do not correspond easily to conventional categories such as walls, slabs, roofs or standard structural families. In such cases, the requirement is not the management of a durable building asset, but the precise coordination of non-standard components, compound joints, fabrication templates, transportable panels and an assembly sequence under constrained conditions.

The article therefore examines a CAD–parametric workflow based on Rhinoceros 3D and Grasshopper 3D as the primary coordination framework for a temporary structure. The objective is not to oppose CAD–parametric modelling and BIM as general categories, but to analyse the conditions under


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which a Rhino–Grasshopper workflow can assume functions commonly associated with BIM: geometric coordination, constructive scripting, clash anticipation, fabrication output and construction sequencing. The issue is methodological. It concerns the capacity of graphical practices to operate as an integrated design-to-construction system when the project exceeds conventional modelling taxonomies.

The selected case study is the Burning Man Temple 2025, Temple of the Deep designed by Miguel Arraiz (lead artist), Javier Molinero and Javier Bono (architects) (Fig.1). Burning Man is an annual event held in the Black Rock Desert, Nevada, where a temporary city is built and dismantled each year. Within this context, the Temple is a central architectural and symbolic structure. It is rebuilt annually as a non-denominational space associated with remembrance, grief and contemplation, and is burned at the end of the event. Bateman (2015) analyses the Burning Man Temples as symbolic devices related to bereavement and ritualized memory. This cultural condition is relevant for the present study because the Temple cannot be understood only as a technical object. It is simultaneously a temporary architectural structure, a collective construction process and a symbolic artefact.

The construction conditions intensify the methodological problem. The Temple is prefabricated by volunteers, transported as separate elements and assembled on site in the desert within a limited time. Its construction requires high geometric precision because there is no possibility of relying on extensive full-scale prototyping before assembly. Errors in fabrication, setting-out or coordination would be difficult to correct on site. The distance from workshop infrastructure and the environmental conditions of the desert make construction reliability a central requirement. For this reason, the digital model must operate as a precise source of construction information rather than as a generic representation of the design.

The contribution of this article is the analysis of a workflow in which graphical modelling becomes the main infrastructure for fabrication-driven temporary architecture. The study focuses on how the Temple was modelled through dependent representational layers: initial planar geometry, modular block hierarchy, panel segmentation, structural detailing, compound joint modelling, façade automation, vortex scripting, clash checking and construction sequencing. Each layer adds information without detaching the model from the geometric system that generated it. This produces a continuous workflow in which drawings, fabrication templates, environmental simulations, structural models and assembly records derive from the same digital environment.

The relevance for graphical sciences lies in the disciplinary implications of this process. The case shows that drawing can no longer be understood only as a means of visual communication or geometric description. In fabrication-driven contexts, graphical practice becomes a method for encoding constructive knowledge, coordinating collective work and translating complex geometry into executable information. This does not eliminate the representational dimension of drawing. Rather, it extends it toward procedural, analytical and constructive functions. The future of graphical sciences therefore depends not only on new images or visual languages, but on the capacity of graphic systems to structure the relation between

Figure 1. Burning Man Temple 2025. Photograph by Milena Villalba


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design intent, material execution and collective construction.
In this context, the article aims to investigate the role of parametric geometric modelling as an operative and representational infrastructure for the design and construction of ephemeral architecture. Rather than addressing parametric tools as mere form-generation instruments, the paper focuses on their capacity to structure design thinking, integrate constructional constraints, and support decision-making processes in conditions of temporality, uncertainty, and limited resources. To this end, a parametric workflow developed in Rhinoceros and Grasshopper is presented and discussed through its application to the design and construction of an ephemeral architectural installation for the Burning Man Festival. The study seeks to demonstrate how such models can function as cognitive and operative systems within contemporary practices of architectural representation and production.

## METHODOLOGY

he methodological process was based on a single digital environment combining Rhinoceros 3D for geometric modelling and Grasshopper 3D for applied visual programming. The objective was not to produce a representational model after the design had been defined, but to construct an operative model from which construction drawings, assembly drawings, dimensional information and fabrication templates could be directly extracted. The workflow therefore developed from an initial geometric definition toward a progressively detailed design-to-construction model.
The first stage consisted of a basic geometric model made with planar surfaces. This model allowed rapid adjustments to the general form and enabled control over the main volumetric and spatial parameters of the Temple, including passage widths, interior proportions and the relationship between the central space and the surrounding elements. At this stage, the model was deliberately simple. Its function was to define the spatial

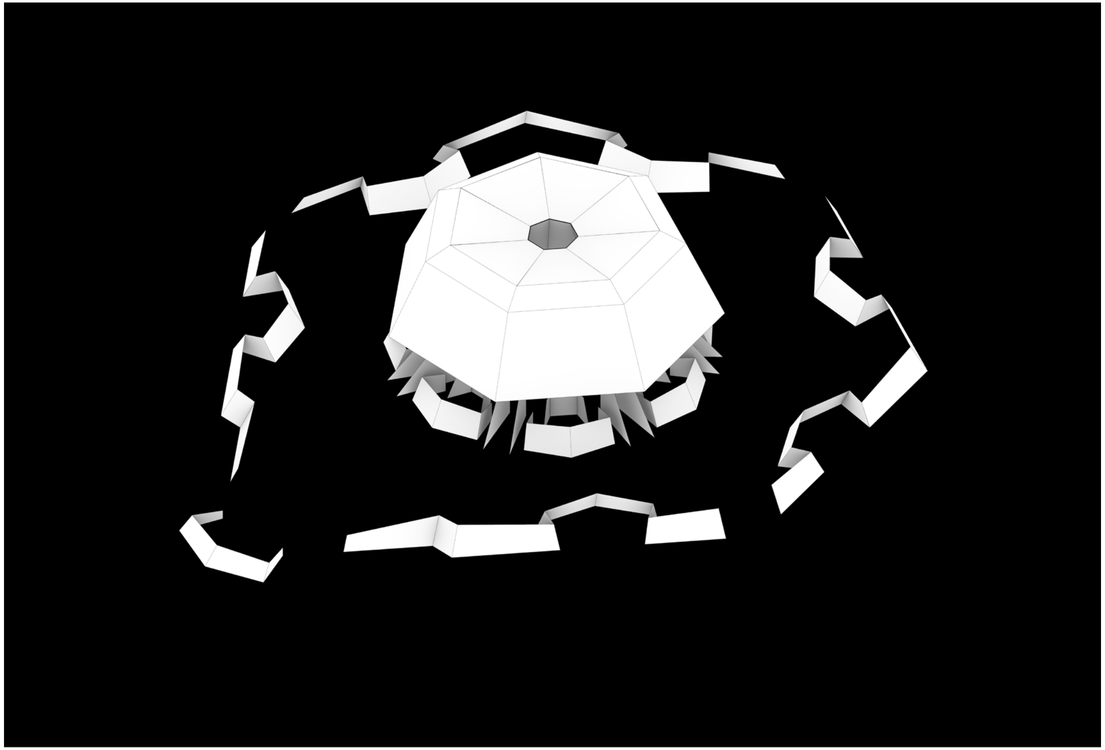

Figure 2. Initial geometric model of the Temple, showing the polygonal toroid and the surrounding vertical planar elements.

