Visible Language

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Visible Language

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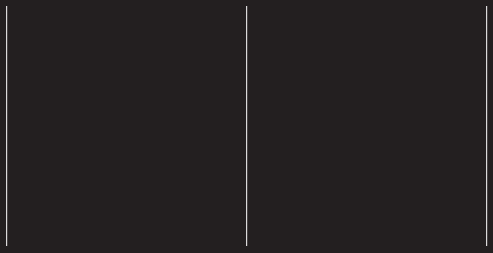

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An Exploratory Study Evaluating the Influence of Taller Stripe Patterns on Reading Comfort Using Ranking Tests, Reading Tests, EEG's, and Eye Tracking

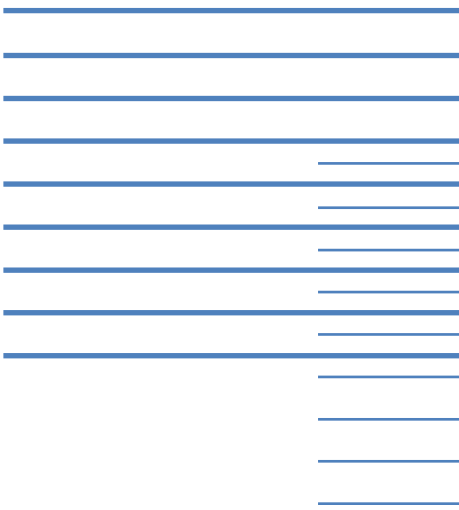
Maarten Renckens
Independent Researcher

Abstract

The Latin script has a vertical stripe pattern in it, which is known to cause visual discomfort. This study started from the hypothesis that a lower stripe pattern could result in better visual comfort than a taller stripe pattern. I evaluated this hypothesis with several letterforms and their correlating stripe patterns, tested in four independent tests: a ranking test, reading progression, measuring neurological response, and measuring eye movements. The results provide some indications that taller stripe patterns are less comfortable, but those results were mostly outside the range of common letter sizes for reading texts. Also, results for letterforms and plain stripe patterns differed. The results suggest that multiple design parameters influence reading comfort simultaneously, and that *'the number of design details per surface'* is a design parameter that could play an important role in determining reading comfort. This needs to be evaluated in further studies.

Keywords

Reading Comfort, Lower Stripe Patterns, Number Of Details, Optimising Design Parameters



1. Research Introduction

Letters play a game of black and white, forming a repetitive stripe pattern through the repetition of black strokes. It is generally known that stripe patterns could be uncomfortable to look at, possibly arousing illusions of color, shape, and motion (Wilkins, 2012).

The effects of the stripe patterns are indicated with the term *'visual discomfort'*, the *'the subjective adverse effects encountered on viewing certain stimuli'* (e.g. O'Hare & Hibbard, 2013). In the context of research into the stripe patterns within text, I propose to use the term *'reading comfort',* which is an existing word in the Dutch language: 'leescomfort'. It is applicable to processing visual information and is commonly applied to indicate a concept as *'the best possible circumstance for reading'* (see: Vivlio, 2020; Sensotec, 2020; Denksport, 2020; Amazon, 2020; De Standaard, 2006). Because the term is not mentioned in the most important Dutch dictionaries, (Van Dale, 2015; Nederlandse Taalunie, 2001), I propose the definition: ***'The ease with which visual information can be processed.'***

While processing info, '*reading comfort'* is influenced by several factors such as the text layout (set with a clear structure, the amount of visual comfort aroused…), the content (including the already acquired knowledge/foreknowledge of the reader, being acquainted to the topic), technical aspects of writing (is it well-written), the working of the brain (learning disabilities, brain injuries…), the environment (disturbing noises)… (this list is extended from Duin, 2013). In my definition of reading comfort, an easy processing of information correlates with a high comfort.

There is not much information about the relation between the stripe pattern in letters and their reading comfort. Stripe patterns are present in two directions: horizontally through the lines of text (e.g. Wilkins, 2012) and vertically through the vertical strokes in the letter shapes (e.g. Wilkins et al., 2007). In text, stripe patterns can hinder readers sensitive to visual stress such as readers suffering from migraine (Wilkins, 2007), and can cause epileptic seizures (Harding et al., 2017; Wilkins, 2012). Stripe patterns in common visual input (TV broadcasts, games) are regulated to avoid such negative effects (British Independent Television Commission, 2001). But regulation does not exist for letters, even though stripe patterns are an inherent part of Latin letterforms.

Regarding the stripe pattern, earlier research on letterforms focused entirely on the horizontal and unequal distribution of the stripe pattern, but none focused on taller letters. This is a pity. Several letters from the Latin alphabet are bound to their strong one-directional pattern, but the height of the stripe pattern just happens to be an independent design parameter which a designer can change easily. Other parameters of the stripe patterns that can be changed are the space between the vertical letter strokes and their thickness. Even more, each individual letter,

each typeface, each font (a variation on one typeface) and each individual letter already possesses a stripe pattern of its own. For instance, a bold font has a smaller distance between the vertical strokes and thicker vertical strokes than the light font within the same typeface. Designers and researchers did experiments on the horizontal distance between vertical stripes. It came forward that words with a rigid stripe pattern take a longer reading duration than words with a less rigid stripe pattern such as present in rounded letters, such as the word "mum" versus the word "dad" (Wilkins et al., 2012; Jainta, Jaschinski & Wilkins, 2010). A less evenly spaced stripe pattern improves legibility for children with a visual impairment (Bessemans, 2012) and increases the speed of word recognition (Wilkins et al., 2007). However, there are also parameters which a type designer cannot change. For example, in an experiment (not involving letters) from Pennachio and Wilkins (2015), viewers favor visual input wherein the stripe pattern is set up in several (overlapping) orientations. But applying this to letters would limit the letters' legibility and would look very sloppy.

Studying the stripe pattern in letters has the purpose of increasing the 'reading comfort'. In earlier studies, the stripe pattern was defined as 'the component strokes' or as 'the sequence of strokes' (Bessemans, 2012; Wilkins et al., 2007). This does not clarify the exact position of the stripe pattern in letters [also named the rhythm]; and specifically, not its height. A clear definition was needed to continue. The following definition was considered viable: 'The rhythm in type is the sequence of the longest continuous black masses within the letters, in any direction' (Renckens, 2020). This definition consequently positions the stripe pattern, starting from above the bottom serifs if present, up to the letters' counter forms (the white). Based on this definition, the stripe pattern has several different occurrences in different letter shapes [Figure 1]. On those differences on which this study focusses.

2. Hypothesis and Research Setup

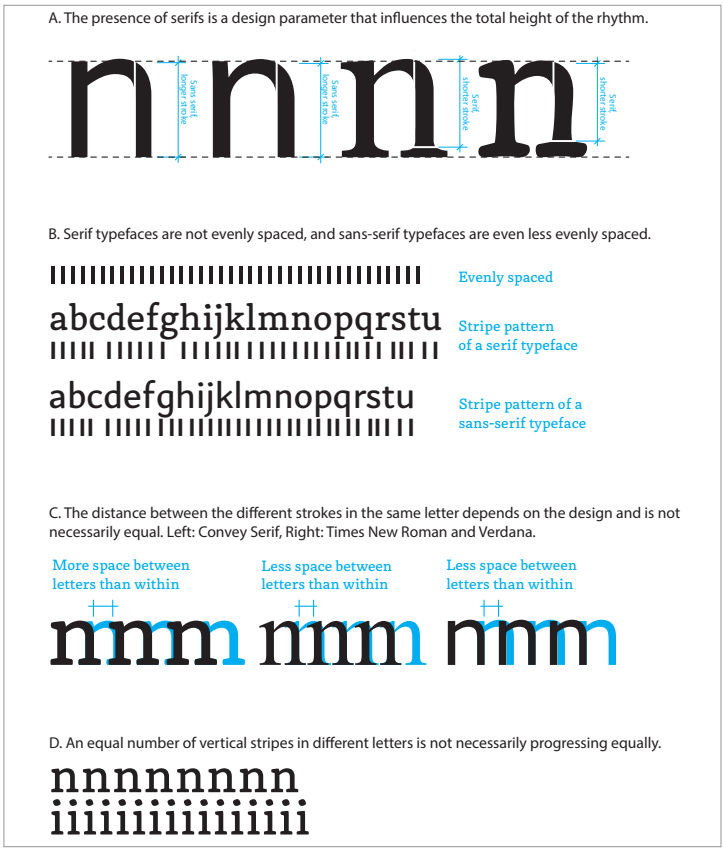
To improve the reading comfort of letters, more knowledge about the effect of the stripe pattern in letters on the reading process is needed. The current study primary focuses on how reading comfort is influenced by taller stripe patterns. A secondary focus is on how more condensed and less evenly spaced stripe patterns influence reading comfort. This study starts from the following paradigms:

1 It is known that stressful visual information results in a changed neurological response, including spiked waveforms (Wilkins, 2012). This causes visual discomfort when visual stimuli provoke an extremely strong neural response (O'Hare & Hibbard, 2011). Taller and more condensed stripe patterns are more prominent, which could result in more neurological response.

