The Malleable Bust: Three-Dimensional Portraiture in a Digital Age

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Digital Modeling Materials

The more powerful digital design tools become, the more important it is to acknowledge their unique constraints and affordances. From animation to information modeling to CAD/CAM, proprietary software offers specialized toolsets that are superficially easy to customize and control but are fundamentally prescriptive. Eventually this may not matter – if we can imagine software that is fully intuitive and comprehensive. In the meantime, an understanding of how different platforms organize visual and spatial information will help students to select the appropriate platform for a task, to maximize its use, to navigate between platforms and to adapt to new or updated versions as they emerge.

For the beginning design student, this might mean encouraging a material inquisitives toward digital media in the same way that is common with physical media. For example, Bauhaus-inspired exercises explore the structural integrity of folded paper or the varying effects produced by pressure on lead. The digital counterpart to such projects means treating digital materials such as pixels, vectors, NURBs and meshes not simply as a stand-in for physical objects (as is often the case), but probing their unique structural characteristics for design opportunities. While the precise regulation of these properties (as with those of physical materials) is a subject for advanced study, a "playful tinkering with material"[1] encourages a basic facility and intuitive understanding lays the groundwork for correct practices and future development.

The present project asks students to construct and then transform a NURBS model of their own head. The first part of the project is prescriptive and teaches control over NURBS modeling at the various scales of control points, curves and surfaces; the subsequent transformation is exploratory, with the guidelines that it be tectonically distinct from the original yet recognizable. Since the class is a mix of architecture, landscape architecture and interior design students (part of the University of Nebraska architecture's new d.ONE curriculum) this also offers a discipline-neutral exercise. Twice-weekly lab sessions provide software tutorials and guidance, and weekly lectures give broader context around issues in technology, portraiture and contemporary design. Within this framework, the intentions of the assignment are proficiency in NURBS modelling and an understanding that digital materials have their own underlying logics that distinguish them both from physical media and from one another. More broadly, the project is the expression of personal identity through material exploration.

Phase 1: Self-Construction

An enduring subject of artistic interest, the bust offers a complex form that demands deep engagement with any design medium[2] - it is a challenging subject. In the human form, only the eye balls are a (roughly) platonic. All other parts are quite idiosyncratic. These are then joined in a variety of ways, making seams an important consideration. Further, individual heads have characteristic creases, bulges, indents, etc. This list could go on – in short, every human head is unique in countless ways, and we have a finely developed ability to recognize these differences.

No experienced modeler would exclusively use NURBS for the task of modelling a human head, but the task reveals important strengths and limitations of the medium. On the one hand, NURBS curves offer precise control that helps to accurately capture profile lines and trace specific features. On the other, NURBS surfaces have a consistent resolution, making it difficult to add selective detail (compare, for example, the resolution needed for the forehead versus the wings of the nose). Since NURBS cannot easily be sculpted, students must engage with the finer grain of the material. They divide their head into strategic sections, explore different tools for shaping these parts, and then join them together into a realistic whole.

Process

A rough series of steps guides the class through the process of self-construction. First, students document themselves in teams of two, taking photographs from which to build their models. The more closely these align the better, so students are encouraged to maintain consistency in viewing angle, lighting, facial expression, etc. Since the students repeatedly evaluate their work against the indefinite but tangible metric of self-recognition, these images form the link between the physical world and the computer – an important one for the beginning design student.

From here, they trace separate contours along front and profile views (Figure 1), which they then align in three-space and combine into three-dimensional curves. Lofting between these curves produces the major surface of the face. This is an iterative process: being unfamiliar with lofting, students make their best guess in creating the scaffold of curves, test it, and then revise as needed. The first results are often monstrous, but as students learn to rebuild and trim curves, adjust control points, and experiment with different lofting options, they develop control over the formation of surfaces and their projects progress toward an accurate likeness.

