Form following itself: the case for embodied fabrication

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Abstract

This paper proposes to use personal data for control of digital fabrication machines, and suggests the creative opportunities that can arise from that process. Two pieces, *Twipology and Rabota*, illustrate in their concept and realisation some of the implications of such interactive fabrication explorations. Within the notion of interactivity, we aim to create a visceral, embodied relationship with digital fabrication tools in order to impact the physical world in which we move.

Author Keywords

digital fabrication; interactive fabrication; embodied fabrication; quantified self; personal data

ACM Classification Keywords

H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces. Haptic I/O.

Introduction

As digital fabrication tools and culture become better known and more attainable, users still face obstacles that prevent them to fully engage with these techniques - obstacles range from 3D modelling skills to the linear process that requires a pre-determined design before even starting. Some interactive fabrication projects have since proposed strategies to address these pitfalls [6,7]. This research situates itself

in a similar context of exploring ways for playful and intuitive digital fabrication processes, notably with the project 'Twipology' and 'Rabota'.

Interactive implications
This research bridges emerging trends in personal fabrication with growing possibilities of data tracking and collection. I'm proposing to use human-based data as parameters for machine control in a fabrication process. This is done in the context of interactive experimentations that typically offer outlets for technological innovations, making them available and accessible to the public as they transition to become mainstream.

I thus propose to bypass the need of drawing on a software altogether and to seek a sense of purpose that emerges from the process itself, taking the focus away from the end-product: an experiential interactive approach. Within that approach, I selected specifically a few components of interactive implications, such as the notion of time and latency, embodiment, location, and scale. Indeed, the engagement of users can be tried with situating digital fabrication processes in unconventional settings: for instance at home, or in a public space, with materials that are not sourced for the machine but that are already part of our physical environment, on location or at distance, in real time or over 1 year, with generic machines or machines that are designed for a single purpose.

Two projects
I tested a few of these opportunities in two art projects that I realised over the last 3 years: 'Twipology' and 'Rabota'. The two projects are part of a trilogy and the third project in currently under development.

- 'Twipology' is a styrofoam garden, the design of which is generated from Twitter conversations. Words and other elements of collected tweets are converted into unusual geometries that together create a unique and radical landscape.

Figure 1. View of the *Twipology* garden.

Visitors are welcome to move within the garden, walk, sit and spend time in the space. Thus the overall design evolves with time, and occupation. Loosely inspired by the constraints of a Japanese rock garden, where contours, reliefs and patterns hold metaphors for the world around, *'Twipology'* invites visitors to reflect and contemplate from their point of observation. This project showed how a space and a landscape could be created from collective data.

- 'Rabota' is a CNC "carving" machine on wheels that is uniquely controlled by sleep data. It measures approximately 40cm x 30cm x 40cm.

The material that the machine uses is the existing fabric of our homes, in this case the bedroom floor. Thus 'Rabota' is conceived as an erosion and subtractive machine that transforms sleep data into a physical alteration of a bedroom floor. We disorient the visitors by literally eroding the floor we stand on. This machine is a sort of a dysfunctional wood planer that cuts through the floor as it processes the data it receives from a sleep tracking device.

Figure 2. Side View of the *Rabota* machine.

This project aims to introduce strangeness into a familiar environment. We alter our understanding of the physical space we rely on by using our own sleep data, as if our dreams are having real materiality that takes the floor from under us.

The material world
With these two projects, I form the hypothesis that the input of personal data in digital fabrication enables users to physically intervene in their everyday life

environment in unexpected, playful and speculative ways and that these processes can completely change the current paradigm of digital fabrication in our culture. I propose that these experiments show an emerging form of narration and that various interactive parameters can construct this narrative affordance.

This research looks also at the possible implications of transforming our physical environment with data. As we address specifically the relationships people establish with artefacts, or tangible objects but also with a sense of living in a material world, we can rethink the fabricated outcomes in terms of the metaphors they uncover of the ways we move and engage with the world around us. This is the case I'm making with the notion of "embodied fabrication".

Embodied Fabrication
In his work on 'embodied interaction', Paul Dourish [3] showed that the convergence of tangible computing [4] and social computing at the end of the Nineties affected the way users would interact with technology, as physicality and phenomenological perceptions would be more involved. In his words "users create and communicate meaning through their interaction with the system (and with each other, through the system)".

I argue that interactive fabrication reinforces Dourish's premise by engaging the body of the user further into the process. As the machine changes scale to become smaller and portable or could adopt possibly a much larger scale, the body of the user can engage with a much greater proximity. The machine does not have to stay on a desktop either, it could be located in different parts of a house for instance (by the bed, in a closet, etc), it could be worn or held closer to the body (which

is already the case with the 3D-printed pen Doodle or proposed in semi-professional contexts [5]).

This newfound intimacy could let us explore possibilities of 'embodied fabrication'. Furthermore, digital fabrication as a social tool or social medium is increasingly being studied, notably for its ability to support collaborative fabrication at distance [2,6]. As we can use those tools to build relationships, they become agents of connectedness [1].

Objects of another kind

We're also facing a few challenges, notably in associating real data with an unrelated geometry. The relationship between data and geometry that is not based on equivalence but rather on aesthetic or user-experience decisions relies mainly on the artist or the designer choices. Here, we're not necessarily concerned with the question of legibility of the data in the materialised outcome, but it's a non-trivial question to keep in mind as users may have expectations in that regard.

Beyond this issue, I also want to question the end point of fabrication, that too often falls either in the functional or the ornamental categories. The 'objects' that we consider here would be thought to have a 'life' of their own beyond their fabrication that usually imply a final inertia. Metaphors of decay, growth or metamorphosis could be used in that purpose, as well as scenarios where 'objects' keep being 'fabricated'. The 'objects' could thus continue to be transformed and to transform their users, or possibly additional users, as they get placed in different contexts. Furthermore, other notions could emerge as the user could foresee a series of objects instead of a standalone one.

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