2 A taller stripe pattern has more vertical distance from top to bottom. Therefore, it could cause more eye closures and require more time before a line of text is scanned with the eyes than a smaller stripe pattern.

FIGURE 1:

Stripe patterns differ between several typefaces and letterforms.



i *The height of the stripe pattern is taller in sans-serif typefaces [Figure 1a]. This is because serifs shorten the vertical stripes (Renckens, 2020);*

ii *The stripe pattern is more condensed in some letters of sans-serif typefaces than within the same letters of serif typefaces [Figure 1b]. This is because serifs require additional space between the letters, in order not to touch each other.*

iii *The stripe pattern in a serif typeface is more evenly spaced and the stripe pattern in a sans-serif typeface is less evenly spaced, but neither are completely evenly spaced [Figure 1b]. This is again because serifs require additional space between the letters, in order not to touch each other.*

iv *For letters with a vertical stroke, the space between consecutive letters is in most cases smaller than the space within letter shapes [Figure 1c].*

3 Crowding (a limited recognition of objects further away from the eye's fovea due to neighboring objects close by) relates to closely spaced contours (Jainta, Jaschinski & Wilkins, 2010). Therefore, it could be that horizontally more condensed stripe patterns in sans-serif typefaces require more time before a line of text is scanned with the eyes than the less condensed stripe pattern in serif fonts.

4 The effects from (1), (2) and (3) could cause a less efficient reading progression, resulting in a slower reading pace.

Based upon the paradigms, the hypothesis is stated that "taller, less evenly spaced, and more condensed stripe patterns could be less effective for the reading comfort." If the hypotheses could be confirmed, this research will not only provide guidelines for type design with more reading comfort but could also contribute to answer the frequently asked question 'which is better: a serif or sans-serif typeface?', for as far as a simple answer can ever be provided on this question.

In this study, the hypothesis is tested with four tests, each focusing on a different methodology and with different research questions (discussed later). The basis for all tests is the typeface "Convey," designed for reading text by the author and adjusted to contain a total of 19 different fonts [Figure 2]. Some of these fonts contain letters, while others represent the stripe pattern within the letters.

The main difference between the fonts is the height. The number for each font's name refers to certain measurements used in type design (UPM, Units per Em). All fonts containing letters are designed to respect internal and external research validity. This means that on the one hand, only one parameter changes (the height of the stripe pattern), ensuring that valid comparisons can be made, but on the other hand, each font is individually re-designed instead of just being vertically scaled. This avoids disproportion and ensures that the fonts are suited for real-life reading materials. Some special fonts were added: a horizontally evenly spaced stripe pattern {R700reg} and two '700-extra' fonts, fonts with a strikethrough {Rsans700_mid and Rserif700_bot}. Those '700-extra's' do not refer to letterforms but serve to test the visibility of stripe patterns when they are shortened by an interruption.

Because not all letters of the Latin alphabet possess the same stripe pattern, the test materials of this research mostly focus on the letters {nmiu}, which contain straight strokes. For some tests, additional letters are required. Those will be described in the chapter about the test itself.

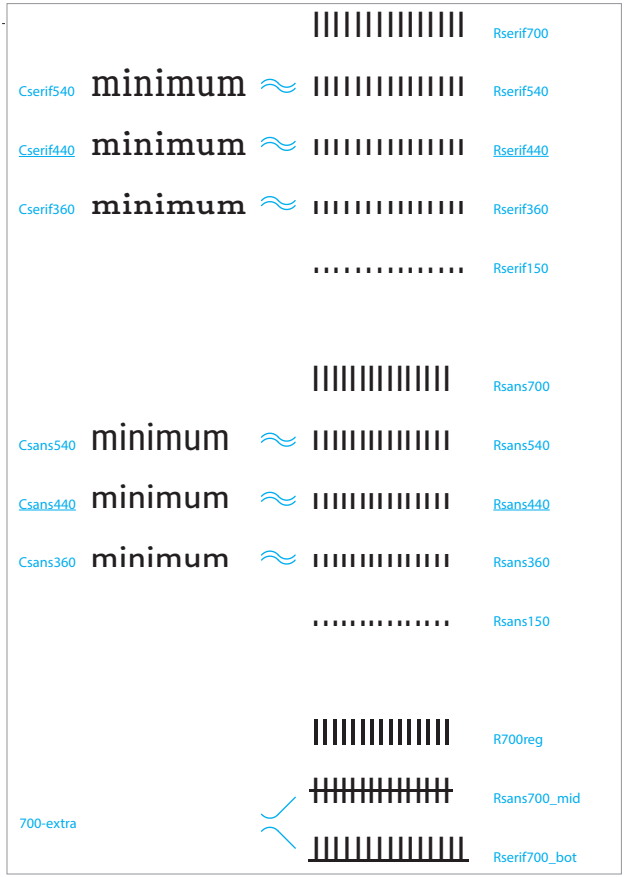
In all test materials, attention is paid to how the multiple text lines were set. It is known that lines of text also form a horizontal stripe pattern, possibly causing visual discomfort. It is known that readers

prefer more line spacing in the layout (Wilkins & Nimmo-Smith, 1987). In the testing materials for this research, text is set with a slightly larger leading (130%) than the often-used default (120%). That extra spacing ensured that the fonts with a larger x-height did not come too close to each other. This line height of 130% was kept throughout this whole research.

For this research, most participants are random students at the university where the lab is situated. Some participants who couldn't make their way to the lab participated at another place in the tests 1 and 2, because those tests didn't require the eye tracking camera or the EEG-cap. A fee was paid for participating, independent of the answers on the tests. The only requirement for participants is that they needed to have normal or corrected to normal eye vision. Regarding the language, non-Dutch speakers are excluded from the reading aloud test; but could participate in all other tests. Learning disabilities are not a base for exclusion but are registered and added to the database for analysis in possible follow-up studies.

FIGURE 2:

All 19 fonts of the typeface 'Convey' (a 'font' is a variation on a typeface). The number indicates the height, with the number 440 correlating with a common x-height.



3. Test 1: Ranking According To Visual Comfort

3.1. Test 1: research questions

1 Is a taller stripe pattern in text perceived as less favorable to look at, compared to lower stripe patterns?

2 Is a more condensed and more unevenly spaced stripe pattern in text perceived as less favorable to look at, compared to wider stripe patterns?

3.2. Test 1: research materials

For the first test, the fonts from Figure 2 are set in the word minimum, in a 5x5 grid [Figure 3]. All 19 fonts are printed on separate papers in high definition. The 13 fonts with stripes form the first series and the 6 fonts with letters form a second series.

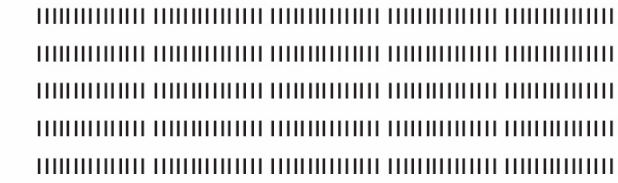
3.3. Test 1: methodology

A total of 51 persons participated in this test. For this test, participants were first asked to rank the 13 sheets of paper containing stripe patterns, and thereafter to rank the 6 sheets with letters. There was no time limit on the test.

All sheets were put on a table by the researcher in a random way, not in a straight line, so participants didn't receive a clue about the expectations of the research.

FIGURE 3:

Test materials for test 1 consisted of 13 papers with different stripe patterns and 6 papers with different letters.



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3.4. Test 1: data collection

Participants were asked to rank the stripe patterns from most comfortable to look at to the least comfortable to look at. If a participant found this terminology confusing, the questions were re-phrased as "Which ones could you easily look at for a long time" and/or "Which ones hurt your eyes." After the participant ranked the stripe patterns, a conversation was started about the order of the stripes. Some participants told me that they tried to read the stripe pattern or made certain associations with it, which was obviously not the intention: some recognized the word 'minimum' in it, others preferred the strikethrough pattern because it looked like the drawings on a prison wall. In those cases, when a participant clearly diverged from the intention, those participants were asked to do the test again concentrating on the feeling the stripe pattern provided them. In case a participant said that some stripe patterns were 'clearer' than others, they were also asked what they meant. In most of those cases, participants then replied that they could read the stripe patterns better. Those participants were also asked to do the test again and to concentrate on their feelings.

After the stripe patterns were ranked, participants were asked to rank the 6 sheets with the letters from the most comfortable to read to least comfortable to read. The assignment was clarified with the explanation "try to imagine you need to read a very long text with each typeface. Which one would you prefer in that case?"

3.5. Test 1: results

The following tables all illustrate the results from more comfortable' (left) to 'less comfortable' (right). Tables 1 and 3 list the fonts individually, tables 2 and 4 groups them per similar height plus the '700-extra's' separated. The expected place of each font in the ranking is indicated by a border. Lighter background colors indicate that the font is often ranked in this position. The lower fonts were ranked more often as 'more comfortable' (left), the taller fonts were ranked more often as 'less comfortable' (right). Notice that the '700-extra' fonts were ranked as the least comfortable to look at.

