Type Sonification: The Audiovisual Mapping of Fonts

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ABSTRACT
An audiovisual research project experimenting with how fonts “sound” through an applied sonification process. Type Sonification explores different conceptual paradigms in which typefaces can be audified through audiovisual mapping. By exploring the attributes of letterforms, this conceptual approach expands the standard uses of type by giving a font a “voice” of its own. The identity of the typeface will no longer be only a representation of the spoken word but an auto-synthesized soundtrack for a body of text. Based on visual and analytical aspects of the font, the generation of typographic notations can be created as a unique textual score.

FIGURE 1: Type Sonification

EVOLUTION OF TYPE
It is important to first grasp of the vast history and evolution of typographic forms. Traditional use of type has always been a purely visual communication tool. Its only segue to any form of sound is mainly through linguistics. With the shaping of the western letterform in sixth century B.C. in the Roman Empire, stone-carved letters of the Latin language evolved and became visually standardized with not only left-to-right reading but also characterized by consistent terminal styling and strokes. It wasn’t until 1439 when the advent of moveable type by Johannes Gutenberg forever changed the accessibility of the written word to the western world. Contemporary standardization of metrics and styles were set into place by early metal type foundries, a practice that lasted over 600 years.

FIGURE 2: Type Sonification

By the 70s, computer science played a key role in the transition of typefaces into the digital realm. Analog production of type for print was becoming obsolete. Towards the late twentieth century, the increase of personal computers and its convenience of desktop publishing transformed type into a commodity. More accessible than ever before, today’s typography can be controlled by anyone with a computer. Formal discipline and training is no longer required to use and manipulate type. However, this DIY approach often yields a kind of poor typography that one might expect.

On a positive note, this open access toward the use of type stimulated the growth of experimental typography. Type has jumped out of the printed two-dimensional state and into interactive, performance, and computational domains. However, in such multimedia applications sound has only been created in parallel. Type Sonification aims to extend the conceptual fork to see (and hear) what intrinsic composition can be created from the attributes of type. Be it serif or sans-serif, italic or extrabold, 10 or 72 point in size, the sounds can be mapped to these typographic variables. This combined with the flow from letter to letter create a natural pattern that exists rhythmically. There can be an interesting balance between the auto-synthesis of sounds and creative composition of typefaces in the form of music notation.
GRAPHIC NOTATION & SCORES

In the early to mid-20th Century, composers began experimenting with the use of symbols and other graphic devices as a means to represent their music. This stepped away from the traditional format and allowed more creative freedom in both composition and performance.

Avant-garde composer, Morton Feldman utilized the position of squares, diamonds and rectangles in his 1951 Projection IV. These shapes broadly specified range and timbre. This approach, called indeterminate music, allows for open interpretation. This permits musical discretion during performances.

The intersection of sound representation and sound realization can be a greater abstraction. For example, Rainer Wehinger's visual listening score that accompanies György Ligeti's Artikulation shows a foray of colorful organic forms. The result was more visual poetry than a notation that is used to perform the composition.

With advancements in technology in the late 20th Century, the auto-synthesis of music composition became more accessible. In a similar path like type usage, anyone with a computer can also create, compose, and edit sound without any professional training. Oliver Wittchow's Nanoloop is a music composition application that was originally for a Nintendo GameBoy using the early generation sound chip to create tunes. The use of a visual sequencer allows the composer to see patterns of sounds. The latest rendition of the app is a more gestural control in the user interface created for touchscreen smartphones such as iPhones and Android. The core concept is the same. 16 step sequencer with various wave or square forms to generate synthesized sounds that's remnant of old school 8-bit games.

Hans-Christoph Steiner's graphical score Solitude was generated with PureData, an open source programming language that creates interactive digital music. His original intent was not solely a visual result as a necessity for the composition process. He was able to "see" changes in speed of sample sounds (denoted in different colors) through sloping shapes and amount of alteration from the original sample by the thickness of lines.

Generally non-intuitive in nature with most graphic scores, perhaps expanding this to the typographic realm will provide a more innate comprehension of the sounds because of the familiarity of fonts.
**Type Anatomy**

In typeface design, every part of a letterform has a name and characteristic. Between different fonts, those attributes are uniquely stylized. In a font set—52 characters made up of 26 uppercase and 26 lowercase, plus numerals and punctuations—these are carefully crafted for optimal visual harmony.

