re|Traces of Search: Exploring Human-Software Entanglements Through the Search Engine

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Abstract
The software art installation 're|Traces of Search' probes human-software relationships by examining in detail a specific and situated action: searching on the web. This work exposes the inner workings of this human/non-human connection; the software - the keystrokes, the scripts and function calls occurring during the exchange - are revealed as a tangible artifact and interactive sonification. We invite guests to explore this non-human representation and touch the software, as it touches us back. As well as highlighting a hidden complexity, this work touches upon questions of transparency and privacy of search engines, and to what extent our relationship with software is rooted in control, in contrast to care.

Author Keywords
software art; search engine; new media art; sonification;

CCS Concepts
•Applied computing → Media arts; •Human-centered computing → Interaction design;

Introduction
Digital technologies are inevitably entangled in our human lives, yet, the engine that lies behind sending a chat message, streaming a video, or loading our social media feed [12], *the software*, is often presented as distant and simpli-

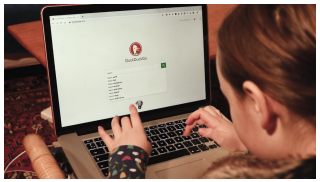

Figure 1: Searching the web is a deeply situated but mundane human-software entanglement.

"The world is constantly done and undone through encounters, which are not always those we might expect. The question of how we learn to live with others, being in the world, is an opening to 'becoming with' – to be touched as much as to actively touch." – Maria Puig de la Bellacasa [6]

fied, or not presented at all, a complex "black box", a machine with an input, an output, and something unknown in between.

Consequent to this invisibility, it becomes harder to understand the intricate workings of a device or a piece of software, but also harder to decipher which values and choices are embedded into its design: if we can't see it, touch it, hear it, experience it, how do we know what it is? Some of the most influential standpoints in HCI build upon dreams of ubiquitous computing, invisible and minimalistic machines that fade into the background [13]. However, as devices become invisible it also becomes less clear what they do and how we are supposed to trust them [11].

This invisibility or simplification might be preferred when striving for efficient and convenient interactions with a system, but also when trying to hide that, just as a user has control over a system, the system often has agency over the user as well. Our relationship with our devices is not just about us asserting control and influence over them, but how they can shape and mold us as well.

When we strictly divide the world of the machines and the world of the humans, not only are we acknowledging that the machine's role is a distant "other", a surveillant, but we also miss out on a part of, arguably, ourselves: "[t]he machine is a contraption; it entangles and incorporates us" [1].

In this work, we explore how machine and human might collaborate, working together as one, as a cyborg, resisting the domination of one over the other [9]. When we touch the software the software touches us back, blurring the distinction between subject and object [10]. In this way, perhaps software is much closer to us than we imagine.

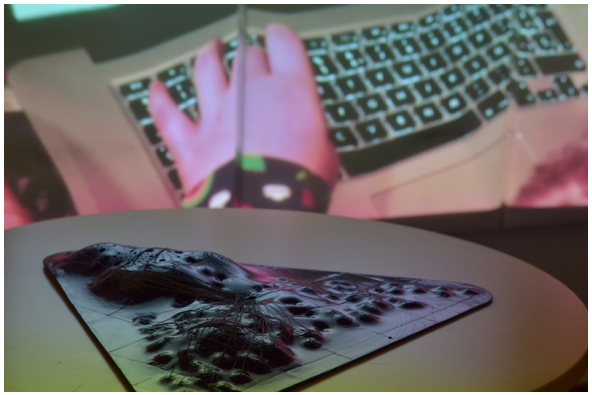

Figure 2: The re|Traces of Search installation consists of an interactive sculpture, sonification and film.

The search engine as a gateway

The focus of this work, the search engine, has an exceedingly significant presence in how we navigate the world wide web. It provides an accessible entry point to the ever-growing amount of knowledge available on the web. Humans shape the engine: our search history, the language settings, the plugins and extensions we gather and customize, all have a direct effect on the way the engine presents itself, the way it sorts and displays information, recommending and completing our choices. Consequently, the engine shapes the human: the auto-complete features, the customization of the search, the order of the results.

