

# Exploring Participatory Sound Art

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## ABSTRACT

*Participatory artworks aim at creating an experience that is open to interpretation. We argue that such interpretations should not be just entirely predetermined by the creators' expectations; rather, they should vary among audience members. We also argue that audience members that experienced the artwork could act as co-designers for the successive iterations of the artwork and broaden the creative process. We investigated these arguments with an exploratory approach aimed at transforming creative practices, by reflecting on the case study of an interactive audio-visual installation based on an augmented typewriter. Audience engagement, designers' feedback, and reflections of expert audience members are discussed in this paper.*

## 1. INTRODUCTION

Participatory art practices are often linked to the concept of “democratization”, since their main objective is to broaden access and encourage creative engagement with the artwork. The predominantly social orientation of such practices has often lead to a confusion between the aesthetic and ethicopolitical value of participatory artworks [1], i.e. the value of the artwork is judged based on the social relationships it mediates, rather than its aesthetics. The most prominent example of this approach is Bourriaud’s “Relational aesthetics” [2], in which “socialities [are placed] at the core of a new conception of the aesthetic” [3].

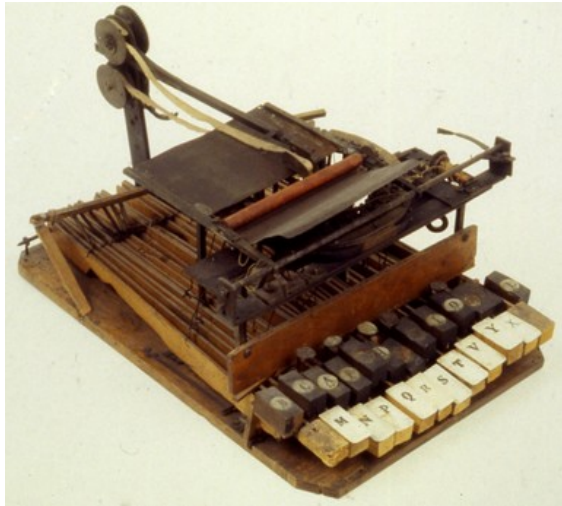
Unlike “relational aesthetics”, our intention is not to assess art practices based on the social context they mediate [3], but rather use this social context as a starting point in order to transform the socialities between creators and audiences and potentially the art practices themselves. We are particularly interested in connecting art creation and perception / participation in an iterative process with the aim to foster creativity and encourage artistic reflection. For this reason, we have adopted an exploratory reflection approach that combines social context with HCI and aesthetics. Most importantly, our focus lies on formative rather than *summative approach* [4], i.e. evaluation that

has the potential of informing and transforming creative practices, rather than merely assessing them. A more comprehensive exploration/evaluation of the artwork was attempted in a workshop with selected expert audience members that took place a few days after the concert. The workshop included participants from the fields of music performance, musicology, music technology and sound design, who were invited to participate in a lab performance, a focus group discussion and a brainstorming session. The purpose of the workshop was twofold: (1) engage in critical discourse and reflection on the artwork at hand (Cembalo Scrivano), and (2) engage in creative ideation with the artwork as a starting point. The latter serves the general objective of establishing a feedback loop between art creation and evaluation: the evaluated artwork is taken as a starting point for collaborative creative ideation using various brainstorming techniques. Previous work in that direction [5, 6] has demonstrated encouraging results, with one of the ideas generated as part of a brainstorming session later developing into an audiovisual installation (rect\_0011 by Benjamin Stahl and Paul Wolff).

## 2. CEMBALO SCRIVANO

The Cembalo Scrivano .2 (CS2) is an interactive audiovisual installation based on an augmented typewriter [7] that generates in real-time audio and visual materials by detecting the user’s typing activity.

