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Before there was reading there was seeing.

People navigate the world and probe life's meaning through visible language. *Visible Language* has been concerned with ideas that help define the unique role and properties of visual communication. A basic premise of the journal has been that visual design is a means of communication that must be defined and explored on its own terms. This journal is devoted to enhancing people's experience through the advancement of research and practice of visual communication.

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website:

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send correspondence to:

Mike Zender, *Editor*
College of Design, Architecture, Art, and Planning
University of Cincinnati
PO Box 210016
Cincinnati, OH 45221-0016
mike.zender@uc.edu

Dr. Maria dos Santos Lonsdale, *Associate Editor - Typography*
m.lonsdale@leeds.ac.uk.

Professor Matthew Wizinsky, *Associate Editor*
matthew.wizinsky@uc.edu

Merald Wrolstad, *Founder*

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Contents

Impact of Kinetic Typography on Readers' Attention

Milda Kuraitytė
Ann Bessemans
Erik Nuyts

Reading is one of the most complex cognitive processes requiring attention. In this research, we investigated the differences in attention duration, measured as fixation duration, of the different sub-categories of Kinetic Typography when compared to Serial Presentation. We used an eye-tracking system to record eye movements of controlled stimuli. Each stimulus consisted of a match between a different word and sub-category of Kinetic Typography. The data collected revealed significant differences between Fluid Typography and Serial Presentation in attention duration.

These results are a starting point to understand better Kinetic Typography readers' attention, which might lead to a better digital reading experience.

K e y w o r d s :
Kinetic Typography,
Attention,
Eye tracking,
Digital Reading

Introduction

This research on Kinetic Typography, conducted with the use of an eye-tracking system, investigates how movement in the different categories of Kinetic Typography affects the attention patterns of a reader and the reading experiences it induces.

Within the field of typography, the term Kinetic Typography describes everything that moves utilizing micro and macro typography. However, in this study we focus on the analysis of a single word. The experience of reading on screen has become a day to day activity for the majority of the reading public. Typography on screen appeared together with the cinema at the turn of the 19th century. The screen, by its nature, is a dynamic platform, and this induced typography to move as well. Matt Woolman and Jeffrey Bellantoni state that Georges Méliès was the first to experiment with "animated letterforms" by using the principle of stop motion animation (Woolman, 1999, p.9). These experiments were done in 1899 and were used for a toy advertisement. By the 20th century, typography started to move on-screen in more complex techniques: it scrolled, spun, or was constructed in time. In the fifties, Saul Bass became the star of Kinetic Typography. Bass's titles for *Psycho* and *North by Northwest* became iconic. They played a crucial role in both Kinetic Typography and the art of cinema titles, illustrating Brownie's statement that Kinetic Typography is not an invention of the digital age (Brownie, 2015, p.4). Later on, rapid technological changes took typography to the computer screen. Noticing the lack of systematic studies of typography on screen, in 1995, Yin Yin Wong laid the groundwork for the field of typography on screen, called Temporal Typography (Wong, 1995, p.6). In her research, Wong identified different movements and helped define the concept of moving type on screen.

One of the factors affecting the legibility of a typeface displayed on-screen is its vector outline. While some font formats such as PostScript allow the operating system to figure out the vector outline, other formats, such as the widely used TrueType, require hinting, which is still lacking for many fonts (Lupton, 2014, p.14), leading to poor legibility on screen. Even though the most significant advantage of typography on-screen versus print is that typography on-screen can have movement involved, it is important to mention that the introduced movement has an impact on the vector outline, and so might influence the legibility of the typeface. Therefore, further and more profound research of typographic movement on screen can deliver us an improved Kinetic Typography reading experience.

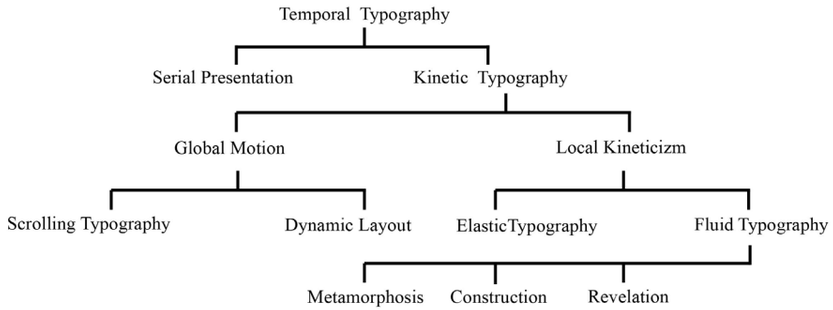
Taxonomy of Temporal Typography

In 2015 Brownie published a taxonomy of Temporal Typography (Brownie, 2015), in which she classified all possible movements of typography (see *figure 1*). This taxonomy is the foundation for our experiment design. In this experiment, we will compare the stimuli of Kinetic Typography using experimental moving type designs. All of the stimuli are classified under the different Kinetic Typography categories and sub-categories as set out by Brownie. The sub-categories of Kinetic Typography are compared to Serial Presentation, the category where no movement is involved.