logic of the project before introducing structural thickness, material dimensions or assembly details.
The main volume was defined as a polygonal toroid organized through a seven-part radial system (Fig. 2). Once this repetition was identified, the model was structured through a block hierarchy. The first level consisted of seven blocks, one for each radial segment. Within each segment, a second level of blocks was created, corresponding to the six different polygonal faces that compose each portion of the toroid. This hierarchy allowed repeated elements to be modified consistently while preserving the possibility of working on specific faces when local adjustments were required. The same principle was applied to the fourteen columns, which derive from the same planar face and are organized through paired symmetries.
A similar procedure was used for the vertical elements supported on the ground. These elements followed the same logic of planar modelling and block-based organization, although their geometric and constructive complexity was lower than that of the central toroid. They were therefore treated as secondary components within the general spatial system. After the main panels had been geometrically defined, each one was subdivided into transportable sections (Fig. 3). This subdivi-


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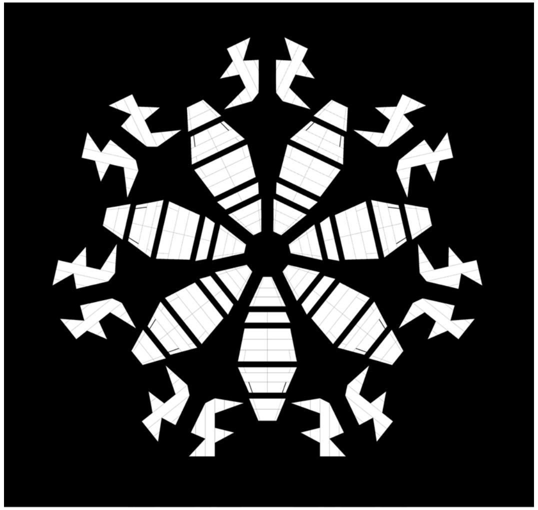

Figure 3. Top view of the subdivided model with unfolded panels, showing the seven-part radial organization and the subdivision of the main volume into repeated sectors.

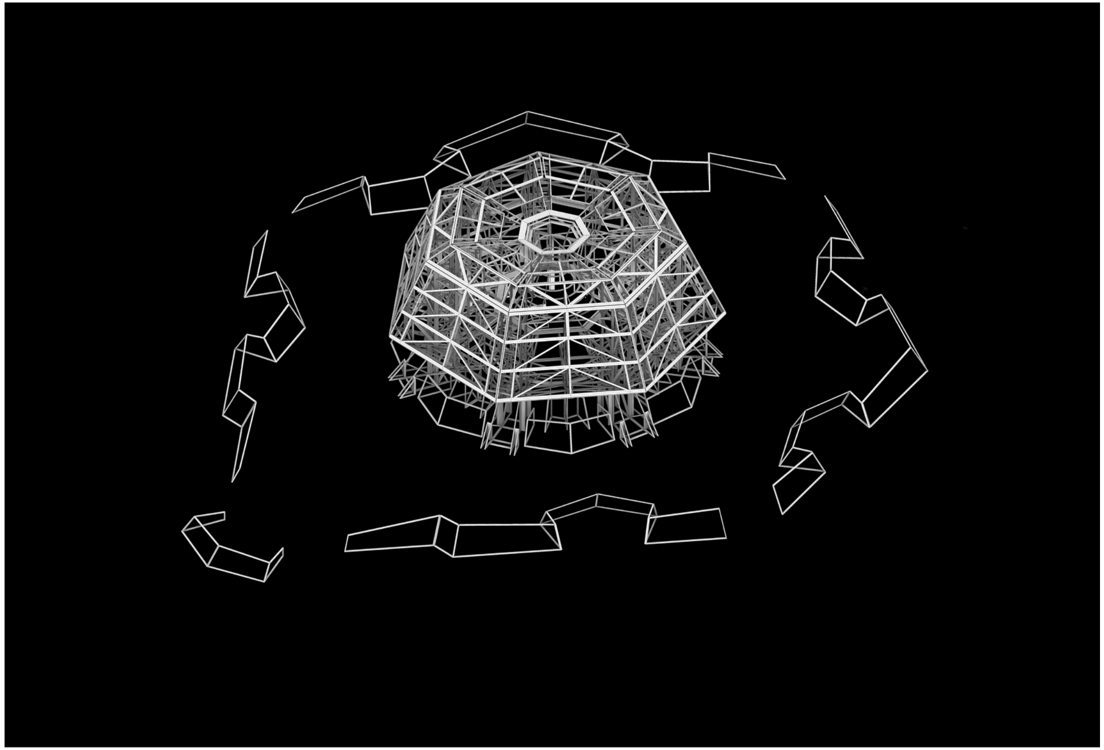

Figure 4. Structural development of the polygonal toroid and surrounding elements after panel segmentation.

sion responded to two external constraints. First, the maximum dimensions of the sections had to be compatible with truck transport, using 8.5 ft × 48 ft as the reference limit. Second, the weight of each section had to allow manual handling by a reduced group of volunteers during prefabrication and on-site assembly. This introduced a decisive shift in the modelling process: the panels were no longer defined only by the architectural form, but also by the logistical and manual conditions of fabrication, transport and construction.

Once the segmentation of the panels had been established (Fig. 4), the structural model was developed in detail. The structure was mainly composed of nominal 4 × 4 in and 4 × 6 in timber profiles, except for the compression rings, which required specific modelling. The model used the real dimensions of the timber sections rather than their nominal dimensions: 3.5 × 3.5 in for the 4 × 4 in profiles and 3.5 × 5.5 in for the 4 × 6 in profiles. This distinction was essential because the digital model was intended to operate as the source for construction drawings, assembly drawings and the measurement of individual elements. Other physical variables, such as dimensional reduction caused by drying, deformation, bending or buckling under load, were not incorporated into the modelling phase. Their effect was considered less decisive than the discrepancy between nominal and real timber dimensions.

The use of blocks was central to this phase. It accelerated the modelling process, reduced redundant manual operations and allowed coordinated modifications across repeated elements. It also enabled precise control of the junctions between adjacent panels. The convex geometry of the toroid allowed most panel-to-panel junctions to be resolved by aligning the outer edges of the inner faces of the panels. As the panels increased in thickness during the design process, either due to larger profiles or the addition of metal plates and plywood façade layers, this configuration avoided collisions between adjacent panels because the faces formed open angles.