3.6. Test 1: analysis

A Friedman test was used for the analysis of the difference in the ranking of the fonts by the participants with α=0.05. A rejection of the null hypothesis means that the ranking of at least one font is different.

A post-hoc paired comparison of the ranking of the fonts via the Eisinga exact test with α=0.05 corrected with the

TABLE 1:

For the individual stripe patterns, participants ranked the smaller stripe pattern as more comfortable (left) and taller stripe patterns as less comfortable (right); but the results are not always very distinct and the two '700-extra' fonts are ranked the least comfortable, against the expectations. Each stripe pattern had 51 occurrences.

	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6	Rank 7	Rank 8	Rank 9	Rank 10	Rank 11	Rank 12	Rank 13
Rserif150	55%	14%	8%	2%	4%	4%	2%	2%	4%	2%	2%	2%	0%
Rsans150	14%	55%	0%	6%	6%	2%	2%	6%	2%	2%	6%	0%	0%
Rserif360	6%	4%	35%	16%	8%	4%	4%	10%	0%	0%	2%	10%	2%
Rsans360	2%	4%	8%	25%	8%	10%	10%	4%	8%	6%	0%	4%	12%
Rserif440	0%	8%	16%	16%	14%	20%	8%	6%	6%	4%	4%	0%	0%
Rsans440	0%	2%	0%	10%	18%	24%	10%	6%	14%	6%	10%	2%	0%
Rserif540	12%	4%	12%	4%	16%	8%	24%	12%	6%	2%	2%	0%	0%
Rsans540	0%	2%	2%	6%	6%	8%	18%	33%	12%	4%	10%	0%	0%
Rsans700_mid	0%	2%	2%	4%	0%	2%	0%	2%	2%	10%	6%	10%	61%
Rserif700_bot	4%	0%	10%	4%	2%	0%	4%	6%	6%	10%	2%	43%	10%
Rserif700	2%	6%	2%	6%	10%	4%	10%	6%	29%	10%	10%	6%	0%
Rsans700	0%	0%	4%	2%	6%	10%	2%	8%	4%	27%	22%	16%	0%
R700reg	6%	0%	2%	0%	4%	6%	8%	0%	8%	18%	25%	8%	16%

TABLE 2:

Also, when grouped per similar height, participants ranked the smaller stripe pattern as more comfortable (left) and taller stripe patterns as less comfortable (right); but the two '700-extra' fonts are ranked the least comfortable, against the expectations. Each stripe pattern had 102 occurrences, except for the 700's which had 153 occurrences in the group.

	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6
150-group	69%	8%	8%	6%	5%	5%
360-group	8%	42%	15%	14%	7%	15%
440-group	5%	21%	37%	15%	15%	8%
540-group	9%	12%	19%	43%	12%	6%
700-extra	3%	10%	2%	6%	14%	66%
700-group	5%	5%	13%	11%	32%	34%

TABLE 3:

Participants ranked the middle size letters {440} as most comfortable (left) and the {360} and {540} sizes as less comfortable (right). Each font with letterforms pattern had 51 occurrences.

	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6
Cserif360	2%	14%	18%	14%	27%	25%
Csans360	12%	8%	16%	16%	25%	24%
Cserif440	35%	24%	18%	20%	4%	0%
Csans440	33%	27%	16%	20%	4%	0%
Cserif540	10%	12%	20%	16%	27%	16%
Csans540	8%	16%	14%	16%	12%	35%

TABLE 4:

Also, when grouped, participants ranked the middle size letters {440} as most comfortable (left) and the {360} and {540} sizes as less comfortable (right). Each stripe pattern had 102 occurrences.

	Rank 1	Rank 2	Rank 3
360-group	18%	31%	51%
440-group	60%	36%	4%
540-group	23%	32%	45%

Bonferroni method compares if the ranking of each pair of the fonts is different and allows the identification of the differences in the fonts in combination with the summed ranks. A rejection of the null hypothesis means that the ranking of at least one font is different.

The Friedman test resulted in p-values of <0.0001, meaning that there is a difference between the ranking of the fonts. The mid-rank is used to rank the aggregated groups.

Analyzing the 13 fonts with stripe patterns

Rserif150 and Rsans150 are ranked statistically significant more often as 'most comfortable'. Ranking the fonts by the summed rank over the subjects

shows the following order (a lower summed rank means ranked as 'more comfortable'): Rserif150 (146) > Rsans150 (179.0) > Rserif360 (263.0) > Rserif440 (280.0) > Rserif540 (280.0) > Rsans360 (338.0) > Rsans440 (358.0) > Rsans540 (384.0) > Rserif700 (394.0) > Rsans700 (469.0) > Regular (483.0) > Rserif700_bot (485.0) > Rsans700_mid (582.0). There is no difference in ranking between those two 150 fonts. The eleven other fonts are ranked statistically significant 'less comfortable' than the 150 fonts, but there is no difference between these eleven fonts.

But when grouping fonts with similar height together, the 150-group is again significantly more often ranked as 'most comfortable', but the 700-extra's group is now significantly more often ranked as 'least comfortable'. The summed rank here is R150 (162.5) > R360 (300.5) > R440 (319.0) > R540 (332.0) > R700 (448.7) > 700-extra's (533.5), in which a lower number means ranked as 'more comfortable'. There is no statistically significant difference between the 360, 440, 540 and 700-groups, which are positioned in the middle.

Analyzing the 6 fonts with letters

Csans440 and Cserif440 are statistically significant more often ranked as 'more comfortable' than the other fonts. This results in the summed rank is Csans440 (119.0) = Cserif440 (119.0) > Cserif540 (197.0) > Csans360 (207.0) > Csans540 (211.0) > Cserif360 (218.0), in which a lower number means ranked as 'more comfortable'. There is no difference in ranking between those two 440 fonts. There is no statistically significant difference between the other four fonts.

When grouping fonts with similar heights together, the results are the same: the 440-group is statistically significantly more often ranked as 'more comfortable' than the other groups. The summed rank is C440 (119.0) > C540 (204.0) > C360 (212.5), in which a lower number means ranked as 'more comfortable'. There is no statistically significant difference between the other two groups.

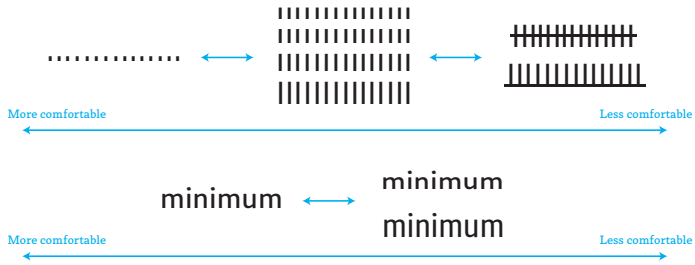
Participants' comments

Participants' comments were in line with the results. For the stripe patterns, participants indicated that the lower stripe patterns caused some order, some rest, while the taller stripe patterns and the stripe patterns with strike throughs were restless. For the letterforms, participants pointed out that the middle sizes were the ones they were used to, and that the other sizes were strange, and sometimes too crowded.

Only one participant differentiated and expressed 'the more evenly spaced fonts' (serif) versus 'the less evenly spaced fonts' (sans-serif). She said that she was an interior architect and the less evenly spaced stripe patterns were 'not nice to look at.'

FIGURE 4:

Graphic visualization of the results. The smallest stripe patterns are ranked significantly more often as comfortable than all other stripe patterns. When the stimuli are grouped together per height, also the 700-extra's-group is significantly more often ranked as less comfortable. For the letters, the middle size was ranked more comfortable than the taller or smaller letters.



3.7. Test 1: conclusions

There are significant differences in the ranking of stripe patterns and letters from the least favorable to the most favorable.

Participants were sensitive to smaller stripe patterns, even if they are only a couple of millimeters high. The smallest stripe patterns ranked most comfortable. However, the visual differences between all the stripe patterns were probably too small, participants had some trouble distinguishing the differences. The (non-significant) results show a tendency that how taller the stripe patterns become, the less comfortable they are ranked. Doing this test again with lesser and more distinct stimuli will probably result in clearer results.

What strikes most is that the 700-extra's, the stripe patterns with a strikethrough, are ranked least comfortable, even less than the 700-straight fonts. While I hypothesized that a strikethrough would break the stripe pattern, making it more comfortable, it seems that the stripe patterns with a strikethrough are the least preferred. It seems that having more details in sight is less preferred than having a tall stripe pattern in sight. A future study can dive deeper into this to clarify those results.

This test clearly proves that the findings for the stripe patterns are not applicable on letters. For the letters, the middle size was ranked as the most comfortable. The results could not clarify why this occurred. This again is probably because there are more details to process. Future studies will clarify.

4. Test 2: reading progression in 45 seconds

4.1. Test 2: research questions

1 Does a taller stripe pattern in text cause a slower reading progression compared to lower stripe patterns?

2 Does a more condensed and more unevenly spaced stripe pattern in text cause a slower reading progression compared to wider stripe patterns?