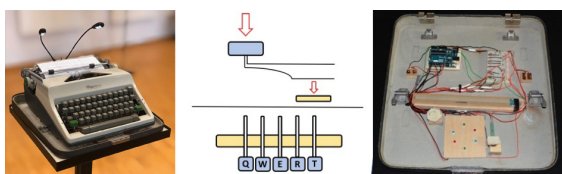
The theoretical groundings of this project are media archaeology [8] and technology re-mediation [9], which are concerned with the idea that new media re-mediate and re-fashion prior media forms. Following this idea, we wanted to take into account historical and cultural considerations to reconsider the device’s usage within a new interactive context. The design of the CS2 was inspired by the writing machine created in 1855 by the Italian inventor Giuseppe Ravizza. Ravizza called his invention Cembalo Scrivano (Scribe Harpsichord) due to the usage of piano-keys (see Figure 1). Ravizza’s invention repurposed the interface of the harpsichord: an existing musical instrument was used as source of inspiration for the development of a new machine, shifting the context from art technology to typewriting. The CS2 mirrors this shift insofar as a typewriter is converted into an interactive art installation (from typewriting to art technology). At the outset of the project, we approached the design of the CS2 taking inspirations from Sengers’s and Gaver’s suggestions to offer multiple interpretations of a design artifact [10]. The first idea we



**Figure 1.** The Cembalo Scrivano invented by Giuseppe Ravizza in 1855. Picture retrieved from Museo Nazionale della Scienza e Tecnologia Leonardo da Vinci, on-line archive.

took from Sengers and Gaver was to clearly outline usability (typing activity), while leaving the audience space to freely interpret the generated sonic and visual materials. The second idea refers to the stimulation of new interpretations by purposefully blocking expected ones: rather than producing a typed sheet of paper the CS2 generates audio and visuals.

The typewriter used in the project is an Olympia SM9 (Figure 2). In the typewriter, each key is connected to an individual metal bar that slides down a few centimeters when the key is pressed. To detect user interaction, we place two touch sensors (TouchKeys [11]). Specifically, we used the information describing where about the TouchKeys has been hit to detect which key has been pressed, prior having assigned a specific position of the sensor to a specific symbol of the keyboard. In the board, this data is (i) converted into specific ASCII values, (ii) used to control the behavior of eight LEDs placed inside the typewriter (Figure 3). The detected ASCII values are then sent to a computer for audio and video generation using Max-MSP and Processing. The communication between the various hardware and software units is based on serial port (Arduino to Processing) and OSC (Processing to Max-MSP). From an interactive point of view, the CS2 is char-



**Figure 2.** From left to right: the Olympia SM9 typewriter used in the CS2; the sensing mechanism by pressing a key (blue) the metal bars touch the touch sensor (yellow) in a specific point; the Olympia SM9 suitcase base equipped with Arduino, sensors and LEDs.

acterised by two states. The first is the idle state, which is associated to a condition of quietness: when no interaction is detected for more than 5 seconds a background sound is generated and the LEDs constantly fade in and out. The second state is triggered when a key is pressed.

The background sound suddenly changes, additional (pre-recorded) sounds are triggered, and the LEDs bright up for a fraction of time. Once the system enters into the second state the various sounds are organized following an activity metaphor. The typing activity is interpreted in relation to the quantity of energy injected into the system. A slow and short typing is associated with low energy levels, while a fast and continuous writing gradually increases the amount of energy detected by the system. The CS2 organizes the materials generated based on the amount of typing activity: low activity produces quiet and punctual audio-visual events; high activity produces dense, articulated, and loud sequences of sound and visuals.

We developed three different audio-visual environments that looped. The three environments are intended as a journey carries aesthetic and symbolic elements linked to the concepts that inspired the installation (i.e. technology, music, and communication).

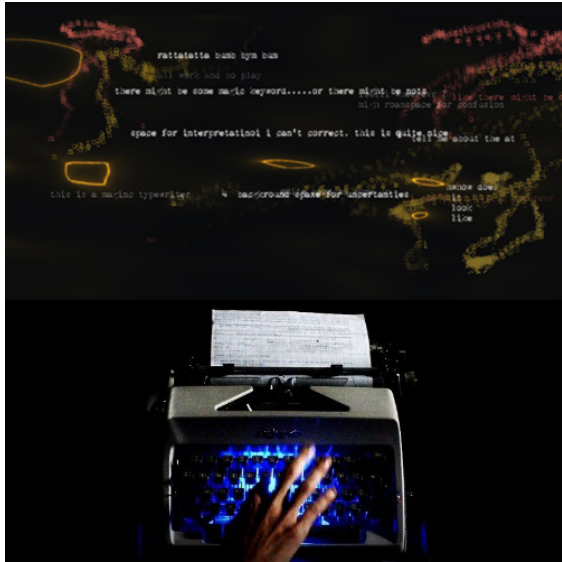
1. “Machines” the sounds designed for this environment are recorded samples and synthesized sonorities evoking mechanical gears and automated machineries. Following the activity metaphor, the system alternates short, punctual and granular sounds with denser and louder metallic sonorities. The visual shows the typed letter that randomly roams throughout the screen leaving a trace behind it. The behavior of the trail is entirely decided by stochastic processes, calling for reflections on delegating controls to the machine.