The most complex junctions appeared between the toroid panels and the columns. In plan projection, the supports were not perpendicular to the panels, but almost concentric with them (Fig. 5). This produced a double angular condition, both vertical and horizontal, that could not be resolved through a direct planar contact. The adopted so-


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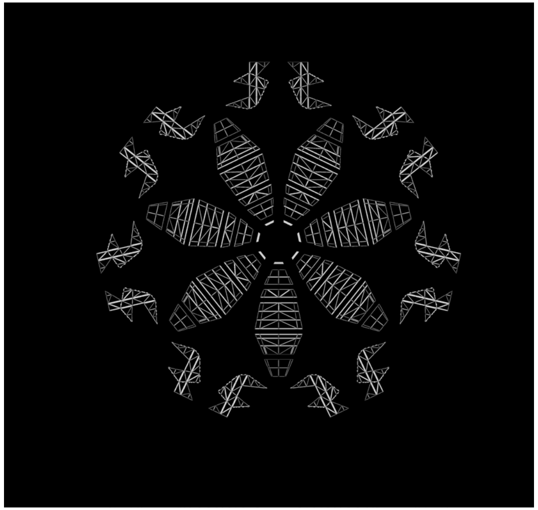

Figure 5. Top view of the structural model, showing the seven radial sectors and the internal subdivision of the segmented panels.

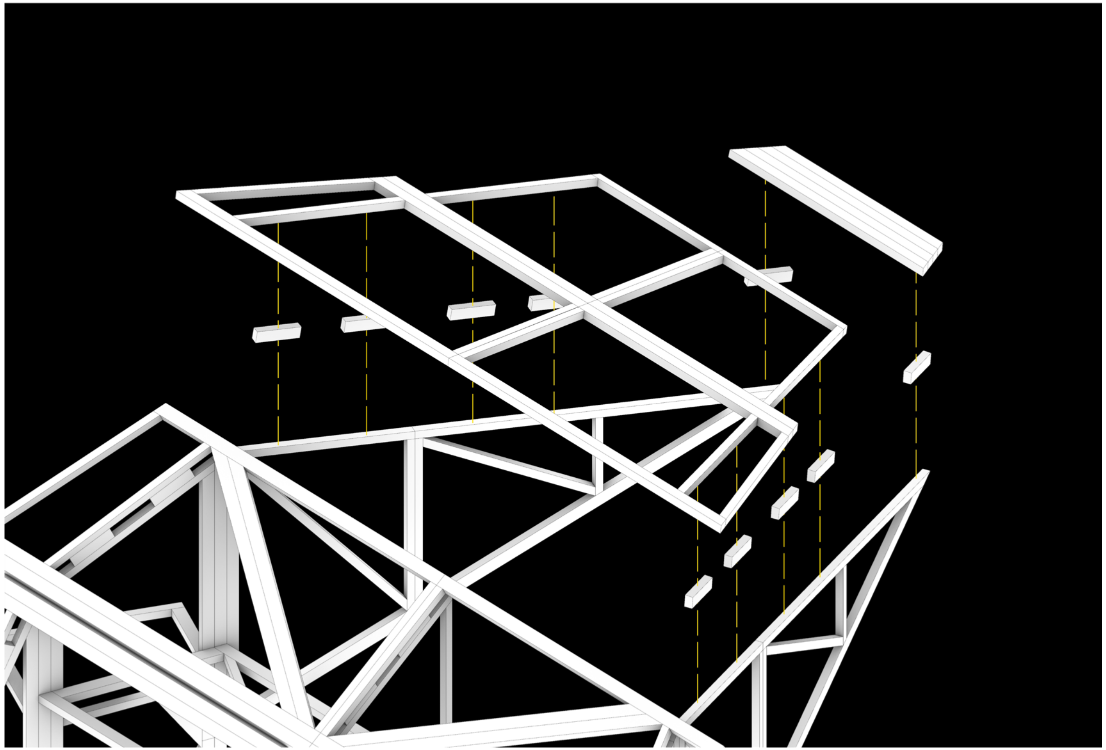

Figure 6. Detail of the wedge system that were used to resolve the double-angle junction between toroid panels and columns.

lution was the modelling of intermediate wedges made from 4 × 6 in profiles (Fig.6). These wedges absorbed the double angle between the toroid panels and the columns and transformed a geometrically complex contact into a constructible joint. Their execution required a telescopic miter saw, which allowed the required compound cuts to be produced.

The next stage consisted of detailed modelling of the entire structural assembly (Fig. 7), including metal plates, brackets and auxiliary connection elements. These components were not added as symbolic annotations or later documentation. They were modelled as three-dimensional geometry within the same file. This made it possible to check the compatibility between prefabricated panels, columns, wedges, timber frames, façade layers and metal connectors before construction. This level of detail was necessary because any unforeseen collision could prevent the assembly of the prefabricated sections on site.

The façade layer was then modelled over the structural panels. This layer incorporated the timber "cracks" that allow light to pass through the envelope. Each crack consisted of a perforation in the plywood panels, approximately 4 in wide, with two lateral 2 × 4 in timber profiles. The modelling of the façade introduced a new modular logic that did not coincide with the structural repetition (Fig. 8). While the structure retained one module repeated seven times, the façade required four different module types. Three of them were repeated twice, while one additional type was used to reconcile the continuity of the crack pattern between the first and penultimate panels. This condition derived from the heptagonal configuration of the volume, where only three faces can be perceived simultaneously.

To manage this discrepancy, the toroid panels were coded according to the façade module to which they belonged. The structural repetition of one module repeated seven times was preserved, while the four façade module types were superimposed as independent blocks within the same model. This allowed the structural and visual logic to coexist without forcing one system to absorb the other.

The modelling of the cracks was automated in Grasshopper. Manual modelling would have required the individual perforation of plywood panels, the generation of two lateral 2 × 4 in profiles


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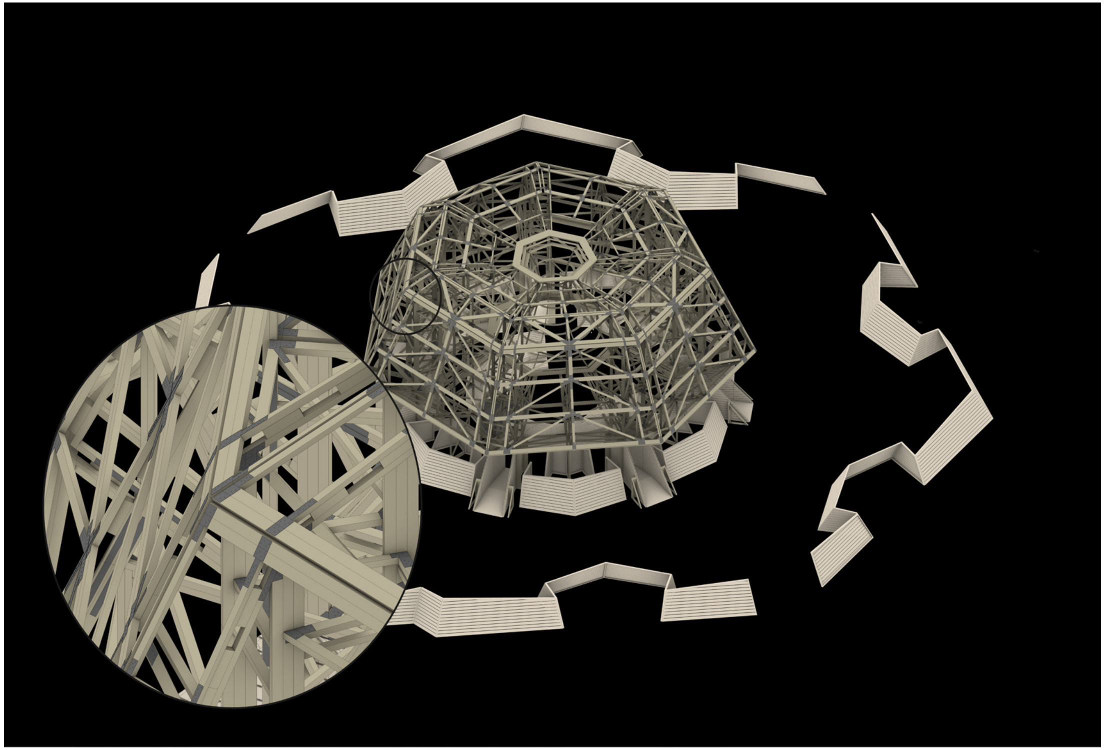

Figure 7. Detailed model of the structural system, including timber profiles, metal plates and brackets used for assembly coordination.