4.2. Test 2: research materials

This test applied the letterforms {Cserif360, Cserif440, Cserif540, Csans360, Csans440, Csans540}. For this test, each font was applied to a list of random words and pseudo-words, half a page long [Figure 5]. Each word contained only one syllable. The fact that all words were of equal length enabled counting the number of words read within a specific time span.

The test was designed in such a way that learning effects were avoided. First, the test was designed four times, each time with a different random order of the fonts. Second, the list of words on a page was long, avoiding that participants would memorize words and thus unintendedly would increase the reading speed.

FIGURE 5:

Test materials for test 2 is a reading text consisting of random words from one syllable

nep diep gig dool blij pel peel gum eb hiel mop buil gun gong lui lijm lig moe end dood glooi hulp dub gin loop glom bel moei gil elp zes hooi dop bed je neep huld bid held pijn een leb in blond mog sol om nul boog bloei tien fa led pep doog het duim hield goed pol ing ei jong eb blup muil god lijd beul puin del bon leun dun geel oud leid rel peld acht gilt hond pel beun iel doom boom pep jij lip bug mob luid bui hup don dood len nen hoen ju nog pi hen hop kon plooi gem pulp pijp heil joop deel

4.3. Test 2: methodology

There were 26 participants who participated in this test. Non-native Dutch speakers were left out because language was a parameter that could influence the results.

The researcher shuffled the sheets before the test began, so he did not see the order in which the participant would read the texts. Participants read aloud each of the six pages for 45 seconds. The reading progression was registered by the researcher, who counted the number of words a participant read and the number of reading errors on each of the six pages. The test took more or less five minutes per participant.

4.4. Test 2: data collection

The reading test measures the reading progression of readers by counting the number of words read aloud and the number of errors while reading within a timespan of 45 seconds.

4.5. Test 2: results

Each font was read once by each participant, so each font was read a total of 26 times. Table 5 lists the 6 fonts with letters individually and table 6 lists the 6 fonts with letters grouped per similar height.

TABLE 5: *The results of the reading aloud test, with all fonts individually. Lighter background colors indicate the 'best' reading achievements.*

	# words	av. words read	# errors	av. Errors
Cserif360	2058	79.154	34	1.65%
Csans360	2085	80.192	29	1.39%
Cserif440	2097	80.654	30	1.43%
Csans440	2160	83.077	35	1.62%
Cserif540	2006	77.154	38	1.89%
Csans540	2047	78.731	31	1.51%

TABLE 6: *The results of the reading aloud test, with the fonts grouped per similar height. Lighter background colors indicate the 'best' reading achievements.*

	# words	av. words read	# errors	av. errors
360	4143	79.673	63	0.01521
440	4257	81.865	65	0.01527
540	4053	77.942	69	0.01702

4.6. Test 2: analysis

A generalized linear mixed model with Tukey's correction for (pairwise) multiple testing (p=0.05) was used to test if the {number of read words} or {the number of reading errors} differs between the fonts, considering the correlation of the reading test for the same participant. A rejection of the null hypothesis means that there is a difference between the number of read words or the number of reading errors between the fonts. The pairwise comparison of the number of read words per font provides two statistically significant differences [Figure 6]:

- In Cserif540 are less words read correctly than in Csans440 (p=0.0077).
- When grouping letters with similar height, group C540 has less words read correctly than in group C440 (p=0.0036).

4.7. Test 2: conclusions

In the taller fonts, statistically significant more reading errors are made. This was expected and suggests that there is an effect of taller stripe patterns on reading.

FIGURE 6:

In all cases that provided significant results, the C540 fonts were read with more reading errors than in the C440 group. The difference in reading speed was not significant.

The (non-significant) results provide additional info which is worth looking into. The 440-group allows readers to read more words aloud within a specific time span. And the fonts with which the most words are read aloud, are not read with the least errors. However, those results are not statistically significant in the current dataset. On this, more research is needed.

5. Test 3: EEG recordings of neurological response while looking at taller/more condensed letters

5.1. Test 3: research questions

1 Does a taller stripe pattern in text induce more neurological response compared to lower stripe patterns?

2 Does a more condensed and more unevenly spaced stripe pattern in text induce more neurological response compared to wider stripe patterns?

5.2. Test 3: research materials

This test evaluates if the neurological response changes for different stimuli. The screen was a 24-inch VIEWPixx /EEG with a resolution of 1,920 x 1,080 pixels.

Subtest 1a

For the first EEG subtest, visual stimuli were made by setting the word 'minimum' in all 19 typefaces from Figure 2. The visual stimuli were flashed on the screen for 300ms [Figure 7]. The short duration was intended to avoid eye movements, and thus to avoid additional neurological response. Each image was preceded by a blank screen that was visible for 2,000ms with a dot in the middle. The dots allow the participant to keep the eye at the center of the screen between different stimuli.

FIGURE 7:

Zoomed-in example materials for the first subtest. The word 'minimum' is flashed for 300ms in the 19 different fonts, containing both letters and stripe patterns. For the actual test, the colors were reversed to white text on a black background.

Subtest 1b

This test evaluates if the neurological response changes when stimuli are shown for a longer time period. For the second EEG subtest, visual stimuli were composed of five lines of text set in all 19 fonts from Figure 2 [Figure 8]. Only the word 'minimum' was used in these lines of text, to avoid possible different associations with different words, and thus different brain activities. The stimuli followed upon each other with a duration of 2,000ms, and in this subtest there were no dots between the different stimuli.

Subtest 2

This test evaluates if the neurological response changes when text intended to read silently is set in different fonts. In this subtest, again the typeface Convey was used, but only the six fonts containing letters. Additionally, four other fonts were added, containing longer ascenders/descenders (parts below the baseline and above the x-height: bdpqj) to reach a more visible stripe pattern. Those fonts are indicated by the term 'min' or 'plus' in their names in Figure 9.

To present those fonts to the participants, sentences with random words were created. The same words were used every time, ensuring the same difficulty level on every page (and thus for every font), but the order of the words was mixed every time in order to avoid learning effects. When a page was read, the participant pressed a key to go to the next font.

FIGURE 8:

Zoomed-in example materials for subtest 1b containing a grid of 5 words long and five lines. The top image shows the assumed visually most stressful stripe pattern and the bottom image shows the assumed visually most stressful letters that were presented to the participants for 2,000ms. For the actual test, the colors were reversed to white text on a black background.

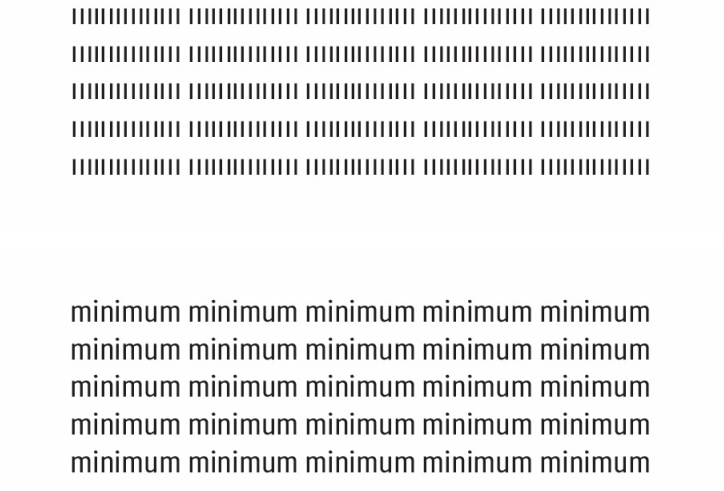
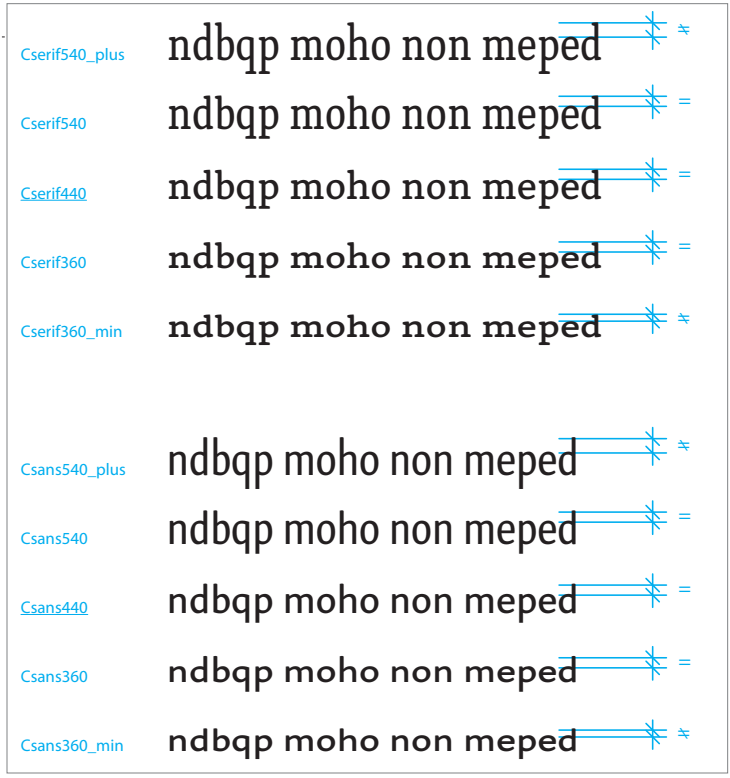


FIGURE 9:

Subtest 2: the testing fonts, with differences in the ascender and descender lengths on the plus and min fonts, to further increase/ decrease the length of the stripe pattern in a way that is commonly applied in type design.