2. “Melodies” pre-recorded instrumental sounds are used as sonic material (mainly short samples related to Western monophonic classical instruments). The section was conceived to feature the way music is traditionally interpreted, although reinterpreted with a contemporary aesthetic (e.g. once triggered, each sound is manipulated by changing the original speed rate). The result is a mix of sonorities oscillating between traditional music instruments and abstract sonorities. The visual displays the typed letter as an exploding entity while at the same time maintaining a harmonious behavior, mirroring the tension between the acoustic and synthetic sounds.

3. “Voices” sampled male and female voices speaking different languages (English, Italian and German) are used as sound material. Although it is possible to perceive the various voices, they were designed to offer a degree of ambiguity by means of segmenting and overlapping the samples. This choice was motivated by the idea of not filling the composition with semantics to avoid influencing the audience interacting with the system. The sounds vary from whispering to loud speaking. The shift between the different vocal qualities is organized following the activity paradigm: slower typing generates quiet and soft articulations while fast typing produces louder and more dense voicing. The visual matches the concept of human voices by displaying abstract representations of mouths that open and close.

### 3. METHODS

Interactive artworks have been mainly evaluated by applying HCI research methods such as usability and UX. These methods have allowed artists to improve their usability and interaction design [12] and to get insight into audience’s



**Figure 3.** Figure 3: A view of the typewriter with the visual output generated by the CS2.

experience. For example, Hóðk suggested a two-tiered evaluation model using adaptive evaluation techniques to fine-tune interaction design [13]. Some of the questions that has been tackled by these works have been: How to access information about audience experience? Which aspects of experience and qualities of interactivity needs to be evaluated? These studies have explored hybrid methods between HCI and art to be more suitable for open-ended scenarios [14]. Furthermore, HCI research methods began to focus on “pleasure and aesthetics” as innovative goals [15, 16, 17]. Ethnographic and qualitative methodologies such as informal interviews, surveys, video, and verbal data evaluations have been used for modeling audience behavior [12, 18, 19], in documentation of long term participatory artworks activities [20], and for providing feedback to creators [21, 22, 23].

We would like to extend evaluation beyond the practices mentioned above. Mainly because artworks are meant to give insights into audience’s emotional experience, social relationships between them and the art creators, and their experience with the environment around.

One of the challenges is the fact that although artists are usually clear in their practice, it is rather seldom that they have an explicit aesthetical intention. Simply, artworks are not created in order to support a single interpretation [6, 24]. Some parameters we explored are: the balance between control and randomness; the interaction cycle; the extent to which participants have to be actively engaged in order for the artwork to be *successful*.

For the evaluation of the work we used a combination of methods including observation, log data analysis, video analysis, as well as expert and non-expert audience questionnaires. Similar sets of methods have been used by previous studies for the evaluation of participatory and collaborative music-making [25, 26, 27]. These methods were complemented by an in-depth evaluation in the context of a workshop, in which selected expert audience members were invited to participate in a lab performance, a focus group discussion and a brainstorming session. The inten-

tions of the two creators were also recorded through a semi-structured interview and a questionnaire and were taken into account in the evaluation process.

### 3.1 Creators feedback

*Designer/creator questionnaire and interview* Prior to the performance, the creators of the piece were asked to answer some questions regarding their intentions and expectations with respect to the interaction with the interface, the notion of agency, the social interaction among participants and the ways in which different performances of the work can vary. This questionnaire was informed by a previous semi-structured interview with the creators, focusing on the compositional idea and their artistic and design goals. Both creators were asked to answer the questionnaire individually.

### 3.2 Performance analysis

Our evaluation of the work is based on a performance that took place at the Institute of Electronic Music and Acoustics at University of Music and Performing Arts Graz in July 2018. This performance was documented and analyzed using a combination of methods: observation, log data analysis, video analysis and an audience survey.

*Observation:* the first and second author of the paper were responsible for observing the performance and taking notes regarding the participants interaction with the interface and each other.