According to Brownie's taxonomy, Temporal Typography has two main categories: Serial Presentation and Kinetic Typography. As there are many ways of making typography on-screen to move, there are many categories within Kinetic Typography.

FIGURE 1

Taxonomy of Kinetic Typography (Brownie, 2015).



Kinetic Typography has two main categories: Global Motion and Local Kineticism. In these terms, the words *local* and *global* represent the location of the movement. In Global Motion, the change occurs in the whole sentence or word, while in Local Kineticism, the change is in a specific place of the sentence, word, or, more commonly, letter. Local Kineticism is the more complex of the two as letterforms are constructed in time or have a changing movement in the outline of the letterform.

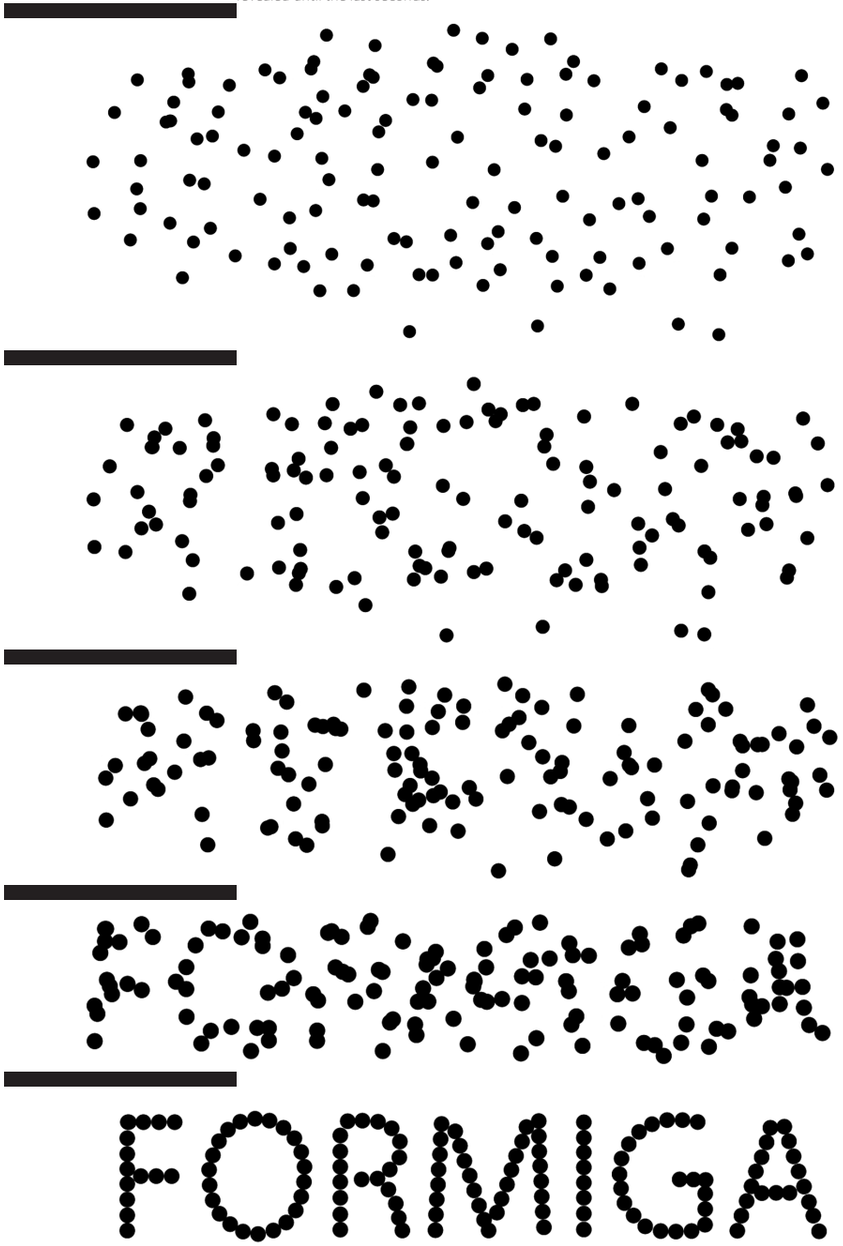
Global Motion is divided into the sub-categories Scrolling Typography and Dynamic Layout. Scrolling Typography is a set of words or piece of text that scrolls through screen. Three sub-subcategories of Scrolling Typography are: Scrolling Vertical Typography, Scrolling Horizontal Typography and Three-dimensional Typography. Scrolling Vertical Typography is the one that scrolls from the bottom of the screen to the top or vice versa. Scrolling Horizontal Typography is typography that scrolls horizontally from one side of the screen to the other side. In three-dimensional Typography, text scrolls from the bottom to the top of the screen and, as it reaches the top, the size and perspective of the text line shrinks, leaving the bottom line of the text larger than the top one. Dynamic Layout is a sub-category where the letters or words in a composition move in relation to each other.