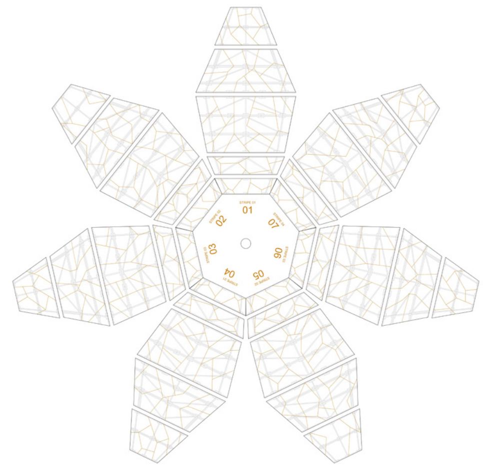

Figure 8. Façade modularity

for each opening and the resolution of multiple intersections with the underlying structure. The Grasshopper definition used the axis of each crack as input. From this line, the system automatically subtracted the opening from the plywood panels, generated the two lateral timber profiles and applied Boolean subtractions where these profiles intersected the structural members. This procedure transformed a repetitive and error-prone modelling task into a controlled parametric operation (Fig. 9).

The central vortex was modelled as an autonomous subsystem. Its geometry approximated a hyperboloid of revolution but was constrained by heptagonal upper and lower limits. The vortex combined two different constructive logics. The first was a CNC-cut plywood structure composed of staggered pieces joined with dovetail connections. This system included vertical pieces and horizontal elements with circular or heptagonal geometries. The second was a surface made with the traditional Fallas technique known as vareta, a construction method developed in Valencia (Spain) for the fabrication of large ephemeral festival sculptures, in which thin cedar rods are bent over a supporting skeleton to generate a continuous curved surface.

Only the plywood structure of the vortex (Fig. 10) was modelled parametrically in Grasshopper (Fig. 11). The definition generated the horizontal rings, the vertical elements, the transitions between heptagonal and circular geometries, the assembly logic and the CNC cutting templates. The vareta surface was not fully modelled as final construction geometry because it depended on an artisanal process of bending and adjustment. Instead, it was tested through a physical scale model in the workshop before being executed on site. This decision established a distinction between elements requiring full digital precision for CNC fabrication and elements whose final form depended on manual adjustment and material behaviour.

The final modelling stage included the interior vertical partitions and the exterior fences. These components presented lower geometric and constructive complexity than the toroid, the columns junctions, the façade cracks and the vortex. They were therefore modelled through conventional three-dimensional solid modelling procedures. Their role was to complete the spatial and constructive definition of the Temple without requi-


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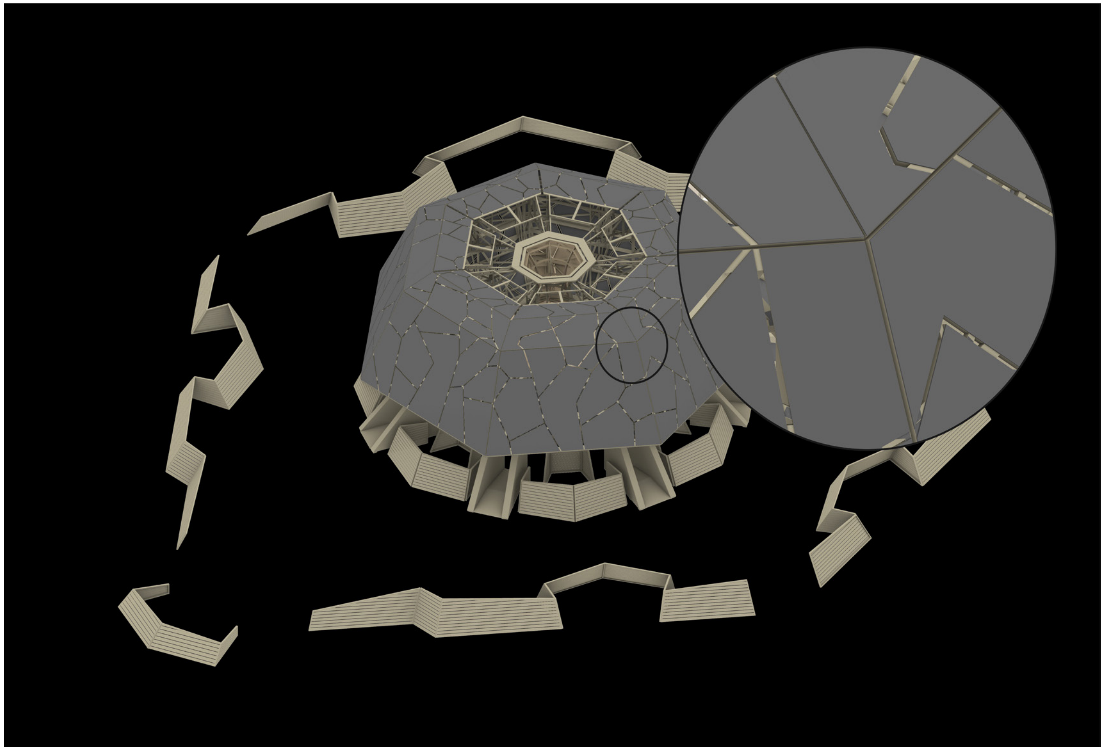

Figure 9. Model of the façade layer and crack pattern applied over the structural toroid panels.