*Log data analysis:* all text entries made during the performance were recorded and saved in a single text file. The log data was later used to analyze the semantic content of the users text input.

*Video analysis:* the performance was recorded using three different cameras, including a first-person video and audio recording, documenting a single participants experience of the concert. The video files were analyzed and cross-checked in order to calculate the exact duration of each interaction with the interface and segment the log data.

*General audience questionnaire:* after the concert, the participants were invited to fill-in a short questionnaire meant for a non-expert audience and focusing on human-computer and social (human-human) interaction during the performance.

### 3.3 Expert audience workshop

Our evaluation was completed with an expert audience workshop with selected participants who attended and participated in the concert.

*Expert audience questionnaire:* the workshop participants were asked to answer a questionnaire focusing on similar parameters to those used in the creators questionnaire: interaction with the interface, agency, social interaction among participants etc.

*Lab performance:* as part of the workshop, the participants were also asked to participate in a lab performance of the piece and subsequently describe and compare their experience to that of the concert. This had the purpose of giving all participants the opportunity to interact with the interface - including the ones who have not done so at the concert - and enable a comparison between the two different contexts (concert vs lab). Data collected during the lab

performance (log data and video) was later compared to the data collected from the actual concert.

*Group discussion:* the lab performance was followed by a focus group discussion on the concept of agency; particularly the two different types of agency potentially involved in Cembalo Scrivano: human agency (participants control over audio and visuals) and software agency (the systems ability - or lack thereof - to display autonomous behaviour).

*Bootlegging:* the last part of the workshop was devoted to brainstorming in the form of bootlegging, a technique specifically chosen in order to stimulate creativity and link creation and evaluation in an iterative and recursive process.

#### 4. CREATORS' INTENTIONS

Before the concert, we asked the creators of the CS2 to share their opinion and intentions about the interface.

*Interaction, intuitiveness, hidden features, correct/incorrect interaction:* they intended the interaction with the interface to be intuitive using an interaction paradigm that is familiar for everyone. Nevertheless, the novelty of the object (because of its distorted nature compared to a real typewriter) should not allow an immediate grasping of the intentions and is supposed to encourage the curiosity of the audience to explore.

There are three hidden features in the work. First, the more energy the user uses in typing, triggers more complex, louder, and more energetic sounds. Furthermore, the creators were controlling when to switch from one section of the three to the next by a midi controller that was far from the interface and was hidden from the audience. Finally, the machine produces various random or stochastic behaviors (e.g. background change, re-purposing of previously typed letters, audiovisual glitches).

Certain behaviors are constrained by the physical nature of the typewriter. One simply cannot type too fast, thus there is an 'upper-bound' to the intensity of the visuals-music which leads to a slower interaction throughout the performance.

Fast typing can block the mechanism of the typewriter. Interactions besides typing keys such as rolling to scroll pages can create acoustic sound which does not influence the composition but adds to the overall experience.

*Agency and Form:* the notion of agency is more complicated. Although the creators indicate that the only active agent during the performance is the participant, their interactions' possibilities are limited to the presets and rules that govern the audiovisual outcome which is designed by the creators.

The audiovisual work has a formal structure consisting of three parts each with a different sound and visual material. The interaction with machine doesn't change, but the machine agency gradually increases throughout three stages of the piece. (Autonomous interventions)

*Performance:* the creators expected the performances to be different only in terms of audience participation; some being completely absorbed or totally unengaged and disinterested. In spite of similar sonic and visual outcomes throughout the piece, there are several micro structures that vary based on stochastic behaviors. The creators expected

that the participants would type a lot of typos (since we are so used to correcting our typing using computers). They expected some users to ignore the content of the text and only use a lot of punctuation, ... They also expected a high diversity among participants, but mainly they expected that people converse through the text and complete each other's story by typing collaboratively.

For the creators, this is the first time they present this work where it is possible to type "readable" words and sentences. So they had high hopes that it contributes to the level of engagement and participation of the audience.

## 5. ANALYSIS

### 5.1 Performance analysis

The performance had a total duration of about 18 minutes, with 13 out of 40 (32.5%) audience members actively participating in it. The average duration of individual interactions with the interface was 34.63 sec (Std. Dev. 20.67). The average interaction time per person was 50.62 sec (Std. Dev. 34.55). Three audience members interacted with the interface twice and only one audience member interacted with the interface more than three times. It's important to note that all users who interacted with the interface more than once were identified as professional musicians (composers or performers).