5.3. Test 3: methodology

A total of 42 persons participated. The test lasted about an hour per participant, including half an hour of attaching the EEG cap to the scalp wet gel and the trials for testing the connection. During the set-up, participants were put at ease with some small talk about daily-life subjects.

For subtests 1a and 1b, the participant was asked to look carefully at the screen. To keep participants' attention, they were told to look/read with attention, because they would receive questions about what they were to see. For test 2, participants were told to look to the screen and to read with attention and at a normal speed, and that they should vocalize each word in their head. To keep their attention, they were told that a question would follow at the end.

The three subtests were shown to the participants in a random order, so not every participant started with test 1A. At the end of each subtest, participants were asked if 'they noticed something, followed by open questions inviting them to describe their perception and possible hindrances encountered during the test. To keep the participants' attention, the visual stimuli 'Cserif440' and 'Csans440' were shown twice, but with the

dot of one letter 'i' moved to the right. Inserting this small eye-catcher was done so every participant would have an easy starting point in the conversation later on, when they were asked to describe the things that they noticed within the visual input. Only if a participant started commenting about the fonts/letters, more focused questions were asked; for example, to describe the noticed design features. If participants didn't start talking about any design features, they were not pointed to any.

In the physical setup, the screen always had a distance of 60 cm from the participant's forehead. This distance was chosen so the whole screen was still in view, and not only partially (and because the reading distance from a screen differs from the reading distance from paper which is more or less 40cm: Legge & Bigelow, 2011; Wilkins et al., 1984). Once participants confirmed that their posture was optimal for the reading test, participants were asked to place the chin on a chin holder, not to re-position the chair and not to change their posture. Before a participant started the tests, a screen containing a welcome screen was shown and the question was asked if the participant could read the words easily.

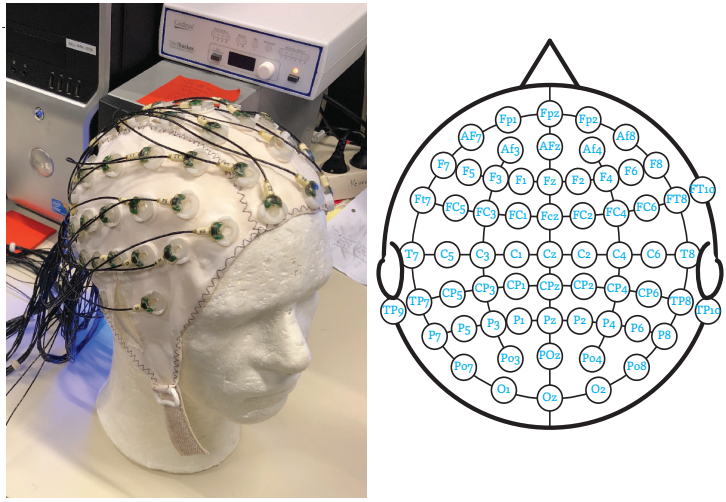
All tests (1a, 1b, and 2) were shown four times to each participant. To avoid learning effects, the computer randomized all the visual input each time it was shown. This also means that every participant looked at all stimuli four times.

5.4. Test 3: data collection

The neurological response was registered with 64 electrodes on a 1,000Hz frequency [Figure 10]. EEG signals were recorded with a 64-channel synapse system and digitized with a sampling rate of 1,000 Hz. All preprocessing and analysis were done with MNE-Python, an

FIGURE 10:

The EEG cap with 64 individual electrodes and their positions.



open-source Python package for exploring and analyzing neurophysiological data (Gramfort et al. 2013). Noisy channels were identified with visual inspection and interpolated. The data was then filtered with a zero-phase band-pass filter between 1Hz and 60Hz. An additional notch filter was applied at 50 Hz in order to remove electrical line noise. Independent component analysis (ICA) was used to identify ocular and movement artifacts. An automated routine for detection of ocular components in the ICA was performed based on the EOG signal. The components identified by this routine were subjected to a post-hoc manual check for additional non-brain signals. The resulting ICA solution was applied to the filtered signal.

The continuous EEG signal was then divided into epochs using stimulus onset triggers. For tests 1a and 1b, the epochs were 2 seconds long while for test 2 the epochs were 15 seconds long. Participants could read as long as they wished, but I had to take equal lengths for the analysis. The shortest duration that any participant did over reading the stimuli in test 2 was used, namely 15 seconds. In each case, a baseline correction was applied with a baseline period of 100ms. Invalid epochs were rejected based on signal amplitude. Overall, 2,678 epochs were included in the analysis for subtest 1a, 2,750 for test 1b and 333 for test 2. Fourier spectral analysis was performed on each epoch using DPSS tapers. Spectral power was averaged for the whole scalp, and then compared across each frequency bin. The frequency bin width was 0.48 Hz, as determined by the overall signal bandwidth and sampling rate. For pairwise comparisons between conditions, t-tests with Welch's correction for unequal variances were used.

5.5. Test 3: results

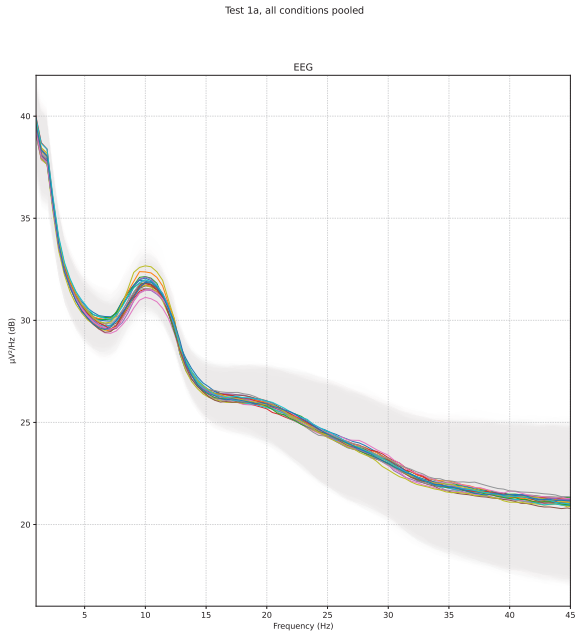
The data of 2 participants was lost due to technical errors and were left out. 40 participants remained. Each participant looked at the visual stimuli 4 times, which means that there are 164 stimuli in this dataset. Figure 11 provides an idea about how to imagine the dataset.

5.6. Test 3: analyses

For this study, I am very much aware of the multiple comparisons problem which requests to inflate p-values when many comparisons are being made. The multiple comparisons correction was not applied because the current study is exploratory, meaning that a lot of different stimuli are included to detect what directions to go with future research. Later studies need to examine the results in more detail and will probably have less comparisons to be made. Therefore, it is not useful to apply stricter rules now than would be done in later studies.

FIGURE 11:

The EEG cap with 64 individual electrodes and their positions.



Subtest 1a: Statistical analysis

For subtest 1a, the test in which all participants looked to the visual stimuli for 300ms, no statistically significant differences ($p<0.05$) were found between the visual stimuli.

Subtest 1b: Statistical analysis

For subtest 1b, the test in which all participants looked to the visual stimuli for 1,000ms, statistically significant differences were found between some frequencies in the neurological response, between specific visual stimuli [tables 7]. The tables are included in the article to show a truthful view of where statistically significant results are present, but also to show where they aren't.

When analyzing all stripe patterns individually [table 7a], taller stripe patterns were associated with more neurological response in all statistically significant results. The only exception is the Rsans360 vs Rsans440 comparison, where Rsans360 produced higher responses. When analyzing the stripe patterns per similar height [table 7b], R150 was associated with smaller responses than '700-extra'. When analyzing the letterforms, the 360 fonts yielded smaller responses in all comparisons where a statistically significant effect occurred [table 7c and d].

TABLE 7(a–d):

The tables indicate which comparison of visual stimuli resulted in a statistically significant difference. The numbers specify the frequencies at which those differences occurred. So, if a cell contains [5.24 5.71] for example, it means that differences were found for frequency bins at 5.24Hz and 5.71Hz. Each frequency bin has a width of 0.48 Hz. Groups are as following: R150 = {Rserif150, Rsans150}, R360 = {Rserif360, Rsans360}, R440 = {Rserif440, Rsans440}, R540 = {Rserif540, Rsans540}, R700 = {Rserif700, Rsans700, R700reg}, 700-extra = {Rserif700bot, Rserif700mid}, C360 = {Cserif360, Csans360}, C440 = {Cserif440, Csans440}, C540 = {Cserif540, Csans540}.