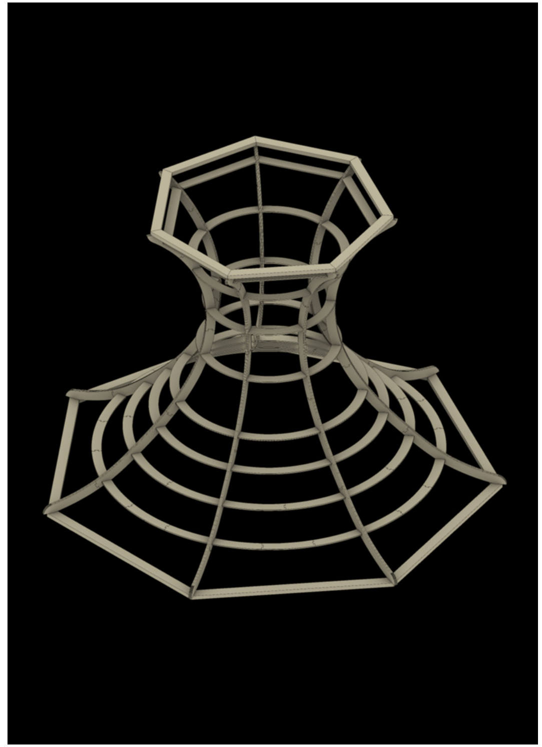

Figure 10. Model of the central vortex

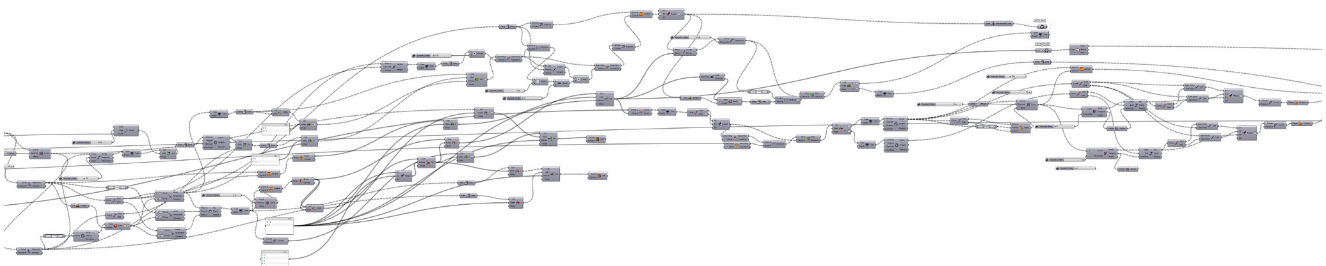

Figure 11. Fragment of Grasshopper definition and three-dimensional model used to generate the CNC-cut plywood structure of the central vortex. See the full-resolution version at https://pcabezos.webs.upv.es/grasshopper/ or by scanning the QR code in the figure.


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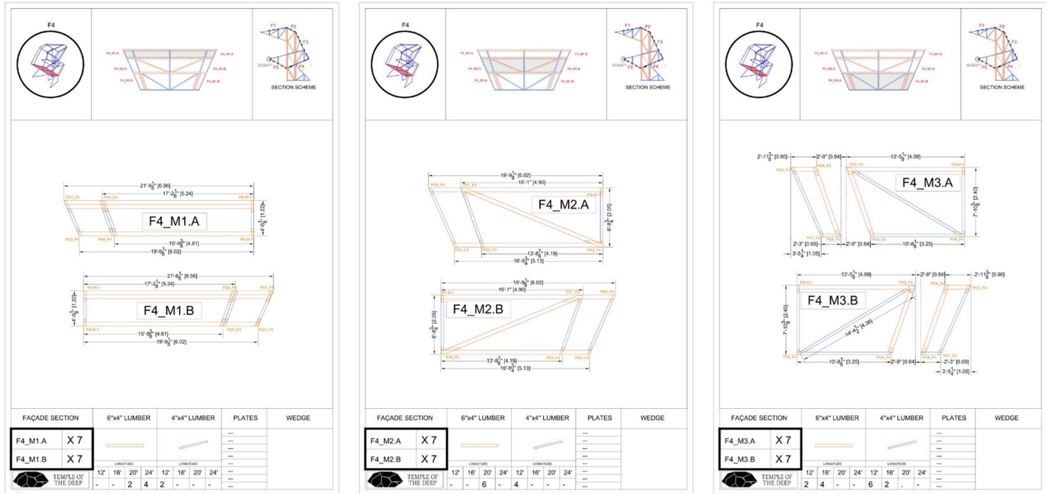
ring a specific parametric system. The complete method can therefore be understood as a sequence of dependent representational layers: initial planar geometry, block hierarchy, transportable segmentation, structural detailing, compound-joint resolution, connector modelling, façade automation, vortex scripting and conventional solid modelling for secondary elements. Each layer added constructive information without replacing the previous one. The resulting model operated simultaneously as spatial definition, structural coordination tool, fabrication database and assembly reference.

## RESULTS

The results derive from the use of a single geometric model conceived as an operative environment rather than as a representational output. The workflow produced six main results:

- Direct extraction of construction drawings
- Integration of environmental simulations
- Generation of structural analysis models
- Simulation of the construction sequence
- Clash detection at the assembly level
- Coordination of non-standard components

These results are not independent outputs, but consequences of using a single geometric model as the basis for design, analysis, fabrication, and construction planning. The first result was the direct production of construction drawings from the three-dimensional model. The same blocks that had been developed from the spatial model and unfolded onto the XY plane for detailed modelling of structure and façade were used to extract CAD linework through Make2D. This avoided redrawing the panels in an independent drafting environment and preserved consistency between the modelled components and the construction documents. Therefore, each drawing remained linked to the geometric logic of the original model, including the position of the profiles, the subdivision of panels, the location of plates and the identification of wedges.



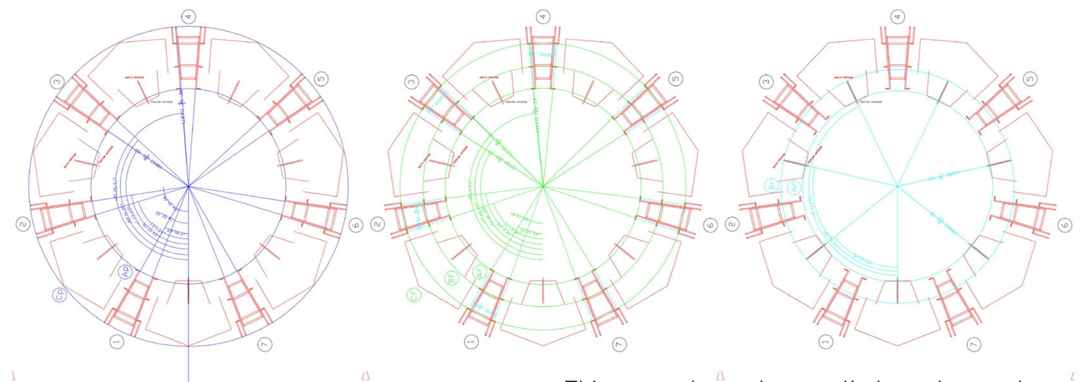



Figure 12. Construction drawing extracted from the three-dimensional model, including panel identification, dimensions, structural profiles, plates and wedges.

Figure 13. Setting-out drawings extracted from the model, showing the radial layout, column base positions and geometric control lines.

This procedure also applied to the setting-out drawings (Fig.12 & 13). The position of the column bases, the radial geometry of the toroid and the relationship between the surrounding elements were extracted directly from the model. This was critical because the assembly depended on the accurate placement of the first elements. Any deviation in the base layout would have propagated through the structure and compromised the position of the subsequent panels. The digital model therefore operated not only as a design model, but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also as a setting-out instrument.