Local Kineticism can be further divided into the sub-categories Elastic Typography and Fluid Typography. Elastic Typography refers to a movement in the outline of the letter. This movement never breaks the outline, so the identity of the letterform remains intact. Fluid Typography is constructed in time and has phases when the identity of the letterforms is not fully revealed, which distinguishes it from the other categories (see *figure 2*). Fluid Typography has three sub-subcategories: Metamorphosis, Construction, and Revelation. Metamorphosis is a category where typography is constructed by the evolution of the shape of an object. In Construction, each letter is constructed from several pieces. Finally, the category of Revelation refers to typography that appears by using colour or rotation.

FIGURE 2

Phases of Fluid Typography

We can see 5 phases of construction of Fluid Typography's sub-category Metamorphosis. From top to bottom, we see screenshots of the stimulus at 2, 4, and 6 seconds respectively, then, screenshots at 8 and 10 seconds. We can notice that the identity of the letterforms is not revealed until the last seconds.



Attention and Eye-tracking

Reading is a complex cognitive process (Hong, Kim, Y., Goetz, E. T.,(1991-2004), p. 205.). In comparison with Serial Presentation, the movement in Kinetic Typography introduces an extra factor for the brain to address while reading, which can make this process more demanding.

Kinetic Typography requires new approaches of analyzation and, thus, a different method than those used when analyzing Serial Presentation. To better assess the differences in reader's attention between the categories of the taxonomy of Temporal Typography, we propose to use eye-tracking technology. There are three main reasons for using eye-tracking technology in our study. First of all, eye tracking is traditionally used for reading research on screen. Also Kinetic Typography can only exist within its medium which is a screen. Secondly, eye tracking provides quantitative results and dynamic visualisations fitting the dynamic nature of Kinetic Typography. Finally, studies such as Deans, O'Laughlin, Brubaker, Gay, and Krug (2010) or Bojko (2013, p.14) reveal how eye tracking data provides us insights on visual attention due to, for example, the close connection between attention and fixations. By taking this into account, we hope that the eye-tracking data can shed a light on which elements of Kinetic Typography attract attention.

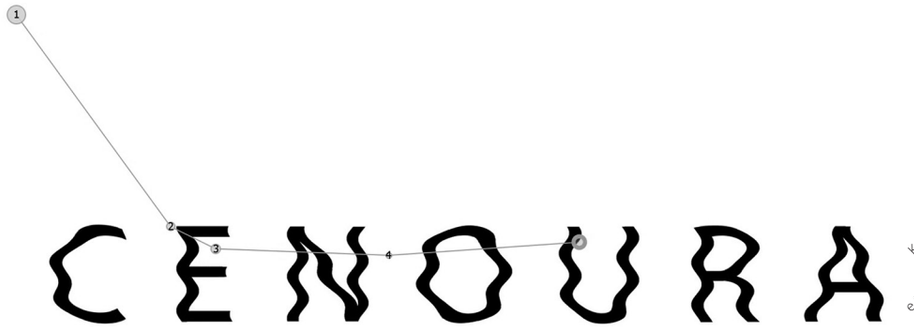


FIGURE 3

Saccade

A saccade is a short ballistic eye jump. In this Scan Path Visualisation, we can see saccades represented by the lines connecting fixations 1 to 2, 2 to 3, etc.