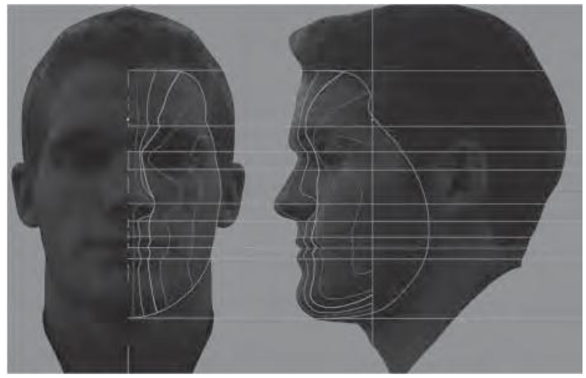

Fig. 1. Preliminary tracing: Mitchell Musel

Facial features may be constructed in the way, or by sculpting surfaces through control points. In this second workflow, students align images or traced lines in three dimensions and shape a simple object – typically a sphere – to match (Figure 2). Since it is a challenge to balance small details with the overall form, students develop the larger forms first and then rebuild at a finer resolution to add detail as needed.

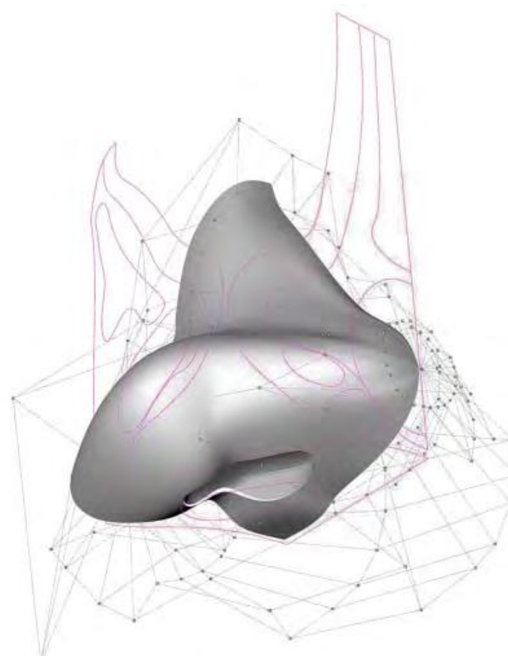

Fig. 2. Detailed editing: Craig Hruska

Given the diverse geometry of the head, neither workflow is complete on its own. The final construction always involves multiple modeling methods and careful consideration of the seams between parts. Though prescriptive, the process is open-ended. Students take the project as far as they are able within the 4 week assignment time frame, but the human face will always contain further detail for them to work toward.

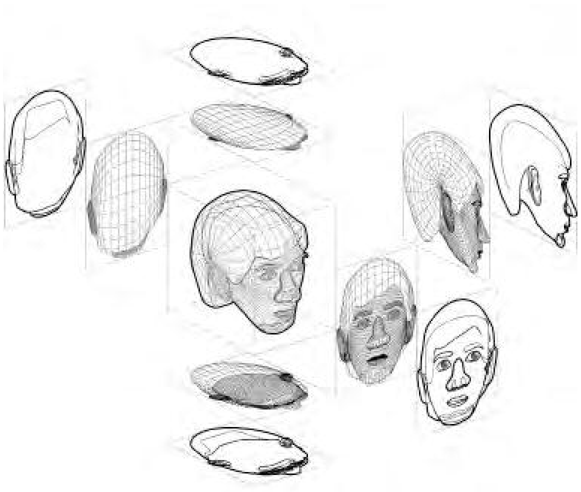

Fig. 3. Self-construction: Craig Hruska

As mentioned, NURBS modeling is not the easiest route for this assignment. What it offers, though, is relatively direct control over digital design's unique capabilities in non-standard, curvilinear geometry.[3]

Phase 2: Self-Transformation

Craftsmanship means not only control of a material, but also responsiveness to its quirks. The grain of wood or veins of stone may add richness to a design. The irregularities of packed clay in a mold become frozen in a bronze cast; Giacometti's use is substantively different from Michelangelo's. Whether a substance flakes, snaps or bends may all influence the process of creation. These are inherent and therefore unavoidable properties, but must be acknowledged and treated with care for full impact.