The consistency between model, drawings and fabricated panels was especially relevant because the Temple could not be fully prototyped before its construction in the desert. The nearest city, Reno, Nevada, was approximately two and a half hours away by car, which limited the possibility of correcting fabrication errors through immediate material supply or workshop support. Under these conditions, geometric uncertainty would have had direct consequences on the construction process. The extraction of drawings from the same model used for design and coordination reduced this risk and made it possible to assemble the pieces according to their intended positions.

The second result was the integration of environmental analysis into early design stages. Because the Temple was an open installation located in the desert, solar exposure and outdoor thermal comfort were relevant design parameters. The workflow allowed Radiance simulations to be incorporated through Ladybug Tools within Grasshopper 3D. The model was used to evaluate received solar radiation and outdoor thermal comfort through the Universal Thermal Climate Index (Fig. 14). This extended the function of the model beyond geometric and constructive coordination. It also became a basis for assessing environmental conditions during design development.

The third result was the generation of structural analysis models from the same geometric-structural model. Karamba 3D was integrated into Grasshopper 3D to support structural assessment during early design stages and to coordinate the development of the structure with the engineering team. The analytical model was not reconstructed as an independent object detached from the design model. Instead, it was derived from the same structural geometry used to organize the timber profiles, frames and bracing elements. This made it possible to relate design adjustments, structural checks and constructive decisions within a continuous digital workflow.

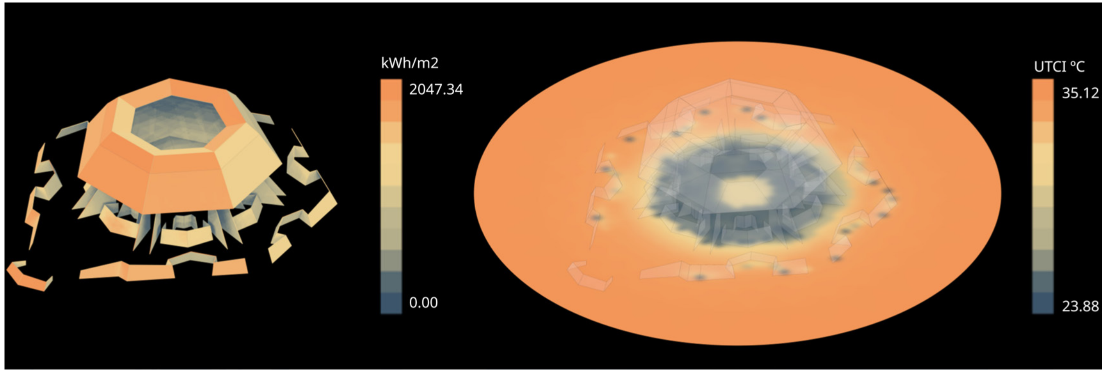


Figure 14. Environmental simulation outputs generated from the model, showing received solar radiation and outdoor thermal comfort through UTCI values.

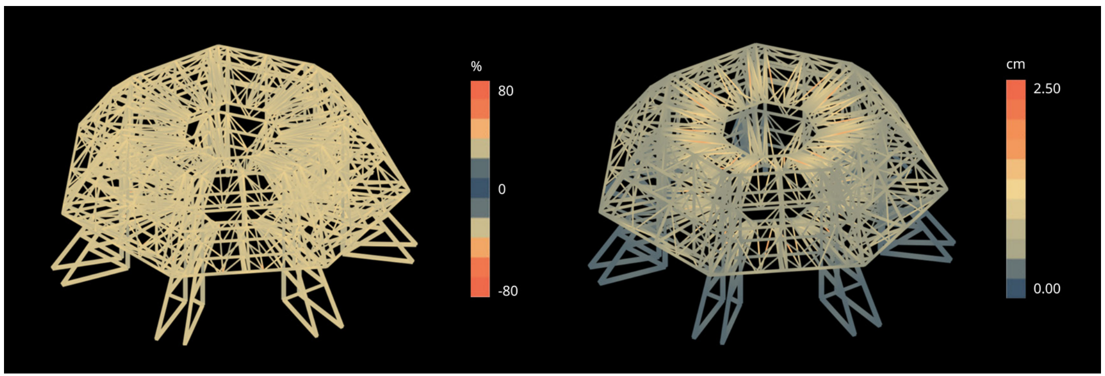


Figure 15. Structural analysis outputs utilization and displacement generated through Karamba 3D from the geometric-structural model

The structural outputs supported the identification of critical areas, displacement values and the behaviour of the main structural system (Fig. 15). They also informed decisions concerning profile dimensions, bracing and the hierarchy of elements. The main value of this process was not the replacement of engineering verification, but the possibility of introducing structural feedback before the construction model had been fixed. This reduced the risk of late-stage changes and allowed the geometric development of the Temple to remain compatible with structural requirements.

The fourth result was the simulation and documentation of the construction sequence. Each panel was assigned a planned construction date. This information was embedded in the model and used to filter the visibility of elements according to time. Grasshopper definitions allowed the rapid


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generation of three-dimensional states showing which components should be completed by each date. The model therefore became a tool for planning the assembly process and managing resources on site.

During construction, the planned dates were updated with the actual execution dates. This transformed the model into a chronological record of the work (Fig. 16). Although the Temple was an ephemeral structure, the model preserves the traceability of its construction process. It is possible to reconstruct which elements were executed each day and to compare planned and actual assembly progress. This result gives the model a documentary value after the disappearance of the physical structure. It also provides a basis for future research on the relationship between design models, construction logistics and ephemeral architecture.

The fifth result was the detection of collisions and the coordination of detailed assembly conditions. The level of detail achieved through the combination of block modelling and Grasshopper automation allowed metal plates, brackets, screws, bracing elements and timber profiles to be checked within the same three-dimensional environment. This was especially important for the horizontal bracing members, whose exact position had to avoid interference with metal plates while remaining accessible for fastening to the adjacent structural elements.

The digital clash-detection process was decisive because the assembly of the panels could not be tested in advance at full scale. The model therefore assumed part of the role that a physical prototype would normally perform. It allowed potential problems to be anticipated before the components reached the site. This was relevant not only for geometric accuracy, but also for construction safety and efficiency under adverse climatic conditions. In a desert context, errors that require re-cutting, repositioning or redesign during assembly produce delays and expose the construction team to additional environmental stress. The detailed model reduced these risks by verifying the compatibility of the pieces before fabrication and transport.