Fonts can have various serif styling—serif, sans-serif, slab-serif, bracketed, or rounded. They can be cursive or italic, if in a serif face, or oblique for sans-serifs and slab-serifs. The family of fonts also extends to the weight of the letterforms, ranging from light, roman, semibold, bold to extrabold. The strokes can be varied in widths as in Modern classified fonts, such as *Bodoni*, or equal in thickness as in most Sans-Serifs, such as *Helvetica*. A common confusion is the x-height of a typeface—the vertical distance from the base to the height of the lowercase x. This height varies between typefaces even though they are specified in the same point size. Therefore, a smaller point size of one typeface can appear optically larger than another design that has a smaller x-height.

In typometrics, each font has specific analytical qualities; there is an intrinsic component of visual balance with legibility. Some typefaces are more symmetric in style, especially when compared to a script font. The density of a typeface can also be calculated. A font can appear darker through its design when comparing the ratio between the letterform and its background. Also the contour or outline of the font can range from simple clean lines to complex, distorted decorative faces.

In the computer science of typography, factors such as hinting data or visual cues for optimal rendering of fonts in the digital realm, also adds datapoints to the font file information itself. This is another level of technical attributes to the typeface in production.

Metrics derived from individual characters of a specific font, or typefaces as a whole, can be processed to create an audio composition. By visually mapping these attributes we can set it to a particular frequency or pitch. Overlaying these values can accentuate depth or complexity of the typographic notation.
AUDIOVISUAL MAPPING

The intersection of sight and sound in a meaningful correlation between datapoints is the key basis in audiovisual mapping. The juxtaposition of these elements in the form of type attributes and graphic scores is the initial undertaking but it is defining relevancy, if any, what determines if the result is an information design piece.

Jörg Piringer’s performance piece of sound poetry entitled abcdefghijklmnopqrstuvwxyz is a phonetic play on the alphabet. Letters are articulated in a rap-like fashion, and the letterforms kinetically projected to correspond to his oral overtures. The increase in point size of some of the letterforms matched the amplitude of his voice. Although it is an engaging sound visualization performance, the typeface used appears to be arbitrary.

In Roger D. Hersch’s Lecture Notes in Computer Science, Do-Hoon Lee and Hwan-Gue Cho’s Beta-Velocity Model for Simulating Handwritten Korean Scripts discusses mathematical formulas to derive an effective system of preprocessing the calligraphic forms. When charted out as a curve, one can immediately see an opportunity to play the curvatures as sound waves. The potential to animate these static diagrams is a good test bed to produce variant noise samples that complements the process of handwriting or handwritten style fonts.

Both of these examples are inspirational sources that are worth exploring further in respect to metatypographical endeavors.

TYPOGRAPHIC NOTATION

With over 200,000 typefaces available, there are countless variables to map to sound, among these aspects are graphic notation, type anatomy, and audiovisual mapping. By starting with one dimensional mapping to create a character note—simple sound patterns can begin to be realized.

**Figure 9:** Jörg Piringer’s abcdefghijklmnopqrstuvwxyz

**Figure 10:** Lifting profile and velocity of cursive stroke generation of Korean handwritten script.

**Figure 11.1-11.6:** Typographic notation study utilizing a collection of character notes set in Garamond. The baseline can be set to a base note such as the Middle C. The outer contour are ascending and descending pitches. The choice of point size affects the audio range.
FIGURE 11.2
Set in Garamond Italic, the complete contour outline can be played with more hollow density. The slight axis of the italic will cause a quick incline in tone.

FIGURE 11.3
When notating only the enclosed space of the letterforms, there is an intermittent silence caused by the characters without counters.

FIGURE 11.4
The various stroke width of the four different weights set in Gill Sans family of Light, Regular, Bold, and Ultra Bold. The tone of the wider stroke has a longer direction than the thinner strokes.

FIGURE 11.5
Outer contour in italic of various weights set in the Gill Sans family of Light, Regular, and, Bold weights. The sloping of the oblique angles yields an ascension in pitch. The dot of the letter “i”s become a higher pitch that sounds in every other letter.

FIGURE 11.6:
The pixel bitmap font is converted to the classical notes below.
COMPOSITION

The process of typesetting multiple lines of text is a method for composing with typographic notations. Multiple line breaks can be on the same track to create a layering effect. This works best with small groupings of text, such as a poem or a quote. The placement of the words provide a visual—which also becomes an audio—emphasis to the composition. This juxtaposition becomes both a musical composition and a visual composition when played.

In a structure that serves multiple functions, there is a risk when overlaying too much text that the composition will lose any distinction in sound—of course, unless this is the intention of the composer. When using of a paragraph of text it is recommended to create a continuous track. The score sheet can have distinctive column widths as that of traditional notation.