	Rserif150	Rsans150	Rserif360	Rsans360	Rserif440	Rsans440	Rserif540	Rsans540	Rserif700	R700reg	Rsans700	Rserif_700bot	Rsans700mid
Rserif150		-	-	-	-	-	-	-	[8.57]	-	-	[3.81 5.71 6.1	-
Rsans150			-	-	-	-	-	-	-	[14.28]	-	[6.19 6.66]	-
Rserif360				-	-	-	-	-	-	-	-	-	-
Rsans360					-	[2.86]	-	-	-	-	-	-	-
Rserif440						-	-	-	-	-	-	-	-
Rsans440							-	-	-	-	[2.86]	[2.86 3.33 3.8	[3.81]
Rserif540								-	-	-	-	[6.19 6.66]	-
Rsans540									-	-	-	-	-
Rserif700										-	-	-	-
R700reg											-	-	-
Rsans700												-	-
Rserif700bot													-
Rsans700mid7													

	R150	R360	R440	R540	R700	700-extra
R150		-	-	-	-	[3.81 4.28 4.76 5.24 5.71 6.19 6.66 7.14]
R360			-	-	-	-
R440				-	-	[3.81]
R540					-	-
R700						-
700-extra						

	Csans360	Csans440	Csans540	Cserif360	Cserif440	Cserif540
C360	-	-	[12.85]	-	-	-
Csans360		[12.85 13.33 13.8	1 [12.85 13.33 13.8]	-	[12.85 13.33]	[12.85 13.33 13.8]
Csans440			-	-	-	-
Csans540				-	-	-
Cserif360					-	-
Cserif440						-
Cserif540						

	C440	C540
C360	-	[12.38 12.85 13.33 13.8]
C440		-
C540		

Subtest 2: Statistical analysis

For subtest 2, the test in which all participants looked to the visual stimuli for a timespan that they determined themselves, some statistically significant differences were found: between Csans360_min and Cserif440 for the frequency bin 7.95Hz, and between Csans360_min and Cserif540_plus for the frequency bins 2.72Hz, 4.64Hz, 4.7Hz and 5.5Hz. The taller the font, the bigger the response.

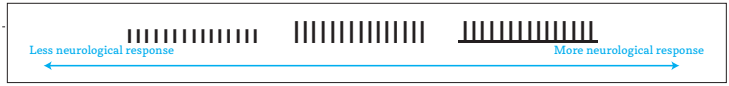
5.7. Test 3: conclusions

Taller stripe patterns result sometimes in more neurological response than lower stripe patterns. As a design researcher, I will not draw conclusions about what neurological response is going on and I am limiting myself to the differences in the visual stimuli.

Across the board, the taller the stripe/font, the more neurological response that occurred [Figure 12]. But there are three reasons why the hypotheses aren't proven. In subtest 1b for example, for the stripe patterns, the results were not found for all similar comparisons: for example, Rserif150 versus Rserif700 provides a significant difference, but Rsans150 versus Rsans700, or Rsans150 versus R700reg does not. The reason

FIGURE 12:

In the taller stripe patterns and in Serif_700bot, more neurological response was registered in a few frequencies (not in all).



therefore could not be determined based on this research. Second, there are more statistically non-significant comparisons than statistically significant comparisons [see Table 7]. This indicates that the effect is not that strong. Third, the results were even less consequent in the visual stimuli containing letters: for example, Csans 360 versus Csans 440 delivered a statistically significant result, but Cserif360 versus Cserif440 did not.

There was no statistically significant difference between any 700-font and the 700-extra fonts, indicating that a strike through will not result in a different neurological response than a 700-stripe pattern. However, it should be stated that there are more statistically significant differences between the lowest stripe patterns and the 700-extra fonts than with the 700-straight fonts. The results therefore suggest that the '700-extra' fonts cause more pronounced differences in the neurological response. A possible explanation for this is the number of details that the brain has to process.

Few statistically significant differences between sans and serif fonts were present, but none are consequent. The results of the three subtests differed. In subtest 1a, no statistically significant differences were found in the EEG's. This could be explained by the short time that the visual stimuli were shown (300ms). Subtest 1b did deliver results, probably because the time to look at the visual stimuli was long enough, 2,000ms.

6. Test 4: eye tracking while reading lines of text

6.1. Test 4: research question

1 Does a taller stripe pattern in text induce more eye closures/longer eye closures/a longer time to read compared to lower stripe patterns?

2 Does a more condensed and more unevenly spaced stripe pattern in text induce more eye closures/longer eye closures/a longer time to read compared to wider stripe patterns?

6.2. Test 4: research materials

The same testing materials as for test 3 were used, and measurements were done during the same three subtests [Figure 13].

FIGURE 13:

The testing materials for test 4.

6.3. Test 4: methodology

A total of 42 people participated. An eye tracker Eyelink 1000 Plus (RS Research, 2020) measured the number of times the eyes were closed and the time a participant needed to read all words set in each font. Data collection occurred at 500Hz.

6.4. Test 4: data collection

Test 2 was done at the same time as test 3, but results were not collected on subtest 1a. The reason is that the duration of 300ms is shorter than an eye closure can last, and that could provide false results.

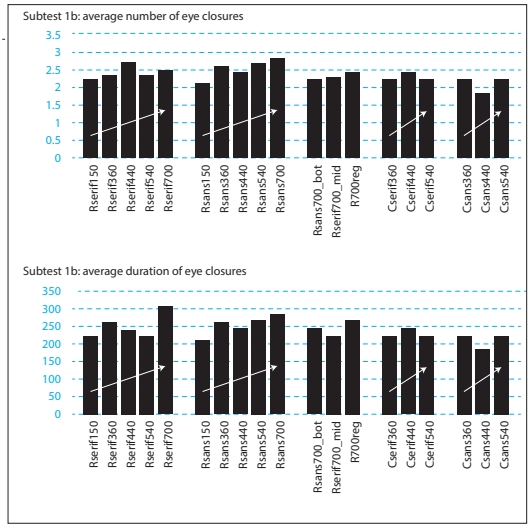
The data was filtered for the moments on which both eyes were closed at the same time. Closures shorter than 5/1000ms were left out, and if one of the eyes opened and closed again while the second eye remains closed, it was only counted as an additional eye opening if that first eye re-opened for a timespan longer than 100ms. This way, non-simultaneous closed eyes were corrected and vibrations in the eye lids were filtered out.

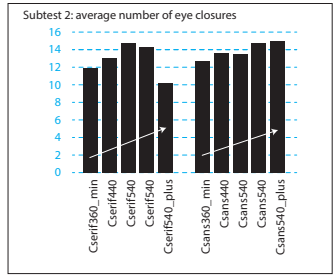
6.5. Test 4: results

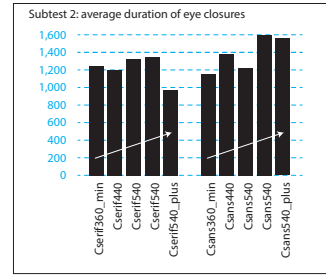
With X as each of the ten fonts applied on a sentence, the results are calculated as (1) the average number of eyelid closures that occurred while reading font X, (2) the average duration of eyelid closures that occurred while reading font X. For test 1 was a fixed duration of 2,000ms used, but for test 2, the participant had control about the duration. Here, (3) the average time necessary to read font X was also taken into account. It is thus only present in Graph 'e'.

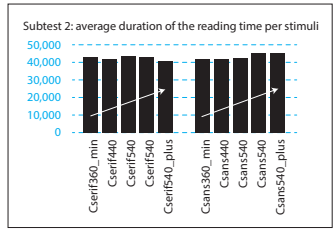
GRAPH 1 (a-e):

The results of the reading test. The white line throughout the graphs indicates the expected trend in the results.









6.6. Test 4: analyses

Mixed regression models were used with a random intercept per participant (which means that the information is correlated per person).

For the numbers of eye closures, test 1b is analyzed via a Poisson mixed regression and test 2 via a negative binomial mixed regression. There are no differences between the visual stimuli ($p>0.05$). Grouping visual stimuli together did not point to differences.

For the duration of the eye closures, test 1b is analyzed via a zero-inflated negative binomial mixed regression and test 2 via a negative binomial mixed regression. Statistically significant ($p<0.05$) results are:

- Eyes are statistically significantly longer closed on Rserif700 than on Rserif150 ($p=0.0479$).
- Eyes are statistically significantly longer closed on R700reg ($p=0.0409$), Rsans700 ($p=0.0254$) and Rsans540 ($p=0.0238$) than on Rsans150.

For the time a participant looked at the cues, test 2 is analyzed via a random effect model with a normal error division. None of the letterforms result in a statistically significantly longer reading time compared to other letterforms.

6.7. Test 4: conclusions

Regarding the stripe patterns, several of the higher fonts have a statistically significantly longer eye closure than the 150-fonts [Figure 14]. But it wasn't found in all of the tall stripe patterns. Additionally, the effect was not found in the fonts containing letterforms, so there is a difference between stripe patterns and letterforms.

