Cultivating Next-GEN Designers

The Systematic Transfer of Knowledge

Harlen Miller
UNStudio
h.miller@unstudio.com

This paper examines the topic of transferring technical knowledge in an expedited fashion to designers, and/or students, through various training programs, tools, workflows and protocols, while highlighting the invaluable cost knowledge sharing has on global design institutions and offices. We will revisit the timeless tribulations of the ‘educator’, acknowledging the inherent limitations associated with transferring technical knowledge from generation to generation within both a design practice and on an academic level. The conceptual design, workflow and construction of `wasl Tower', UNStudio's latest 308m landmark structure, located in the city center of Dubai, will be referenced as a case-study to illustrate the importance of transferring knowledge within a specific project setting.

Keywords: Talent Pooling, Education, Complexity, Efficiency, Workflow

INTRODUCTION
The transition for a young designer from academic study to professional practice is never a seamless experience. UNStudio, over its 25+ years of practice, has sharpened its ability to cultivate and train new generations of designers through a distinct academic philosophy coupled with a professionally-rooted system of training programs, custom tooling, software workflows and project protocols. These educational mechanisms all serve to expedite the transfer of technological knowledge to new designers entering the workforce in the quickest and most resonating way possible.

The ‘wasl Tower’ was selected from UNStudio’s body of work not only for pushing the boundaries of cultural iconography and complex geometry, but because its primary objective was to streamline digital
and manufacturing workflows, while utilizing the latest Computational and BIM modeling software in order to achieve greater design quality, team efficiency, and improved coordination with sub-consultants, all while dealing with challenging timelines, budgets and client considerations.

CONTINGENCY MANAGEMENT
In practice, establishing a team structure where project specific knowledge and experience is redundantly backed-up after being obtained through key designers is essential to ensuring a generational hand-off of information. This isn’t as relevant within an academic setting given general team size and project duration. This management principle is the safeguard for all technical knowledge that will be shared within the institution/team. Regardless if applied on a micro-project basis or throughout an entire office, this management strategy remains sound.

- **Standard Team Structure:** Teams are organized with little flexibility to take over existing projects that are running within the institution, in emergency situations. This poses a high-risk to the project at hand and the continued flow of knowledge in an office.
- **Redundant Team Structure:** Teams are organized to operate smoothly in case of emergencies, with key members of the design team backed-up through repetitive roles and positions. This becomes costly for company resources and poses management coordination issues.
- **Efficient Team Structure:** Teams are organized to operate smoothly in case of emergencies with key members of the design team backed-up through a fluent knowledge of technical practices and resources. Team members can fluidly move throughout multiple projects without redundancy or risk.

NOTE: Efficient Team Structures can only be obtained by applying a multitude of knowledge sharing methods throughout the larger intuition. This will be outlined further.

![Figure 2](image-url)
UNStudio’s ‘wasl Tower’, next to the Burj Khalifa. Set for completion in the winter of 2020, the ‘wasl Tower’ will have one of the world’s tallest ceramic façades, setting a regional standard for the use of indigenous materials and sustainability. Its responsiveness and ability to acclimate to local temperatures through passive shading and cooling techniques articulated throughout the façade sets this building apart in the harsh desert climate. Its design aesthetic is derived from the classical term ‘contrapposto’ or counterpoise, referencing the natural tilted position of the shoulders and hips in the human form as body weight shifts. This leads to the tower offering a unique silhouette from a 360 degree viewing angle.

Due to the exceedingly short construction timeline for a building of this scale and geometric complexity, the decision to execute this project through a custom Computational and BIM workflow was taken early in the concept design process. This strategy was undertaken with the primary goal of building a lean and agile design team that operated from a position of informed decision making instead of by a ‘trial and error’ elimination process.

Once an optimized workflow was established, training courses, tutorials, primer papers, and custom scripting tools were created and implemented, not only within the design team but throughout the office to ensure knowledge continuity in case there was a migration of key team members from within UNStudio.