FIGURE 4

Fixation

Fixation is a stop between saccades. In Figure 4, we see saccades represented by circles. Larger circles represent longer fixation duration. In this example, we see eight different participants, represented by eight different colours, watching the same stimulus. The number inside the circle refers to the number of fixations each participant has made since the start of the stimulus.

While we are reading, our eyes make short ballistic jumps to find objects. This movement is called a saccade (see *figure 3*), and when the eyes stop, we call this a fixation (see *figure 4*). Fixations are the stop where we process the information. The fixation location is also called the attention point (Bojko, A. (2013) p.14). Eye-tracking systems allow us to see and analyze a scan path of the eye movement, represented by the series of saccades and fixations (see *figure 5*). The collected data can also be exported as heat maps, which are visualizations representing the duration of the fixations (see *figure 6*). Heat maps are relevant for researches focusing on either fixation duration or attention. We cannot measure the attention of a person directly, as attention is a subjective state of mind. Therefore, in this study, we will use fixation duration, measured in milliseconds, as an approximation of attention, on the basis that fixations are referred to as attention points (Bojko, 2013, p.19), and the assumption that if the eyes fixate on a location, the person's attention is focused on that location (Rayner, 1998, p.375). Note that saccades are also important in attention studies (Deans, 2010). During this jump, attention searches for a focus point and is not entirely absent. But it is assumed that attention is on another level than a level really useful for reading. Therefore, the experiment discussed in this paper will mainly describe the impact of typography on fixation duration and less on the measures regarding saccades.

FIGURE 5

Scan path visualization

Three screenshots of the Scan Path visualization of Fluid Typography's sub-category Construction. We see fifteen participants watching the stimulus at the same time. We can follow their fixations and saccades as the stimulus evolves.