Out of 22 entries, 3 were made by the creators of the piece: 2 in the beginning of the performance ("this is a magic typewriter... there might be some keywords", "or maybe not...? your turn now...") and one in the end ("thank you"). Two of the entries made by audience members could be interpreted as a search for these "keywords", as they made use of "magic words" commonly used in stage magic tricks ("simsalabim") or popular movies ("expecto patronum").

Two more entries cited popular movies, one making a reference to the act of typing as well: "all work and no play makes jack a dull boy" - a proverb obsessively typed by the lead character in the movie *The Shining*, based on the homonymous novel by Stephen King.

Two of the entries commented on the process of the performance itself, while four different entries referred to the nature of the interface, inquiring whether it is a computer, a living organism or an Artificial Intelligence. Only one entry, made by a professional musician, was entirely non-lexical and seemed to explore the sonic potential of the interface, e.g. typing in different speeds, rhythmic patterns, or even dynamics - an option that was not explored by any other user during the performance. Two other entries consisted partly of random typing patterns, which could be attributed to a sonic exploration of the interface.

Finally 27% of all entries were references to previous entries by other users (e.g. asking or answering other users questions, repeating or completing words from a previous entry etc.), indicating the social character of the interaction among participants.

### 5.2 Audience feedback

By the end of the concert audience were kindly invited to fill out a questionnaire if they were interested and had a few minutes time for it. We did not collect demographic



data about the audience but there were in total 40 people and 17 of them filled out this survey.

The questionnaire included five same questions regarding each piece of the concert. The audience were asked to rate each question between 1-5 (strongly disagree - strongly agree) to evaluate the following criteria: their participation, physical interaction with the interface, the sonic impact of their actions, the effect of their actions on other participants actions and vice versa, and how musically interesting was the sonic outcome.

## 6. EXPERT AUDIENCE WORKSHOP

Collaborative workshops are defined as collaborative design events providing a participatory and equal arena for sharing perspectives, forming visions and creating new solutions [28]. The workshop was designed for an expert audience of musicians, musicologists, music technologists/sound designers and took place two days after the concert.

### 6.1 Questionnaire

Four out of six of the workshop participants found the interaction with the interface to be intuitive and did not observe a learning curve, while the other two did not express an opinion on the matter.

All participants reported that the level of control that participants had during the performance was relatively low and limited to the semantic content of the text, in contrast to the sound output, which as one participant observed felt composed. The participants were able to observe a formal development in the piece, although there was no general agreement as to whether different parts of the piece were distinguishable from each other. Only one participant was able to identify all three parts.

No hidden interaction components were observed by the participants, including the keywords promised by the artists at the beginning of the performance. As incorrect ways of interacting with the interface they named misspellings, too fast typing resulting in type bars getting jammed, and forgetting to return the carriage at the end of a line.

All participants agreed that the semantic content of the text input was central to the performance. Regarding ways in which different performances of the piece can diverge from each other, most participants mentioned the semantic content of the dialogue taking place among audience members (e.g. through answering each others questions), as well as a possible shift in focus between semantic content and sonic exploration in different performance settings.

All participants agreed that the work encouraged social interaction among audience members, though two of them pointed out that the single-user interaction paradigm allowed for asynchronous rather than synchronous interaction.

### 6.2 Group discussion

Regarding system autonomy, the opinion was divided. Some of the participants suggested that the system displayed low agency and was rather reactive than interactive, while one participant suggested that the reappearance of words typed by previous users could be interpreted as a form of agency. Several participants agreed that this notion of agency could

be enhanced if in the last part of the piece, which was largely based on recorded speech as a source of sound material, these old messages would return as spoken words. Two of the participants mentioned that the opening lines typed by the artists (“this is a magic typewriter... there might be some keywords... or maybe not...? your turn now...”) created the expectation that the system would perform some semantic processing of the words typed (e.g. recognizing or relating words based on their meaning).

There was general agreement among workshop participants that the level of control that the users had over sound was rather low. One participant suggested that a more differentiated mapping of the keys (e.g. mapping number keys or same row keys to similar sounds) could help shift the focus of the performance from the semantic content of the text input to the sonic interaction with the interface.