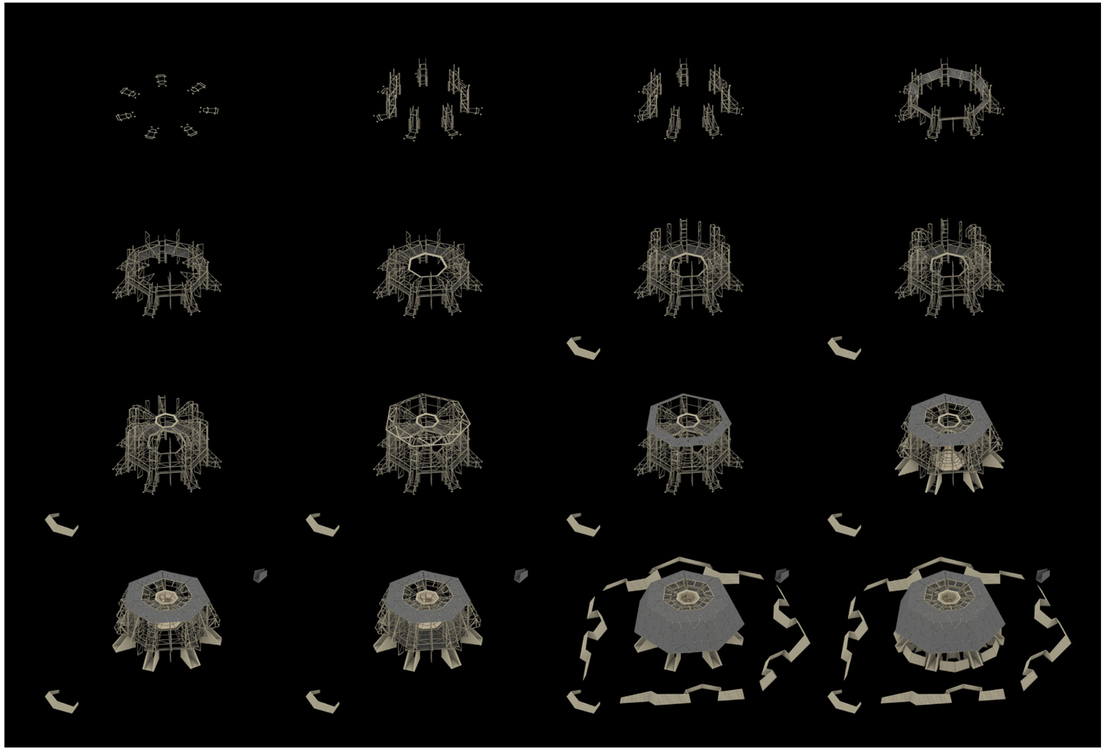

Figure 16. Sequential visualisation of the construction process generated by filtering the model according to planned and actual execution dates.

The sixth result was the precise modelling and coordination of each non-standard component. The project did not fit the typological categories on which conventional BIM software usually operates. Its elements were not easily classifiable as standard walls, slabs, roofs or conventional structural families. The geometry was non-orthogonal, the toroid required repeated but geometrically specific panels, the junctions between panels and columns involved compound angles, and the façade cracks generated numerous local intersections between plywood and timber profiles.

The Rhino–Grasshopper workflow made it possible to model these components directly as specific geometry, without forcing them into predefined building categories. This allowed the exact position, dimension and relationship of each piece to be controlled during design. The result was not only a higher level of formal precision, but a more reliable constructive coordination system. Design conflicts that would have remained hidden in conventional two-dimensional documentation or in a generic BIM classification could be identified in the model before fabrication.

This precision was also relevant for the façade system. The automated modelling of the cracks allowed each perforation, lateral 2 × 4 in profile and Boolean subtraction against the structure

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to be generated from the axis of the crack. This avoided manual repetition and reduced the probability of local errors. The façade was therefore coordinated as a constructive layer rather than as a graphic surface. Its visual pattern, perforations, supporting profiles and structural intersections were integrated in the same model.
The central vortex confirmed the same logic at a different scale of complexity. The Grasshopper definition generated the CNC-cut plywood skeleton, including rings, vertical pieces, transitions between circular and heptagonal geometries and assembly templates. The model allowed precise fabrication data to be extracted for the digital components, while the vareta surface was resolved through physical testing and artisanal execution. This produced a hybrid result in which digital precision and manual construction were not treated as contradictory processes, but as differentiated layers of the same design-to-construction workflow.
Taken together, these results show that the model functioned as a single operative infrastructure. It was not limited to visualization, nor to documentation after design decisions had been made. It integrated geometric definition, constructive detailing, environmental assessment, structural feedback, fabrication outputs, assembly planning and construction traceability. In this sense, the main result of the workflow was the transformation of graphical modelling into a construction management and fabrication-control system for a temporary, non-standard and volunteer-built structure.

Figure17. Burning man temple construction. Photograph by Milena Villalba

## DISCUSSION

The results show that the workflow cannot be interpreted only as a case of digital modelling applied to a complex form. Its relevance lies in the transformation of graphical practice into an operative infrastructure for construction. The model did not function as a visual record of the project, but as the medium through which design decisions, geometric constraints, fabrication data, assembly logic and temporal information were coordinated. This condition shifts the role of drawing from descriptive representation to procedural control.
The case confirms that parametric modelling is not defined by formal complexity alone. Its value depends on the explicit organization of dependencies between elements, dimensions, fabrication rules and assembly conditions. This interpretation is consistent with the distinction proposed by Caetano, Santos, and Leitão (2020), who frame computational design as a field structured by rule-based and relationship-based procedures. In the Temple, parametric logic was used less as a tool for generating alternatives than as a method for preserving consistency between repeated elements, differentiated façade modules, structural components and fabrication outputs.
The workflow also supports the interpretation of parametric design as a digital process rather than a stylistic category. Wortmann and Tunçer (2017) emphasize the need to differentiate parametric design according to the structure of digital workflows. The present case reinforces that position. The main contribution of the model was not the production of a visually complex object, but the capacity to maintain continuity between geometric definition, construction documentation,


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environmental assessment, structural analysis and assembly sequencing. The graphical model became the common environment through which heterogeneous design information was organized. This has direct implications for the relation between CAD–parametric environments and BIM. The results do not justify a general opposition between both systems. BIM remains relevant for projects that require asset management, standardized building categories, multidisciplinary documentation and long-term information control. However, the Temple shows that BIM is not always the most efficient coordination framework for non-standard, temporary and fabrication-driven structures. The project was composed of pieces that could not be easily classified as walls, slabs, roofs or conventional structural families. Their definition required direct geometric control rather than typological attribution. This limitation corresponds to current discussions on the integration of computational design and BIM, where visual programming expands BIM capacities but also reveals interoperability and modelling constraints (Seghier et al., 2025; Semjén & Szép, 2025).
In this case, the Rhino–Grasshopper workflow assumed several functions usually associated with BIM: clash anticipation, construction sequencing, documentation extraction and coordination between design and fabrication. These functions were achieved without translating the project into a conventional BIM taxonomy. The model operated through explicit geometry, block hierarchies, parametric definitions and embedded construction data. This suggests that the disciplinary question is not whether BIM should be replaced, but which modelling environment is appropriate for each type of construction problem. For a one-off ephemeral structure, the priority was not long-term management, but precision, fabrication reliability and assembly control.
The results also clarify the role of simulation within graphical practice. Environmental and structural analyses were not external validations applied after the design was fixed. They were integrated into the same modelling environment through Ladybug Tools, Radiance and Karamba

Figure18. Façade detail. Photograph by Milena Villalba

3D. This placed environmental exposure, outdoor thermal comfort and structural behaviour within the design process. Similar tendencies appear in research on environmental parametric workflows and simulation-based design, where geometry is linked to performance evaluation (Giaveno et al., 2021; Kamel et al., 2024; Wai et al., 2024). In the Temple, this integration was particularly relevant because the structure was open, exposed and assembled in desert conditions.
The construction sequence produced another relevant disciplinary outcome. By assigning planned and actual execution dates to modelled components, the model became a temporal archive of the construction process. This is significant because the physical structure was temporary and disappeared after the event. The model therefore preserves not only the geometry of the Temple, but also the record of its assembly. In this sense, graphical practice extends beyond design and construction toward documentation of ephemeral architecture. The digital model becomes a post-construction research object, capable of supporting future analysis of logistics, sequencing and collective construction.
The case also exposes the limits of full digital control. The vortex combined CNC-cut plywood elements generated from Grasshopper with


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a vareta surface executed through an artisanal process. This distinction is important. Not all construction knowledge was reducible to parametric modelling. The digital model provided precision where CNC fabrication required it, while the final surface depended on material behaviour, manual adjustment and physical testing. The method therefore did not eliminate craft; it defined the boundary between digitally controlled elements and manually adjusted elements. This hybrid condition is relevant for graphical sciences because it prevents an overly deterministic understanding of digital design. The future of representation does not lie in replacing material knowledge with computation, but in defining precise interfaces between computational control and constructive practice.