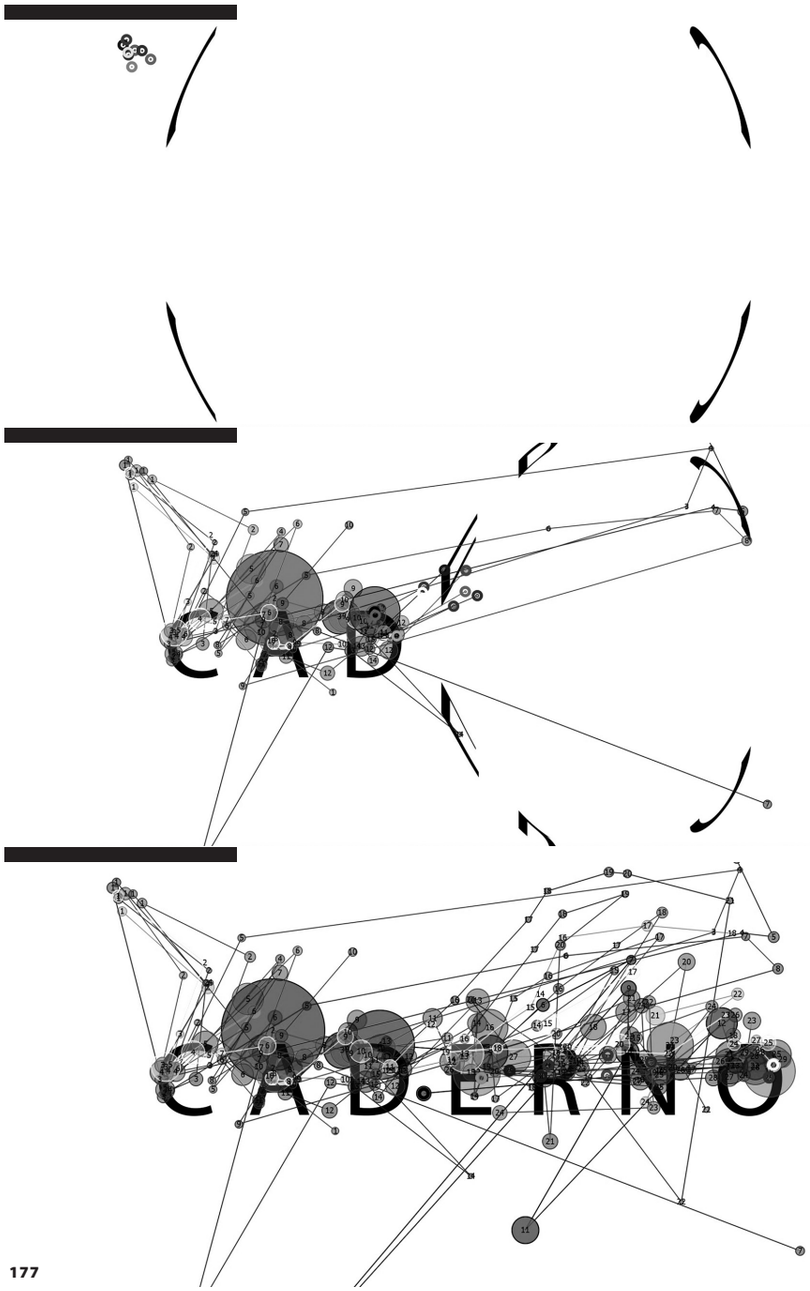
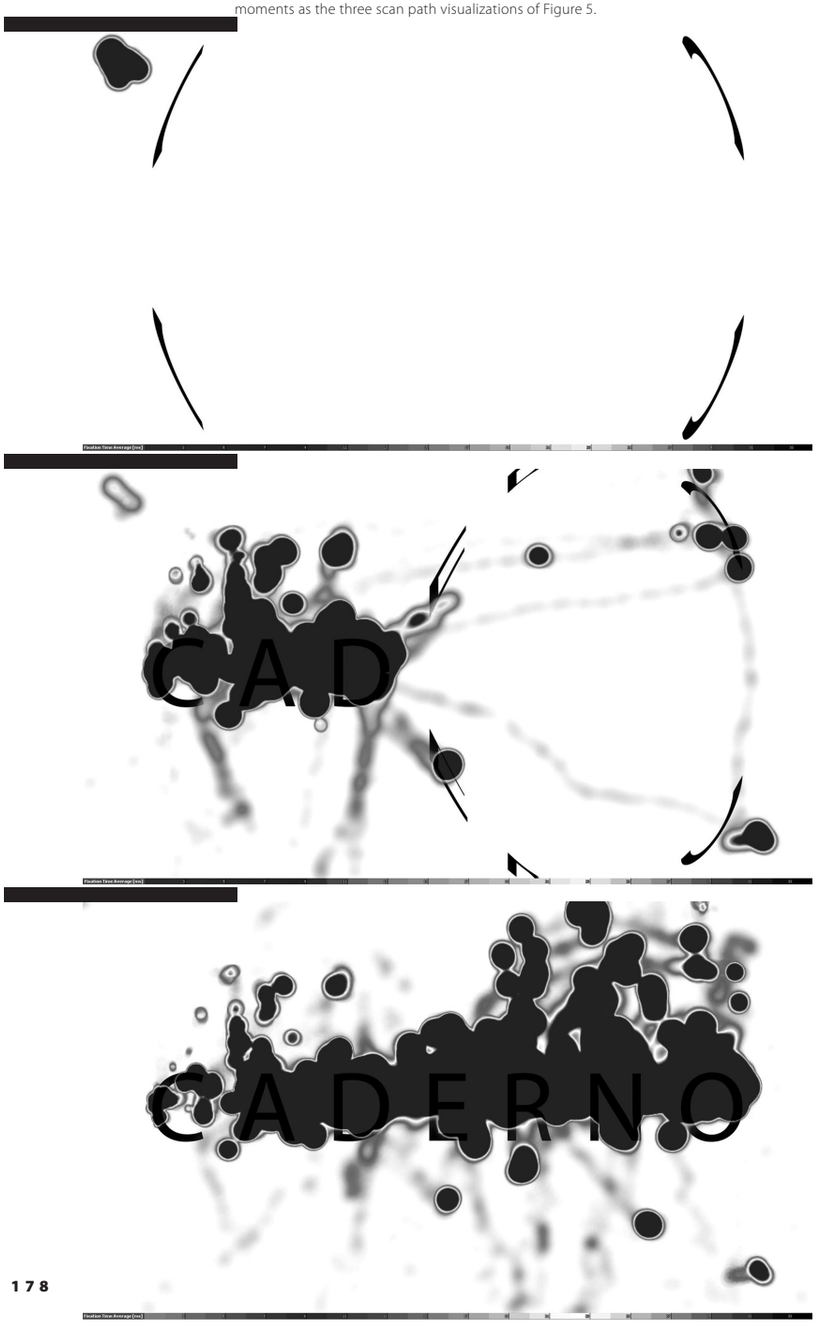


FIGURE 6

Heat map

In this figure, we can see a heat map, where the temperature of the colour (from blue to red in the original) represents the duration of the fixation for a given area. We see fifteen participants watching the stimulus at the same time. These are the heat maps at exactly the same moments as the three scan path visualizations of Figure 5.



