Grease pencils and the persistence of individuality in computationally produced custom objects

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This article explores the relationship between an established craft production method and a computational adaptation of that method. In looking at a specific tool, the grease pencils used in the fitting and production of prosthetic limbs, we examine the ways in which complexity, tacit understandings, and human movement are translated into a collection of variables and considerations manipulable in a digital environment. We discuss, briefly, the persistent individuality of objects like prosthetic sockets, and the ways in which their materiality and necessarily custom nature push back against assumptions that computational production is generalizing, disembodied, and abstract.

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In the second volume of *The Stones of Venice*, John Ruskin (1853) argued for the importance of invention over precision. Highlighting the difference between the English glassmaker and the Venetian glassmaker, he argued that

> *the former thinks only of accurately matching his patterns, and getting his curves perfectly true and his edges perfectly sharp, and becomes a mere machine for rounding curves and sharpening edges, while the old Venetian cared not a whit whether his edges were sharp or not, but he invented a new design for every glass that he made, and never moulded a handle or a lip without a new fancy in it* (p. 168).

Ruskin's argument highlights a major perceived difference between computational methods and making (or craft): like the English glassmaker, when we use computational methods of production (such as subtractive or additive manufacturing), we imagine a process that will ultimately produce a potential army of the same object, with precision and consistency and with a minimization of human error. Computational methods imply calculation, the imposition and use of a well-defined model, and through such aspects the predictability and consistency typically associated with industrial production. But when we make or craft, we make one thing, unique or novel in its

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characteristics, connected irretrievably to both the embodied experience of the maker as well as to the particular materials used in its construction. Richard Sennett (2008) echoes Ruskin's sentiment, suggesting that, alongside the codification of mechanical schema that took place during the industrial revolution came a moment when the craftsman became representative of 'the positive value placed on variations, flaws, and irregularities in handwork' (p. 84). In the positions held by both Ruskin and — a century and a half later — Sennett, there is the contention that, no matter how often the process of crafting is done, the objects created are one-offs, different from their mass-produced cousins thanks to the intervention of the hand of the craftsman.

Whether for aesthetic reasons such as those cited by Ruskin or functional reasons, crafted objects have not been eliminated by industrialized design practices and their computational correlates. Craft objects persist in their need to be crafted, rather than designed and produced. And, in fact, some objects appear to resist the impetus to become mass-produced, seeming to require the crafter's hand and eye. A hand-turned pot may satisfy aesthetic desires different from those satisfied by a mass-produced pot. Beyond the aesthetic, such objects and practices might also satisfy a moral imperative. As Walter Crane put it at the end of the 19th century, the Arts and Crafts movement 'represents in some sense a revolt against the hard mechanical conventional life and its insensibility to beauty … It is a protest against that so-called industrial progress which produces shoddy wares, the cheapness of which is paid for by the lives of their producers and the degradation of their users' (1903 [1893]: pp. 12–13). Or, as Sennett (2008) and Crawford (2009) see it, the craftsman's own agency and desire to feel ownership over the results of his labour are at issue in their non-participation in mass production. Regardless of the particular motivations behind them, craft fairs and their latter-day kin, online marketplaces like Etsy, persist.

Some objects, however, have very pragmatic reasons to be made individually. PrintAbility, a project currently underway at the Critical Making Lab in the Faculty of Information, University of Toronto explores — through the production of sockets for prosthetic legs—the relationship between computerized making and objects that persist in being made using craft methods. In the remainder of this article, we use PrintAbility as a case for thinking through some of the relations between computational methods — often understood as generalizing, disembodied, abstract, and replicable — and making — typically understood as context-specific, embodied, concrete, and unique. Though PrintAbility itself has concrete goals regarding access to medical devices, our involvement in the project is also an opportunity to better understand the ways in which computational practices can be inflected by existing craft methods. Ultimately, in this article we claim that closer attention to the particular ways bodies are interpolated within craft practices is key to developing computational supports for such practices.