Initially, there is an element of indeterminacy when choosing a body of text to be typeset in a particular font in a specific point size. John Cage's *I Ching* approach of randomness was a main system for him to compose using chance. In the de-composition of the typeface Rosewood Figure 12, the composition naturally disintegrates based on the ornateness of the letterform.

**Figure 12:** Composition in the audio break down of the typeface Rosewood.

**Figure 13:** John Cage’s *I Ching* for random composition
CASE STUDY

I first started to research this topic as an artist-in-residence at the Atlantic Center for the Arts in July 2010. The inspiration for this piece came from exposure to the master artist, Joshua Davis, aka Bit Shifter, one of the pioneers of the 8-bit chipmusic scene, an electronic style of music where early video game consoles are re-purposed as instruments.

This genre inspired me to explore the possibility of integrating type with the unique sounds of 8-bit music. The most obvious font style of choice would be pixelated bitmap fonts to visually generate the 8-bit sounds since both being “low resolution” in nature. GarageBand is an easily accessible application for quick prototyping. Manually designing letterforms in a program intended to create and edit music was very limiting. Ironically, it paired well with the conceptual limitations of the sound. Designing a bitmap alphabet in the graphical notation view of the application immediately yielded a natural rhythm based on the width and height of the letterforms.

The composition process was building layers of type through the tracks. A mix of repeating certain words or phrases could be emphasized to become a milieu for visual poetry. Exploring the audibility difference between all caps versus lowercase or script provided the level of visual and sonic emphasis for the piece.

The final performance of the composition allowed the audience to both hear and read the score. The main storyline scrolled through the screen in realtime as the supporting tracks looped in the background. Shifting baselines and a change of point size affects the notes. The correlation between the type and its placement on the track timeline becomes lyrical in quality while forcing the audience to read at the pace of the width of the typeface—serifs tighten the breaks between each set of character notes, while script fonts weave a connected melody.

The next iteration of this prototype is to use a more appropriate application to create a true 8-bit soundtrack. Little Sound DJ (LSDJ) is a textual music editor made specifically for a Nintendo Gameboy. By breaking down the typographical notation of the bitmap fonts and re-mapping the notes in LSDJ, new patterns can be created and truly played and performed in an 8-bit platform.

FIGURE 14: Typographic Score prototype
CONCLUSION

The guidelines established in this research provided a greater range of areas in which to experiment with. The aim is to enhance the audience's experience with an auto-synthesis composition with the development of a musical instrument application. However, the question of whether this serves best as a visual accompaniment to the music or an actual notation to perform remains to be determined. Ongoing experimental compositions and updates on the latest research can be found at: www.typesonification.com

BIOGRAPHY

Siu Chong is an information designer and new media artist. Co-founder of Spire Integrated Design, a consulting studio in New York City, she has created software interfaces for stock trading firms and transportation providers.

Siu's training began at Brooklyn Technical High School in the area of Graphic Communications Technology while simultaneously pursuing studies at NYC Technical College and The Cooper Union. She received a BFA degree in Communication Design from Parsons School of Design.

She has been a guest panel speaker at the CAA Conference on the topic of “Information Mapping the Graphic User Interface.” She is also part-time faculty at Parsons and has taught Graphic Design, Typography, and User Interface Design. Siu holds an MFA in Design + Technology from Parsons. Her love of typography inspired her thesis, “Typometrics: A Computational Method for Objective Typeface Classification.”

As a new media artist, Siu explores the experimental electronic music arena. She was an artist in residence at the Atlantic Center for the Arts in 2010 where she started exploring Type Sonification.

IMAGE SOURCES

FIGURE 1: Siu Chong, Analog to digital

FIGURE 2: Siu Chong, Type Sonification

FIGURE 3: Morton Feldman: Projection IV (1951) www.youtube.com/watch?v=pk74GH-_H2M

FIGURE 4: Rainer Wehinger visual score of György Ligeti’s Artikulation (1970's) www.youtube.com/watch?v=71hNl_skTZQ

FIGURE 5: Nanoloop’s (iPhone version) graphic sequencer http://www.nanoloop.de/


FIGURE 7: Siu Chong, Visual Taxonomy


FIGURE 9: Jörg Piringer’s abcdefghijklmnopqrstuvwxyz


FIGURE 11.1 - 11.6: Siu Chong, Typographic notation study

FIGURE 12: Siu Chong, Composition break down of type features of the decorative typeface Rosewood.

FIGURE 13: John Cage’s I Ching for random composition

FIGURE 14: Siu Chong, Typographic Score prototype