While the 700-straight fonts resulted in statistically significant longer eye closures, the 'extra-700' fonts did not. That means the strikethrough affected the visual comfort of the stripe pattern when the effects on the eyes are measured.

The significant results only occurred when sans with sans was compared and serif with serif. There was no single statistically significant effect between horizontally differently spaced stripe patterns. This points out that even/unevenly spaced stripe patterns have less influence on the eye closures than lower/taller stripe patterns.

FIGURE 14:

Statistically significant results mostly occurred when comparing the extremes {150 vs 540 or 700}.

7. General discussion

The role of stripe patterns in reading comfort

In all four tests, some statistically significant results were found. The height of the stipe pattern has several significant effects on the reading comfort, but effects differ between letters and stripe patterns. The horizontal distribution of the stripe pattern (distance between the stripes) had no useful significant effect in this study. Results of the current study do not directly point out if a serif or sans-serif typeface would be better for reading comfort.

The height of the stripe pattern

The results weren't always uniform. For example, the comparison of the serif pair 150 vs 700 versus the sans-serif pair of 150 vs 700 provided different results in the EEG. Also, not all stripe patterns resulted in the expected results. Therefore, some care is required when interpreting the results. Because there are only results on some places, they support the impression that taller stripe patterns have some effects, but it can 1) be too small to play a role within letters, 2) be too small to be measured by conventional devices or 3) be too small to hinder an audience with normal sensitivity to stressful visual stimuli. Therefore, it is too early to make solid conclusions. At the moment, no similar studies exist to compare with. It could be useful to do the same tests with people more sensitive to visual stress because excessive neurological response may hinder a sensitive audience more. We refer to people suffering migraine and others, such as mentioned in Aurora et al. (1991; mentioned in Wilkins, 2012). More research is needed.

No effects were found on the even/less even horizontal distribution of the stripe patterns. This contradicts other studies which did found effects of the stripe pattern in type design, such as Wilkins (2007) and Bessemans (2012). In both studies, making the spacing of the letters less even (e.g., a letter m without the equal spacing within) provided better reading results for certain target audiences. That this study did not provide statistically significant results probably depends on 1) that the horizontal spacing was not that distinguished in this study, 2) that there were differences in the methodologies and 3) that this study did not include children or poor readers.

The 700-extra's

It was expected that the '700-extra' group, the stripe patterns containing a strikethrough, would limit the visibility of stripe patterns. But contradictory, this group was ranked as least comfortable and caused a difference in neurological response compared to very low stripe

patterns while the 700-group did not. While in the eye test, no significant results were measured on the 700-extra's. This suggests that a strikethrough makes it more difficult to process the image, but not to look at the image.

The same is noticed when comparing results of the stripe patterns with results of the letterforms. The lowest letterforms were not performing any better than the average height of the letterforms. This means that more design parameters than only the stripe pattern influence the reading comfort within letters.

I looked into which design parameter it could be and came to *the number of details per surface*. This parameter is expected to have an influence on reading comfort, because there is more information to process while reading. This parameter accompanies other parameters such as the height of the stripe pattern, how condensed a stripe pattern is, how (un)evenly spaced a stripe pattern is, and of course general parameters such as page layout, type size, etc. If this parameter would have an influence, this would also explain why the lowest fonts (360's) were ranked less comfortable than the average heighted fonts (440's): there were more details to process on a small surface.

No research was found that focused on this parameter within a typographic context. Future studies have to clarify the influence of this parameter.

Evaluation of the used approaches

In this study, four different tests applied four different methodologies. In all those tests, the results differ. For example, in the EEG-test, most of the statistically significant results are found in the 700-extra group, while in the eye-tracking test, most of the statistically significant results are found in the 700-straight group.

This does not indicate that any of the used methods were inappropriate, but it illustrates that different aspects of the reading process were measured in each test: the EEG evaluated neurological response, while the eye tracking focused on eye activity. So that will have been the reason for the differences in the results.

Those differences in the results point out that it would be difficult, if not impossible, to determine one parameter in which the reading comfort will be 'the best' under all circumstances. The overall reading comfort will probably depend on several design parameters at once and will depend on the condition on which the reading comfort is measured (neurological response, eye movements…).

Future studies

The results strongly suggest that more design parameters influence reading comfort simultaneously. Based on the results

of this study, it can be stated that the design parameter 'height of the stripe pattern' probably plays a larger role than how condensed or how evenly spaced the stripe pattern is. But not all non-statistically significant results should be dismissed yet and the number of details per surface is a parameter about which no information is known yet. Those are to be further evaluated.

8. General conclusion

This study started from the general hypothesis that *"taller, less evenly spaced, and more condensed stripe patterns could be less effective for the reading comfort."* With this question, it strived to provide insights in making type design more comfortable to look at, and to evaluate the question if a serif or a sans-serif typeface would be better for reading. In this study, some effects were found on the tallest versus the lowest stripe patterns. But the results were not strong enough to prove the hypothesis right or wrong. Additionally, the stripe patterns on which most of the statistically significant effects were found are just out of range for regular type design.

This study strongly illustrates that: 1) results differed between the letterforms and the stripe patterns, showing that the reading comfort is not only influenced by the stripe pattern. Several results suggested that *'the number of design details per surface'* could be influential in the reading comfort, more than the height of the stripe pattern. 2) Results from the eye tracking and neurological responses were not identical. Someone studying reading comfort should take in mind that what is more comfortable for the eyes is not necessarily better for the neurological responses.

This study materials could not clarify if 1) letters already have the least hindering height of the stripe pattern [and that type designers thus intuitively do a good job], 2) if the testing devices were not refined enough. Because this was a preliminary study, the focus was not yet put on this kind of detail. Further studies are necessary to clarify.

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Maarten Renckens is a multidisciplinary person. He combines functions as design researcher (designer & Linotype technician) / landlord / Environment Expert (urban planning & building permissions). But above all, he does the things he likes to do. As someone who used to have light reading difficulties himself, he took the task to enlarge the knowledge about the design parameters that could influence the reading comfort of texts. Within this context, he tests different design parameters with different audiences create more awareness of proper text design.

Snapshots of Text on Instagram:

Fashion Curator Communication from a Design and Museum Studies Perspective

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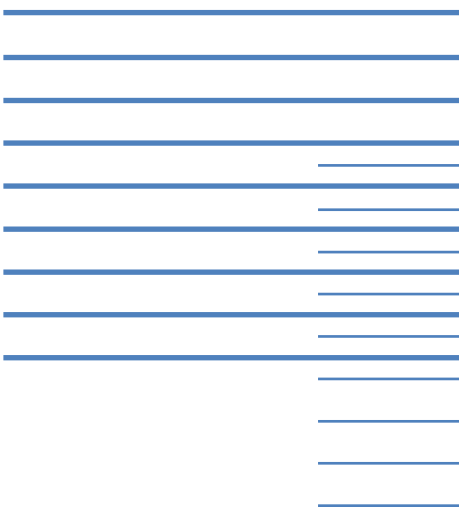
Abstract

This paper aims to examine engagement for a specific Instagram practice of fashion curators: posts featuring *Snapshots of Text*. It builds upon previous research, which indicates that fashion curators frequently post such images of text on Instagram (Sand et al. (2022)) and represent a high impact niche community particularly suited to qualitative research, whose communication strategies have been underexplored. The study examines multimodal digital communication by fashion curators from a design perspective, with a focus on engagement. Its mixed-methods approach combines qualitative eye-tracking, surveys, semi-structured interviews, participative netnography, thematic content analysis, and data analytics. It draws on communication and museum studies to gain a better understanding of how the visual elements of language are used and received in the Instagram environment. Findings indicate that while engagement with *Snapshots of Text* posts is higher with certain typographies and sizes, engagement is also dependent on certain caption characteristics. Furthermore, they indicate that a cross-pollination of digital fashion communication and museum studies research, particularly museum label guidelines and visitor engagement studies, may benefit both domains.

Keywords

Instagram, Communication studies, Museum studies, Fashion curators, Digital fashion communication



1. Introduction

Texts in fashion communication are loaded with meaning. They have been explored by generations of linguistic and semiotic scholars. That written text is experienced visually is, however, barely addressed in digital fashion multi-modal analysis. Firstly, understanding a text, one word at a time, means we picture its meaning (Mendelsund (2014), Wolf (2000)). Secondly, reading means looking at the geometries of letters, the angles and curves of numbers and punctuation marks, and the space that surrounds them. Viewers experience these shapes along with the content ((Van Leeuwen (2006)). Words are shapes, with contextual meanings of their own, before their expressive and symbolic qualities activate the meanings of their content. Since the very first inception of writing in Mesopotamia, Egypt, China and the Mayan cultures, text has had a visual form. Its shapes are particularly noticeable in hieroglyphs and calligraphy, medieval illuminated manuscripts (Figure 1), concrete poetry, and graffiti. Visual elements of texts are more noticeable if the language is unknown to the reader, as the form remains the only option to decipher meaning. The aesthetic qualities of handwritten or printed texts may reference social class, education, and cultural norms. The font used for an academic paper, a bake sale, or a tombstone will thus usually differ. Despite scholarship addressing images in terms of language (Barthes (1977), Kress and van Leeuwen (1996, 2001)), typography as language (Van Leeuwen (2006)), and linguistics from the domain of typography (Swann (1991), Walker (2001)), surprisingly *Snapshots of Text* have largely been neglected in multimodal Instagram analysis.