Experiment Design

The experiment was designed to see what is the impact of the different Kinetic Typography sub-categories on attention duration, measured as eye tracked fixation duration, compared with the attention duration of Serial Presentation. The experiment consisted of showing a sequence of stimuli to a participant and recording eye movement data with an eye-tracking system. Each stimulus consisted of an animated 10 seconds video displaying one single word in one of the sub-categories of Kinetic Typography.

There were a total of 30 participants, 9 of which were non-native speakers. The participants were university students with an average age of 25 years. All the participants had normal or corrected to normal vision. None of the participants was diagnosed with any kind of disability.

The participants were divided into two groups: A and B (see *figure 7*). Each group had 15 participants, and each participant was shown seven videos of different sub-categories of Kinetic Typography. Participants from different groups were shown different matches between words and sub-categories to avoid the impact of the specific word in the results. All stimuli were shown in random order, and the switch between the stimuli was made automatically. The only instruction given to the participants was to watch the videos.

Method

Apparatus and Stimuli: All data were collected with Eye-tracker SMI iView X Hi-Speed 1250 in Psycholinguistic Laboratory at Faculty of Letras, University of Lisbon in November 2017. Every stimulus was controlled by its language, meaning, and length.

Language, Length, and Meaning

The Portuguese language was used for the stimuli. Since the experiment was conducted in Portugal, we wanted to avoid deviations in results due to unfamiliarity with the language (see *figure 7*). All the words had the same length to prevent length from becoming an additional independent variable. As well, all stimuli consisted of grammatically comparable words. If one stimulus were an adjective while the other was a noun, the speech part of the stimulus would be an additional variable to consider in the analysis. Moreover, some of the participants may 'prefer' one speech part over another, that way distorting the experiment results. Therefore, the same speech part was selected for all the stimuli - nouns. However, each stimulus contained a different noun. The objective was to avoid that the participants would initially read the word attentively but, due to the repetition, would not read it thoroughly in the following stimuli.

Results

We investigated the impact of (1) sub-categories of Temporal Typography (Serial Presentation, Vertical Scrolling Typography, Horizontal Scrolling Typography, Metamorphosis, Construction Revelation and Elastic Typography), (2) native language (3) word shown and (4) group on several different eye movement measures: Average Fixation Duration, Total Fixation Duration, Number of Fixations, Average Saccade Duration, Total Saccade Duration, Number of Saccades. For the statistical analyses, General Linear Models (GLMs) with repeated measures were built using SAS.

FIGURE 7

Stimulus per group

The groups were shown stimuli with the same word but different sub-categories.

Word	Meaning in English	Category	Sub-category	Group A	Group B
Chinelo	Slipper	Scrolling Typography	Scrolling Vertical	A	
		Fluid Typography	Revelation		B
Cenoura	Carrot	Fluid Typography	Revelation	A	
		Elastic Typography			B
Pintura	Painting	Serial Presentation		A	
		Fluid Typography	Metamorphosis		B
Violino	Violin	Elastic Typography		A	
		Scrolling Typography	Scrolling Horizontal		B
Formiga	Ant	Fluid Typography	Metamorphosis	A	
		Fluid Typography	Construction		B
Gravata	Tie	Scrolling Typography	Scrolling Horizontal	A	
		Serial Presentation			B
Caderno	Notebook	Fluid Typography	Construction	A	
		Scrolling Typography	Scrolling Vertical		B

The linear models showed no significant impact of the word that was shown nor of the group to which the participant belonged, confirming the experience was controlled. It was found that being non-native influenced the fixation variables for all categories, so a correction coefficient was calculated by the Generalized Linear Model for non-native speakers.

FIGURE 8

Results - A comparison of eye movement measurements between Serial Presentation and the categories of Kinetic Typography

Estimates of a Generalised Linear Model of several eye movement measurements depending on category and native language. The first row gives the estimate of eye movement measurements in milliseconds/counts for Serial Presentation. The other rows (except the last one) state for the different typefaces how much the estimates of the eye movement measurements differ from eye movement measurements of Serial Presentation. The last row shows how much the estimates of the eye movement measurements of non-native Portuguese speakers differ from eye movement measurements of native Portuguese speakers. Stars indicate if the estimate differ significantly from Serial Presentation: * = p < 0.05, ** =p<0.01, *** = p < 0.0001

