
The Voice Pump: An Affectively Engaging Interface for Changing Attachments

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Abstract

In this paper, we present the preliminary results from an ongoing interaction design experiment, the *Voice Pump*. The *Voice Pump* is an affectively engaging air-based interface for attuning to the differential qualities of voices in order to change attachments between native Danish speakers and non-native Danish speakers, in particular refugees coming to the country. We present the outset for the design process, the current version of the design, the technical setup for the air-based sound processing and how we plan to continue our explorations in the future.

Author Keywords

Affective Interaction Design; Affectively engaging interfaces; Interactive Sound; Air-based interface; Tactile interface; Affective attachments.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

The *Voice Pump* is an experimental and affectively engaging interface for exploring qualities of voices as a way of relating to refugees in Denmark. In the wake of

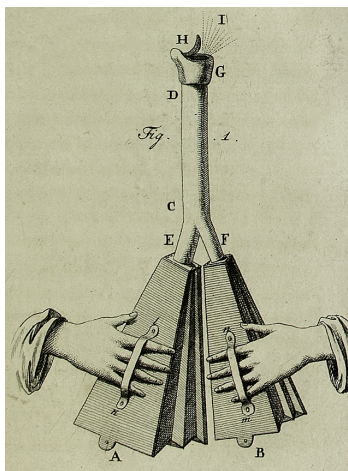


Figure 1: Early speech synthesis using airflow controlled by bellows. Illustration from Von Kempelen, Wolfgang, "Mechanismus der menschlichen Sprache nebst der Beschreibung seiner sprechenden Maschine." (1791). SLUB Dresden CC-BY-SA 4.0.

the ongoing refugee crisis, refugees are often referred to in the media and popular discourse in Denmark as a homogeneous group of non-individuals, attributed with general qualities and uniform motives. However, this is not the case at all; the refugees are a heterogeneous coming-together of individuals with different stories, cultural backgrounds and voices. With the *Voice Pump*, we want people to attune to this differential. Our primary aim, however, is not to engage directly with refugees' stories on a level of content. Rather, we are trying to engage people affectively through an experimental interface allowing people to attune to refugees through affective interactions with voices, the qualities associated with these voices and the affective gesture involved when speaking a non-native language. In this paper, we present the background for carrying out this design experiment and how we conceptualize affect and affective engagement as a theoretical starting point for our design process. Based on this, we describe the *Voice Pump* and its technical setup. We report on the preliminary results from presenting the work in different contexts and outline future steps.

Related Work, Background and Description

The *Voice Pump* experiment has been carried out under the heading of a larger interdisciplinary research project on *Affects, Interfaces, Events* funded by the Danish Independent Research Council (4180-00221) in a subproject that deals explicitly with the design of affectively engaging interfaces [4] in relation to interactive sound design [6]. Recently, Lottridge et al. have defined an *affective interaction* as any interaction that is coloured by an emotional experience [7, p. 201]. However, advances in affect theory and philosophy have also emphasized how affect is also central for understanding our attachments to each other and the

world [1, 3, 8]. Here, affect is seen as a constitutive force of human experience and larger social or societal formations. This is a different theoretical path for the investigation of affect in HCI and interaction design than what is presented under the headings of Affective Computing [10], Emotional Design [9] or interactional approaches to affect in HCI such as [2].

In prior work, we have investigated how it is possible to design for *affective engagement* [4, 5]. Interactive and digital technologies can engage people on an affective level of experience, activating them bodily, making them feel and act differently in a given situation. This kind of engagement continuously modulates the course of the interaction. In the design of the *Voice Pump*, we have explored how affectively engaging interfaces can enable affective interactions through the use of experimental digital and interactive technologies on a micro-level that can catalyze new affective attachments on a macro-level. Importantly, this is not to be understood in any way as a form of 'affective engineering' or an attempt to determine people's actions in a given situation; rather, every event of interaction is unique and can only offer particular conditions of emergence that cannot be fully determined in advance [5].

In affect theory, it has been shown how affect can be used to articulate the dynamics of situations involving high degrees of uncertainty, precarity or crisis [3]. This guided our choice of context of intervention towards an extremely affectively saturated theme in the current political climate in Denmark – and on a global scale – namely the refugee crisis. From the outset, we wanted to explore ways in which we could create an affectively engaging interface, which would be able to change

existing affective attachments between native Danes and refugees. Early on in the design process, we decided to explore the potential in creating an interactive sound installation that would let people listen to and interact with actual refugees' voices using rubber pumps as interaction devices. By using rubber pumps, we wanted to explore the connection between controlled airflow and the spoken human voice, as seen in e.g. von Kempelens illustration from 1791 (Fig. 1), but using digital technologies.