The volunteer-built condition of the Temple reinforces this argument. Because the structure was assembled by a non-standard construction team under adverse conditions, graphical information had to be clear, consistent and directly executable. The model and drawings were not only tools for specialists; they mediated between designers, engineers, fabricators and volunteers. This gives the workflow a social dimension. The graphical system coordinated collective action by reducing ambiguity, clarifying sequences and anticipating conflicts. In this respect, the case aligns with the cultural relevance of the Burning Man Temple as a collective symbolic structure rather than as a conventional building object (Bateman, 2015).

The main limitation of the method is that it does not provide a universal model for all architectural production. Its strength depends on a specific alignment between geometric complexity, prefabrication, short assembly time, limited tolerance for error and temporary use. The model did not incorporate all physical variables, such as timber shrinkage, bending or buckling under load. These were treated as secondary compared with the need to model real profile dimensions and assembly interfaces. The workflow was therefore precise in constructive geometry but not exhaustive as a material behaviour model.

The broader implication is that graphical sciences must be understood as a field concerned with operative models, not only with images. In the Temple, drawing became a system for producing, testing, fabricating, assembling and recording architecture. This confirms that the future of graphical practice is not limited to new representational aesthetics. It concerns the capacity of graphic systems to organize complex relations between form, matter, performance, labour and time.

## CONCLUSIONS

This article has analysed the design-to-construction workflow developed for the Burning Man Temple 2025, Temple of the Deep, as a case study of fabrication-driven graphical practice. The study shows that a CAD–parametric workflow based on Rhinoceros 3D and Grasshopper 3D can operate as the main coordination framework for a temporary, geometrically complex and non-standard structure when the model is conceived from the beginning as an operative construction environment.

The first conclusion is that the model assumed functions that exceeded conventional representation. It was used to define the spatial configuration of the Temple, organize its seven-part radial hierarchy, segment panels according to transport and manual handling constraints, develop the timber structure with real profile dimensions, resolve compound-angle joints, automate façade cracks, generate CNC templates for the vortex, incorporate metal connectors, extract construction drawings and simulate the assembly sequence. The model therefore acted as a single infrastructure linking design, fabrication and construction.

The second conclusion is that block-based modelling and parametric scripting provided complementary forms of control. Blocks were effective for managing repeated structural elements, radial sectors, panel hierarchies and coordinated modifications. Grasshopper was effective where manual modelling would have been inefficient or error-prone, especially in the façade cracks, Boolean subtractions, vortex geometry, environmental simulations, structural model generation and temporal filtering of the construction sequence. The workflow did not rely on one uniform modelling strategy. It combined different graphical procedures according to the geometric and constructive problem being addressed.

The third conclusion concerns fabrication reliability. Direct extraction of construction and setting-out drawings from the three-dimensional model reduced the gap between design geometry and fabrication information. The use of Make2D on unfolded blocks avoided independent redrawing and preserved consistency between the model, the drawings and the fabricated panels. This was critical because the Temple could not be fully prototyped before assembly and because construction took place in a desert context with limited access to corrective resources. Under these conditions, the accuracy of graphical information became a construction requirement.

The fourth conclusion concerns the role of analysis within the graphical model. The integration of Radiance through Ladybug Tools enabled early assessment of solar radiation and outdoor thermal comfort. The integration of Karamba 3D allowed structural models to be generated from the same geometric system used for design and coordination. These analyses did not replace specialized verification, but they introduced environmental and structural feedback into the design process before the model was fixed for fabrication. The graphical environment therefore operated as a shared basis for design, evaluation and coordination.

The fifth conclusion concerns construction sequencing and traceability. By embedding planned and actual execution dates into the model, the workflow made it possible to simulate the construction process and document the real sequence of assembly. This transformed the model into a temporal record of a structure that was physically temporary. The model now preserves information about what was built each day and how the assembly developed. For ephemeral architecture, this archival function is not secondary. It is a way of preserving construction knowledge after the di-


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sappearance of the object.

The sixth conclusion concerns the limits of conventional BIM in this specific context. The results indicate that a BIM workflow based on standard categories would have been less appropriate for a structure composed of non-orthogonal, non-standard and fabrication-specific components. The project required direct geometric modelling of pieces that could not be easily assigned to predefined building categories. The Rhino–Grasshopper environment allowed the team to work with explicit geometry, compound joints and fabrication outputs without forcing the project into a typological taxonomy. This does not imply a general rejection of BIM. It indicates that BIM is not the default solution for every form of architectural coordination, especially when the priority is fabrication precision rather than asset management.

The seventh conclusion concerns the relation between digital and manual construction. The vortex demonstrated that the workflow could combine CNC-based precision with artisanal execution. The plywood skeleton was generated parametrically and fabricated through CNC cutting, while the vareta surface was resolved through physical testing and manual adjustment. The method therefore did not impose full digital control over all parts of the building. It defined which components required parametric precision and which components were better resolved through craft knowledge and material behaviour.

The contribution of the case to graphical sciences is the demonstration that drawing can operate as a constructive, analytical and logistical system. In the Temple, graphical practice coordinated geometry, structure, fabrication, assembly, simulation and temporal documentation. The model was not an image of the project; it was the operative medium through which the project became constructible. This expands the disciplinary meaning of drawing without abandoning its representational basis.

The study also confirms the relevance of graphical practices in contexts where architecture is collective, temporary and culturally significant. The Burning Man Temple is not only a technical structure. It is a symbolic space built by volunteers and dismantled through ritual destruction. The graphical workflow supported this process by reducing uncertainty, coordinating collective labour and translating a complex design into executable information. Its value lies in making a fragile and temporary construction possible through precise graphical control.

The final conclusion is that the future of graphical sciences should not be framed only around new visual forms, digital images or representational techniques. It should be framed around the capacity of graphical systems to organise relations between design intention, material constraints, fabrication data, environmental performance, construction labour and time. The Burning Man Temple 2025 shows that, in fabrication-driven temporary architecture, drawing becomes an operative infrastructure for building.

Figure 19. Burning Man Temple ceremony. Photograph by Milena Villalba


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