In the case of figural sculpture, the accurate likeness has become ever more prosaic. Just as the camera offers instant portraiture, so digital scanning and object printing have made realistic sculpture into a widely accessible commodity. In *The Work of Art in the Age of Mechanical Reproduction*,[4] Walter Benjamin suggests that such accurate technological reproductions necessarily supplant artistic attempts at realism. Instead of recording reality, a new subject might be the medium itself.

What, then, are the idiosyncrasies of digital materials? As a group, these float freely, express an infinite thinness and may collide in space. Voxels and raster images typically conform to a pixelated grid, meshes are notable for their polygonal faces and NURBS for their subordination to control curves. As with physical - materials, these qualities may be suppressed or celebrated. In the second phase of the project, students design a process around a particular NURBS quality. In this way, it is a counterpoint to the first. In the self-construction, students have a particular task that they must use NURBS to complete. Here, NURBS are the starting point.

Process

If the first phase of the project is prescriptive, the second is equally exploratory. This transformation of the head from a realistic whole into an aggregation of elements is intentionally open ended. The only guidelines are that the product recognizable and that it still be a NURBS model (Figure 4). This encourages students reflect on what they have learned about NURBS as a modeling material and to intensively engage with some specific aspect of it.

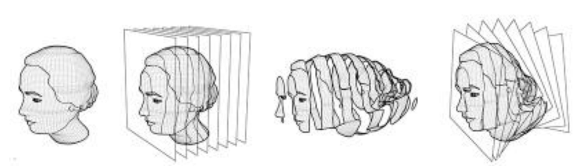

Fig. 4. Transformation sequence: Mallory Lane

Fig. 5. Self-transformations: Mitchell Musel, Mallory Lane, Kamron Mahmoodzadeh

For many students, this means a return to the curve as the fundamental generator of NURBS geometry. Different types of offsets, projections, lofts and extrusions subdivide the original model and re-construct it with a new tectonic expression. Other students explore the process at the level of surfaces or even objects, using arrays and Booleans to transform their models (Figure 5). In an introductory course it is impossible to teach students all the computer skills they need, so the hope was that seeing a diversity of options would both encourage them to share techniques with each other and to set a precedent for self-instruction.

It is worth noting that these processes are not scripted and do not rely wholly on built-in commands, but fall somewhere in between. Students define a repetitive operation or a sequence that they then execute manually. The software can do amazing things on its own, but this can cause problems if not properly understood. This middle ground is an attempt to embrace the unique qualities of digital design while maintaining a skeptical distance from the intoxicating possibilities of modern design software.

Results and Reflections

As a core course in University of Nebraska's new d.ONE sequence, the Introduction to Computer Applications is part of a program that emphasizes not only skill-building, but 'design thinking' and 'design making.' Loosely defined, these concepts suggest that students begin to establish their own priorities in projects rather than fulfilling a set agenda. The recurring discussion of digital materials is intended to support this direction, reminding students of the constraints of any design medium. The open-endedness of the second phase also calls upon students to define their own processes, albeit within the confines of the course scope.

In this way, the exercise also aims to introduce students to the importance of systematic processes in design. The loss of construction syntax is one commonly noted danger of working digitally. With hidden grids, object snaps and snap tracking, it is often more efficient to draw only desired geometry than to build off of construction lines. However, the NURBS surface itself is built from control curves (Non-Uniform Rational B-Splines), and these are in turn built from control points. For surface modelling, these curves and points might be loosely thought of as a three-dimensional equivalent of construction lines – the hidden guides that organize form-engage them, but they will always be there. If students develop an awareness of the underlying qualities of materials –physical or digital—they will be more prepared to take advantage of whatever medium they encounter.

Notes

[1] Albers, Josef. "Concerning Art Instruction." Black Mountain College Bulletin: Asheville, NC. 1934.

[2] Hall, James. *The Self-Portrait, A Cultural History*. Thames & Hudson: London. 2014.

[3] Carpo, Mario. *"The Demise of the Identical Architectural Standardization in the Age of Digital Reproducibility." International Conference on the Histories of Media Art, Science and Technology*. Banff New Media Institute: Banff. 2005.

[4] Benjamin, Walter. "The Work of Art in the Age of Mechanical Reproduction." *Illuminations*. Trans: Harry Zohn. Harcourt, Brace & World: New York. 1968.