**‘WASL TOWER’**

The ‘wasl Tower’ is a benchmark 308 meter super-high-rise structure located in the heart of Dubai’s City Center, next to the Burj Khalifa. Set for completion in the winter of 2020, the ‘wasl Tower’ will have one of the world’s tallest ceramic façades, setting a regional standard for the use of indigenous materials and sustainability. Its responsiveness and ability to acclimate...
KNOWLEDGE SHARING CULTURE
UNStudio has adopted the philosophy that the workplace should be an extension of one’s education. Although most employees have graduated from their respective universities, the desire to evolve professionally and acquire new skill sets still remains. The transfer of knowledge cannot be communicated through a singular source or method, so a multifaceted approach to knowledge sharing is taken:

- UNS Knowledge Platforms: The KP Platforms are a series of research topics headed by senior specialist from within the office that can assist in
- Transferring any archival knowledge gained from existing projects to new employees and teams.
- Intranet Archive: Is a living repository specifically for UNS employees that communicates the knowledge gained on projects in a searchable blog format.
- Workshops: In collaboration with the ‘Computational Knowledge Platform’ the office host frequent courses in software workflows, complex geometry rationalization, parametric design and scripting, BIM, modeling, rendering, VR and other skills.
- Custom Tooling: Repetitive or time consuming task are identified on a project basis to evaluate if there is a bespoke solution or a universal tool or approach that can be applied. Custom Grasshopper Toolbars, VB, C#, Python coding languages or other tools are generated and distributed to the office on the In-
Figure 7

a) The 'Master Design File' controls every aspect of the design, from the formal geometry, façade rationalization, program stacking, efficiency ratios, structural grid placement, MEP requirements, wind-tunnel test analysis, core sizing, vertical circulation, fire egress, building safety, etc.

b) The 'Master Design File' structure must be meticulous with a clean layering system denoting not only 'live' architectural components but also archival 'Construction Lines' linked to scripts and plugins. Key information from the 'Master Design File' will be referenced into BIM software for documentation later in the workflow.

DEFINING THE WORKFLOW

Each project must have a 'preliminary workflow analysis' conducted in order to determine the appropriate software exchange that will be used during the design process. Factors include project phase, timelines, deliverables, LOD (Level of Detail), size of team, experience level, efficiency of coordination, complexity, etc.

After performing a 'preliminary workflow analy-
sis' on the ‘wasl Tower’, it was determined that base geometry modeled in our native design software (Rhino) would be used to feed secondary geometry rationalization plugins (Grasshopper) and then pipelined into documentation tools such as (Revit). The base geometry for the entire tower was created through a series of scripted auto-lofts creating a perfectly structured UV nurbs surface. One adjustment to a linked control geometry vertex point and every aspect of the façade system will automatically update, including fabrication specifications and cost reports. File and workflow literacy on the team becomes paramount.

NOTE: there is a tendency to link workflows into a seamless transfer of geometry across all software which is fueled by the misconception that a ‘live-update’ or ‘real-time’ workflow model is beneficial and more efficient. There should be caution in doing so, as the slightest accidental adjustment to a linked ‘Construction Line’ or ‘Control Geometry’ by a new team member can send a shockwave of updates through the workflow process.

There is never a fluid process where all software will be harmoniously linked and exchanging geometry without subtle adjustments needed along the way. At best, with a complex project, the updated changes to the design will take hours, if not days, to reintegrate into the workflow. The plus side; use this delay in the workflow as a quality control protocol to inspect material before it goes to sub-consultants and external parties. This also reinforces why every line and vertex within the ‘Master Design File’ should serve a purpose, and be labeled according to function or linked software.