Estimates	**Fixation Duration Total**	**Fixation Duration Average**	**Fixation Count**	**Saccade Duration Average**	**Saccade Duration Total**	**Saccade Count**
Serial Presentation	8427	443	23,2	48,1	828	17,6
Construction	-104	-172 **	6,4 **	-3,2	348 ***	8,2 ***
Revelation	-183	-148 **	5,0 **	-3,7 *	230 **	6,4 **
Metamorphosis	-21	-108 *	2,9	-3,4 *	177 *	4,8 **
Scrolling Vertical	43	-70	0,6	-0,9	99	2,1
Scrolling Horizontal	-80	-42	-1,1	0,0	75	1,4
Elastic Typography	-92	-23	0,5	-1,0	68	1,7
Non-Native Portuguese	277 *	96 **	-2,1 *	-0,9	-95	-1,5

Figure 8 can be interpreted as follows: The reference situation (in this research, Serial Presentation presented to a Portuguese native speaker) has a mean Average Fixation Duration of 443 milliseconds (see second row, column 2). The other rows are corrections on this reference number. E.g., the mean Average Fixation Duration of Construction is 443 – 172 = 271 ms. This difference with Serial Presentation is significant (P-value < 0.01). The correction of non-native Portuguese speakers is cumulative with the corrections of category. E.g. the mean of the Average Fixation Duration of a non-native speaker that is presented a stimulus in Metamorphosis = 443 (reference situation) – 108 (Metamorphosis) + 96 (non-native speaker) = 431 ms.

Some noteworthy results of Figure 8: (1) The category sub-category of the stimulus has never a significant impact on Total Fixation Duration. (2) The Average Fixation Duration of all categories of Temporal Typography were shorter than the Average Fixation Duration of a stimulus of Serial Presentation. However, significant differences only appeared in sub-categories of Fluid Typography: Construction, Revelation, and Metamorphosis. (3) The Total Saccade Duration of all categories of Temporal Typography were longer than the Total Saccade Duration of a stimulus of Serial Presentation. Significant differences only appeared in sub-categories of Fluid Typography: Construction, Revelation, and Metamorphosis. (4) Even if we tend to spot some trends, none of the variables of Scrolling Typography or Elastic Typography differed significantly from Serial presentation. (5) Both the number of Fixations and the number of Saccades differ almost always significantly from Serial Presentation for the three Fluid Typography categories: Construction, Revelation, and Metamorphosis. (6) Non-native speakers fixate less often but for longer, both on average as in total.

Apart from the analyses shown in the table, we also investigated the correlation between the Number of Fixations and Fixation Duration. There was a significant negative correlation between the Number of Fixations and all measures of Fixation Duration. The stimuli with the higher Fixation counts had shorter Fixation Durations. For Average Fixation Duration, the Pearson correlation coefficient equals -0.82 (P-value < 0.0001).

Discussion

There is a clear difference in the way participants looked at the three sub-categories of Fluid Typography compared to Serial Presentation. Construction differs the most from Serial Presentation, then Revelation, and finally Metamorphosis. There were no significant differences in Total Fixation Duration between all the categories, but with Fluid Typography, participants fixate for shorter durations, yet more often. Fluid Typography also resulted in Higher Total Saccade Duration when compared to Serial Presentation. The dynamic nature of Fluid Typography might cause this effect. In Fluid Typography stimuli, participants are shown several independent objects, and therefore their eyes move more often to focus on these objects, leading to the shorter but more often fixations. This duality of lower Average Fixation Duration but similar Total Fixation Duration makes us wonder whether Fluid Typography could be a better fit than Serial Presentation for people with different reading patterns such as shorter fixations, a characteristic of, for example, people with Attention Deficit Hyperactivity Disorder (Rayner, K., (1998) p. 378.).

Another relevant result was the lack of significant differences in any measures between Serial Presentation and Scrolling or Elastic Typography. These categories are less complex than Fluid Typography and, therefore, closer to Serial Presentation. The lack of significant differences here seems to suggest these are indeed good alternatives for Serial Presentation, which do not overly affect the reading experience of a single word, at least when measured by fixation and saccade measures.

A limitation of the study was the small number of participants per group. Another limitation was the considerable number of participants who were non-native speakers. Rayner and Schother have shown that non-native speakers have longer fixation times (Schoter, 2012). Therefore, in the future, a more controlled environment would be secured by excluding non-native speakers.