All participants agreed that the single-user interaction with the interface created a type of “stage”, putting pressure on the participants-performers, though this was not necessarily evaluated negatively. One participant commented that this gave the performance an almost “ritualistic” character, while someone else suggested that using more than one interfaces could help distribute the attention and encourage interaction among participants (e.g. using 2 typewriters and thus enabling the participants to engage in “conversation”).

### 6.3 Lab performance

Five of the workshop participants furthermore participated in a lab performance of the piece using a computer keyboard as an interface. The participants reported that the pressure in the lab concert was much lower than in the actual concert and while only one of them had participated in the actual performance, all of them had the chance to contribute to the lab performance. One of the participants observed that there was less social interaction between participants in the lab concert. This is confirmed by the log data collected during the performance: out of 10 entries only 1 makes a semantic reference to a previous entry from another user.

Two other participants mentioned that they focused explicitly on the differences between the computer keyboard and the typewriter as interfaces specifically the typing speed limitations that apply to the typewriter, as opposed to the computer. Another participant suggested that the key sounds of the typewriter constitute an important aesthetic component of the piece, which was missing from the lab performance. The “enter” key seemed to also play an important role in the lab setting. This key is used to start and stop the rendering in Processing and, as there is no such key on the typewriter, its function was not originally designed as an interaction component. When one of the participants accidentally discovered the function of the key, 2 other participants chose to experiment with it.

Another significant difference between the actual and the lab concert was the shift in focus from text to exploratory interaction with the interface. Concretely, 50% of the entries were non-lexical. Among the entries with semantic content, 1 consisted of letters and individual words without syntactic relations, 2 referred to the concept of “future”, 1 made a reference to the search for keywords (“magic words”) and 1 (in Spanish) reflected on the interaction with

the machine, wondering what would happen if the software did not work. The average duration of individual interactions with the interface in the lab performance was 59.7 sec (Std. Dev = 41.05), in comparison to 34.63 sec (Std. Dev. 20.67) in the actual performance. The lab performance lasted about 13 minutes, giving all five participants the opportunity to interact with the interface twice. The average interaction time per participant was 119.4 sec (Std. Dev. = 60.74), as opposed to 50.62 sec (Std. Dev. 34.55) in the actual performance.

#### 6.4 Brainstorming

Participatory artworks rarely aim to define a specific type of experience. Instead, they aim at creating an experience that is open to interpretation. It is valuable if such interpretations are different from designer/creators' expectations or inconsistent among audience members. As key elements for the participatory process, we used creative workshop. The main approach in this workshop is to balance complexity and interactivity to create processes that are engaging and interesting both technically or musically.

Bootlegging is a "structured brainstorming technique particularly suited to multidisciplinary settings"[29]. In bootlegging sessions, participants mix familiar concepts in a way that stimulates creativity. A bootlegging session requires a theme. Our theme was text-communication inspired by typewriter. It also requires the definition of four categories for idea generation, two relative to the user side and two related to the theme and technology. Our two user related themes were audience, experience or activity. The two other categories were the medium, and technology. The participants, divided into two groups, rapidly generated ideas on coloured PostIts notes for each category, mixed those ideas and created random combinations of each category per group. Those combinations then became the trigger of a brainstorming session, attempting to imagine different potential applications to support each combination.

#### 7. REFLECTIONS

The workshop findings were shared with the creators of the work, who were additionally asked to provide some feedback on their usefulness for future work. The creators mentioned that they were likely to work on a new installation based on the knowledge they acquired while working on Cembalo Scrivano. One of them considered the participants difficulty to identify all three parts of the piece to be a significant finding, suggesting either a high degree of coherence, or insufficient differentiation between different parts of the piece.

When asked whether they would integrate any of the participants suggestions in a next iteration of the piece, they mentioned that they would be interested in using AI or a second hidden user in place of an AI in order to perform semantic analysis of the text, and that actual keywords could be used as triggers in order to progress the story line. Furthermore, they suggested that the piece might work better in a smaller performance setting, with 3-4 participants. Regarding their expectations from the performance, they mentioned that they expected some of the users

to interact with the interface longer, producing larger segments of text.

Overall, from analysis of participants interactions with the interface/piece, comparing it with creators expectations, and designing further iterations with the participants during the workshop; we created a process that could be useful as a creative approach by itself. We hope it helps designers, composers, and audience members collaborate more often during the creation process and switch or overlap roles within a shared context.

#### Acknowledgments

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