**EXPPELLING THE MYTHS**

The most disruptive factor that can block the fluid exchange of knowledge within a design practice is the misconception or circulation of myths associated with various ‘design tools / workflows’ and their inherent true value. **FACT:** there is no magical all-inclusive tool that solves the architectural industries gamut of problems. Each tool or suite of software a designer uses to sculpt and execute their vision carries strengths and weaknesses. It’s up to the institution to have open discussions with all levels of staff and management about the cost benefits, technical limitations and functionality of every ‘design tool’ utilized within an office workflow. One inalienable truth remains after this debate has exhausted itself;

**GEOMETRY IS MERELY GEOMETRY**

Regardless of the native software a piece of geometry was created in, a proficient design team should be able to transition it from point A to point B through any workflow while maintaining form, geometric tolerance, tagging quantities, imbedded data, and other relevant information. All geometry constructed in digital space can be deconstructed into its fundamental components which remain unbiased in any format or interface; Vertices and Vectors. From
Figure 9
The ‘Master Design File’ in Rhino holds all relative geometry related to building form, façade details, curtain-wall build-out, structure and a base core reference to calculate efficiency. The Revit model houses a higher level of drawing detail as shown above for full documentation.

Figure 10
Custom scripting component highlighting variations in: angle a) and inclination within the curtain-wall mullion modules, b) corner angle and inclination within the curtain-wall glazing panels, c) the 4 types of solar blocking Ceramic Fin elements.
here, one can always proceed with the laborious task of reconstruction in whatever native platform desired.

Figure 11
Every method of transferring geometry from software A to software B is explored and benchmarked to evaluate processing time, data lose, and geometric fluency.

During the ‘preliminary workflow analysis’, the design team should uncover certain logistical questions; What are we contractually responsible for? What is the ultimate LOD (Level of Detail) for any 3D model that is produced, and not just BIM models? Who is receiving the design geometry and for what purposes? And most importantly, what remains proprietarily the institutions vs. the consultant or client? Architecture is a service based industry and that service should never be replicated through an offices R+D, custom tooling and ‘working files’ unless given consent. Software is intended for the masses; a ‘workflow’ is a recipe for efficiency. Expectations about consultant input must be gauged appropriately. Some structural engineers only want centerlines and vertex points to define column locations and post-tensioning cable anchors. Some façade manufactures prefer only closed polysurfaces purged of additional tagging and embedded information to lighten the model. Some cost estimators want fully tagged Revit models, while others only want a tabulated Excel sheet. Knowing a software’s limitations not only helps define the proper ‘workflow’, but also educating the design team on what the scope, input and breadth of a consultants contribution to a project will be helps eliminate an unnecessary LOD in the design.

EPILOUGE
Knowledge sharing and the generational hand off of information as it relates to the world of academia is in stark contrast to the world of the architectural practitioner. In a university setting, the thorough documentation and systematic transfer of professional expertise is only injected through the position of the professor. Students rarely have access to previous generation’s achievable drawing sets, board layouts, script libraries, 3D models and research data while pursuing their own endeavors. Real world notions of the profession are filtered through a top down structure with only subtle influence from fellow students that might have had the opportunity of an internship to base their assumptions of professional practice on.

This hierarchical method of knowledge transfer and filtration is neither good nor bad, positive or negative, but perhaps serves its purpose in allowing young generations of designers to remain experimental in their design process and self-reliant in their own discoveries.
Figure 13
Clean modeling techniques must be executed in the native design software in order to prevent time lost for rebuilding.

Jading the mind with 20 to 30 years of ancestral experience and project nostalgia from an office can lead to preconceived understandings of form and space. ‘Reinventing the wheel’, ‘breaking the mold’ and discovering novel means of operating are rewarded in the highest regard. This is perhaps why more forward thinking offices remain connected to academic discourse as ‘think tanks’ to safeguard real world projects from the turbulence of experimentation until it has been proven efficient, financially feasible, and applicable.

Professional practice is similar to academia in its pursuit of fresh and innovative ideas, although more reluctant to gabble on such propositions that have yet to be field and trial tested in a real world setting. For this reason, the educational mechanisms outlined in this paper serve to streamline digital and manufacturing workflows, while utilizing the latest Computational and BIM modeling software in order to achieve greater design quality, team efficiency, and improved coordination with sub-consultants, all while dealing with challenging timelines, budgets and client considerations.

Regardless of the institution, academic or professional, both settings should establish and outline a clear system for achieving ‘The Systematic Transfer of Knowledge’ while cultivating Next-GEN Designers

REFERENCES
(no references specified)
Figure 15
The construction site of ‘wasl Tower’ as of February 2018