In the current study, we focused on stimuli consisting of a single word. The question naturally arises: what would the results look like if we worked with a sentence or even a text? Analyzing text could provide us insight on comprehension. The text comprehension task analysis could be a further step of this research to understand further the participants' experience of reading Kinetic Typography and how the longer Fixation Duration or higher Number of Fixations could be related to comprehension. Having a group of participants with distinct characteristics, such as ADHD, could test if Fluid Typography is suitable for different reading patterns and also highlight limitations with the use of certain categories of Kinetic Typography.

References

Bojko, A. (2013) *Eye Tracking The User Experience; A Practical Guide to Research*, Rosenfeld Media, Brooklyn, New York.

Brownie, B. (2015), *Transforming Type, New Directions in Kinetic Typography,* London: Bloomsbury Academic.

Deans, P., O'Laughlin, L., Brubaker, B., Gay, N., Krug, D. (2010) *Use of Eye Movement Tracking in the Differential Diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) and Reading Disability,* Article, https://www.scirp.org/journal/PaperInforCitation.aspx?PaperID=2920 (assessed on 2th of May, 2019)

Hong, Kim, Y., Goetz, E. T.,(1991-2004) *Neuropsychology and Cognition,* Chapter *Children's Use of Orthographic and Contextual Information in Word Recognition and Comprehension;* book series (NPCO, volume 11), pp. 205.

Lupton, E. (2014) *Type on Screen: A Critical Guide for Designers, Writers, Developers, and Students (Design Briefs),* New York, Princeton Architectural Press, pp. 14.

Rayner, K., (1998) *Eye Movements and Information processing: 20 year of research,* University of Massachusetts, Article, http://www.infinitychallenge.com/clamlist/Rayner_1998.pdf (assessed on 7th of December 2018) pp. 375.

Schoter, E.R., Rayner., K. (2012) *Eye movements and word recognition during reading, Visual Word Recognition Volume 2: Meaning and Context, Individuals and Development.* Psychology Press; New York, pp. 73-101.

Wong, Y. Y. (1995) *Temporal Typography: Characterization of Time- varying Typographic Form,* MC thesis, pp. 6, https://dspace.mit.edu/bitstream/handle/1721.1/29102/34312115-MIT.pdf;sequence=2 (accessed on 3th of December 2018).

Woolman, M. And Bellantoni, J. (1999), *Type in Motion: Innovations an Digital Graphics,* London: Thames & Hudson, pp. 9.

Authors

Milda Kuraitytė is a PhD student in Communication Design at the Faculty of Fine Arts, University of Lisbon. Previously, Kuraitytė completed her master's degree jointly at the Faculty of Architecture in the University of Lisbon. More recently, Kuraitytė's research interests have broadened beyond Design and Fine Arts to include Psycholinguistics and the possibilities offered by the eye tracking technology when applied to Typographical research. Kuraitytė's present research, Tracking Kinetic Typography, analyses Kinetic Typography by using eye tracking technology, in a collaboration with the Psycholinguistics Laboratory at the University of Lisbon. Kuraitytė is also an active member of the European Cooperation in Science and Technology groups E-Read and ELN. Under these program, she recently collaborated with PLX-MAD Art School in Belgium and the Aristotle University of Thessaloniki in Greece, where she developed studies on reading on screen and comprehension.

— Faculdade de Belas-Artes da Universidade de Lisboa,
— Largo da Academia Nacional de Belas Artes 4, 1249-058 Lisboa, Portugal

Prof. Dr. Ann Bessemans is a legibility expert and award-winning graphic and type designer. She founded the READSEARCH legibility research group at the PXL-MAD School of Arts and Hasselt University where she teaches typography and type design. Ann is the program director of the international Master program 'Reading Type & Typography'. Ann received her PhD from Leiden University and Hasselt University under the supervision of Prof. Dr. Gerard Unger. She is a member of the Young Academy of Belgium and lecturer at the Plantin Institute of Typography.

Prof. Dr. Erik Nuyts is researcher and lecturer at the University College PXL and associate professor at the University of Hasselt. He got a master degree in mathematics, and afterwards a PhD in biology. Since his specialty is research methodology and analysis, his working area is not limited to one specific field. His experiences in research, therefore, vary from mathematics to biology, traffic engineering and credit risks, health, physical education, (interior) architecture and typography. His responsibilities both at the University College PXL as at the University of Hasselt involve preparation of research methodology, data collection and statistical analyses in many different projects. He is responsible for courses in research design, statistics and mathematics.

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