In its current setup, the *Voice Pump* (Fig. 2) lets you "pump up" voice recordings of non-native Danish speakers reading out loud a page from an official "Learn Danish" textbook. Pressing the rubber pumps moves the recorded voices from low to normal to high pitch based on the airflow. You have to maintain a steady air pressure to hear the entire recording in a normal pitch, but you can also explore the low and high pitches to accentuate different affective qualities of the voices. Using the rubber pumps provides a novel form of interaction on a micro-level that aims to make people explore differently the recorded voices presented in the machine. This, we believe, might provide a different way of differentially attuning to the voices that have very different accents and affective qualities, thus reflecting the heterogeneous group of individuals covered behind the label "refugee".

Technical Setup

To facilitate experimentation of the mapping between interface and audio feedback, we decided to physically separate the interface and the audio playback. Thus, the *Voice Pump* consists of two parts: a computer for sound-processing and a novel interface mechanism housed in a modified vintage suitcase – originally a

carrying case for a 1962 East German vacuum cleaner. Communication between the parts is based on the standard OSC (Open Sound Control) protocol for networking electronic musical instruments and multimedia equipment.



Figure 3: The *Voice Pump*. (Photo by Ben Cahill, ITU).

The real-time audio processing on the computer (a Linux laptop or a Raspberry Pi) is performed using the Minim audio library, giving us the possibility to experiment with the mapping between the output of the user interface – i.e. air pressure – and audio parameters such as pitch, gain, echo, low pass filtering and thresholds for starting and stopping the playback. The tactile interface consists of two rubber pumps each connected to air-pressure sensors (piezoresistive transducers). These two sensors interface to an Arduino microprocessor that embeds the air-pressure values in OSC-messages and communicates with the computer via an Ethernet board.

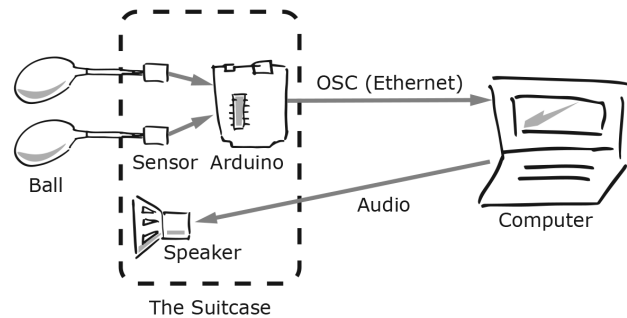


Figure 4: Technical infrastructure of the *Voice Pump*.

During an interactive session, it is possible to play two separate audio-tracks tied to each of the two rubber pumps. Each of them controls the speed and pitch of a prerecorded audio-track. If both tracks get in sync (within a tolerance of 600 ms), the system replaces the current set of voices with a new set of voices.

Preliminary Results and Next Steps

Besides from in-house experimentation at the IxD lab at ITU, we have presented the *Voice Pump* at three different occasions. The first occasion was a public event ("Cultural Night") at the Medical Museion (a combined medical museum and research unit at the University of Copenhagen). At this event, the audio-material consisted of recordings of peristaltic sounds, which triggered a different use situation. Secondly, the installation was presented at an international research-creation workshop in Montréal comprising a number of researchers and artists. This led to a range of discussions of what voices to record, and whether it might be stigmatizing to only include refugees' voices in the recordings. Thirdly, we presented the *Voice Pump* at an internal seminar for a native Danish speaking



Figure 4: Material resistance: Running out of air. (Photo: Ben Cahill, ITU).

audience. Here users pursued a near-perfect reproduction of the spoken word, wanting to "help the speakers", but "running out of breath" due to the malleability - the material resistance - of the rubber pumps (Fig. 4). This was perceived as a quite distressing experience; you were in control of another person's voice, but not able to make them "talk".

Generally speaking, the feedback we have received so far strongly accentuates the potential of the *Voice Pump* as an affectively engaging interface while pointing to a range of things that must be considered in the remainder of the project. In its current version, the voices in the machine are from non-Danish speakers from different countries, with different accents, and different levels of proficiency in speaking Danish. Importantly, though, neither of these are refugees. Throughout the project, we have made a deliberate choice not to approach refugees as a potentially vulnerable group until we had a fully working prototype that we believed would be meaningful for them to engage with. We have, however, been in contact with a range of local help organizations in the design process. The next step is to start recording voices of actual refugees and collect them in the machine. Further, there is still a need to refine the interaction to make it easier to maintain a normal pitch when pumping up the voices. We are also in the process of investigating potential contexts for displaying and testing the setup to be able to explore the basic assumptions in the project about relating micro-interactions to changes in affective attachments on a macro level. We do believe, however, that the design in its current form has a potential worth exploring further. This potential both relates to the affectively engaging form of interaction, and the affectively saturated context of intervention.

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