With this artwork, we explore the medium that supports a human/web symbiotic evolution: software. The mundane task of one search query conceals an immense stream of activity that takes place beyond the human's interaction. A couple of keystrokes to edit the query, a few seconds of human-machine interaction, trigger thousands of minuscule

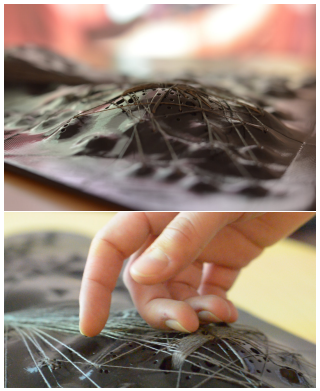

Figure 3: The slopes and valleys of the sculpture represent the scripts, and each thread represents a function call.

operations which complete, collect, and display the result of the search. In the context of digital content, this dense software activity, the medium, is the actual *message* delivered by the search engine and the browser to the human users. With this artwork, we wish to unveil this message and contrast its complexity with the perceived simplicity of a search query.

Touching software

> *"Based on and yet exceeding our sense of touch - based on our ability to manipulate virtual objects we cannot entirely see - [software] is a magical source that promises to bring together the fractured field of new media studies and to encapsulate the difference this field makes."* – Wendy Hui Kyong Chun [5]

The installation consists of three layers: a projected film capturing the act of using a search engine, a sonification of the software that makes this act possible, and a tangible sculpture representing the complexity and connectivity involved in the software.

Using conductive thread as a precise capacitive sensor enables a very tactile fine-grained interaction between the visitor and the multi-dimensional recording of act and software. Hovering your hand over the sculpture activates it, playing an audiovisual trace of the surface layer interaction as a user normally experiences it. Touching the physical representation of the software execution immediately brings out more details in its sonification, letting the sound of the software touch you back. With more of your skin touching the delicate threads of the fossilized software operations, the video and sonification are gradually slowed down and the software is rendered in ever more detail.

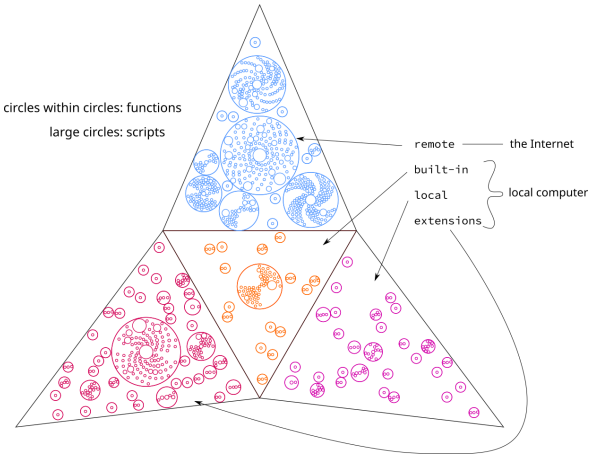

Figure 4: The sculpture represents software as functions within scripts with different origins.

This interaction reveals some general aspects of software execution in the browser. It also provides a glimpse into a very specific and situated interaction. This specific human-machine moment is different than all others, it captures one human's interaction, on a specific device, from a specific location, using a specific browser and search engine, entering a specific search term. If we were to repeat the capturing and assembling process again it would render a different result.

Thus we draw from the metaphorical as well as the literal meaning of 'touch' [6, 2, 3]. When we touch the physical representation of software, we are also touched by it, as when the girl in the film touches the software by using the search engine, the software touches her back by shaping her experience and her decisions.

Figure 5: The design and fabrication process of 're|Traces of Search' requires lengthy dedication and manual labor. As authors and artists, by fabricating the sculpture, we have experienced the exaggerated complexity of threading each and every function call, further emphasizing the intricate domain that software enables.

With this piece, we call for a deeper focus on working and making together with non-human/machine members in art and design. What might it be like to reimagine a world where software's touch is not an act of *control* or surveillance, but an entanglement, or an act of *care*? [4]

Future work

The sculpture can be milled in wood for a more polished and robust finish. A poster with more details on how the original software events are connected to the sculpture should accompany any exhibition of the sculpture.

Resources

Poster: https://doi.org/10.5281/zenodo.3784223 [7]
Video: https://vimeo.com/414672711 [8]

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