FIGURE 1:

St. Barbara reading a book, a tower beside her by Masters of the Gold Scrolls - 1450 - National Library of the Netherlands, Netherlands– Public Domain. Courtesy Europeana.

This article outlines a social semiotic approach to analyzing the ideational, interpersonal, and textual meaning potentials of letter forms, drawing on Jakobson's distinctive feature analysis and Lakoff and Johnson's theory of experiential metaphor. Distinctive features are recognized and applied to the analysis of examples: weight, expansion, slope, curvature, connectivity, orientation, and regularity.

The emotional experience of text aesthetics can best be described by Don Norman's general experience of design (Norman (2004)). Norman cites three categories of aesthetic perception: visceral, behavioral, and reflective. The visceral reaction ignites feelings and taps into attitudes toward certain typographies. They might seem familiar, or their color and shapes may evoke beliefs or memories. The rounded and bubble-gum-pink Barbie logo, for example, is experienced differently than the sharp-edged new black and white Twitter logo. Behavioral perception is related to the ease of use, which in the case of text would be how legible it is. Reflective perception is the most self-conscious category (Ortony et al. (2005)): "Would my friends judge me if I posted in Barbie typography?" This paper builds on previous research by Wragg and Barnes (2016) on audience perceptions in design. It aims to investigate a common Instagram practice by fashion curators—*Snapshots of Text*—from a design perspective. It compares the results with museum label caption guidelines, a domain in which users (visitors) have been the subject of studies since the 1910s (Davey (2005), Bitgood (2009)).

FIGURE 2:

Instagram post courtesy of Alexandra Cunningham Cameron, curator of contemporary design at the Cooper Hewitt Museum New York. https://www.instagram.com/p/CeoH5YUot8l/. Screenshot by the author.

What Snapshots of Text is, and is not

It should be noted that this research does not address image-*with*-text, that is the *overlay* of text over images on Instagram. That category includes typography overlaid in Instagram stories or reels, or images overlaid with text snippets (called "quote cards" by Pfurtscheller 2020 and "inspirational quotes" by Lohmeier et al. (2020)). Memes (see Du et al. (2020), Skjulstad (2020), Yus et al. (2012)) also feature an overlay of text and belong to the images-*with*-text category. In what Skjulstead refers to as "self-referential memesphere," images are usually subtitled by text and relate to the text by amplifying or altering the textual meaning, the way a caption of a New Yorker cartoon does. As Osterroth (2015) has pointed out, memes are a collective phenomenon based on repetitions and variations. These repetitions include the overlay of specific typographies that reference meme culture (Davis (2021)). Text overlay via the Instagram app also integrates a limited choice of typography formats. *Snapshots of Text* posts, however, are pictures of textual forms. They are pictures in the sense of Mitchell, as "complex assemblages of virtual, material, and symbolic elements" (Mitchell, (2005), xiii) and mediate text through a picture. They are less aligned with subtitles than they are with the concept of a "virtual window" as described by Friedberg (2006). Friedberg described the "windows" interface on computers as a dynamic space similar to cinematic screens. She does so by referencing the painter Leon Battista Alberti, who in 1435 described his process of painting as first sketching a rectangle on a surface, which he regards as *"an open window through which the subject to be painted is seen"* (Alberti (1972), 55). Images of text may be pictures of

FIGURE 3:

Instagram post courtesy of Kaat Debo, Director & chief curator MoMu - Fashion Museum Antwerp. https://www.instagram.com/p/CeoH5YUot8l/.

book pages, posters, neon signs, or screenshots of online web pages or articles – the possibilities are as varied as there are text forms (figures 2–5 and 11). The following research questions (RQ) are addressed:

RQ1: Which *Snapshots of Text* posts can generate higher engagement?

RQ2: Can guidelines for exhibition object captions inform social media captions?

2. Context

FIGURE 4:

Instagram post courtesy of Alexandra Cunningham Cameron, curator of contemporary design at the Cooper Hewitt Museum New York. https://www.instagram.com/p/CGUw19SMfnR/

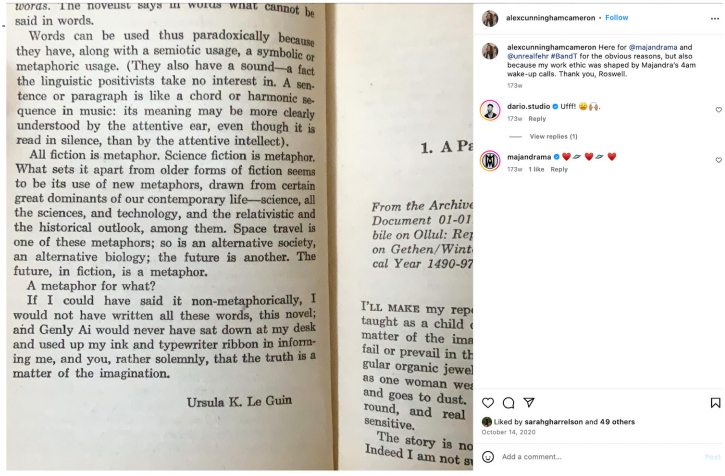
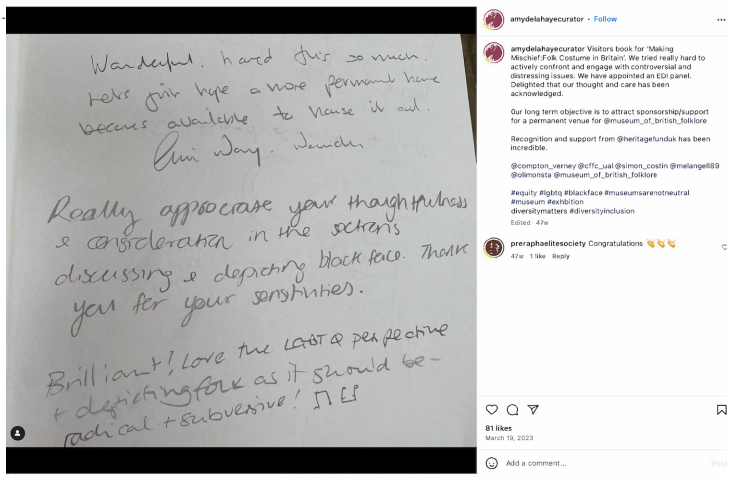


FIGURE 5:

Instagram post courtesy of Professor Amy de la Haye, curator, author, and Rootstein Hopkins Chair of Dress History & Curatorship at London College of Fashion. https://www.instagram.com/p/Cp-htH-NErs//.



The use of text as image on Instagram is examined within the context of communication studies, the "Instagrammatics" (Highfield and Leaver (2016)) of the platform, current fashion Instagram practices, as well as museum studies.

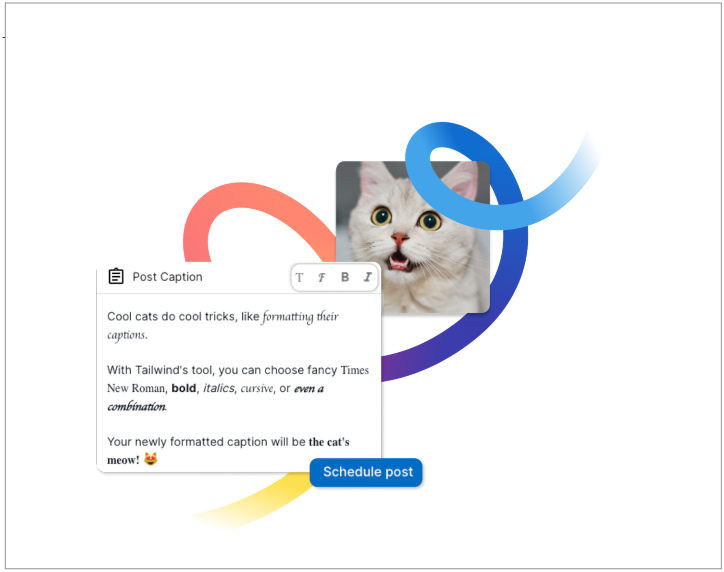
2.1 Instagram and Text

The Instagram social media platform currently has over 2 billion monthly active users (Statista (2023)). The primary focus of the platform, founded in 2010, was the sharing of images. The platform recommends that creators "educate, excite, and engage" (Instagram (n.d.)) with their content. There are three ways that users can share texts in posts. Firstly, through the captions that accompany images. The main text style used for captions and comments is "Proxima Nova," created by Mark Simonson in 2005. According to Simonson, Proxima Nova is the most popular commercial font on the web since the 2010s and can be found on hundreds of thousands of websites (Simonson (n.d.)). Instagram captions offer users the option of "Helvetica Neue Regular," a 16-pixel font. The font perception of Instagram captions may vary depending on the device, operating system, and user settings: Android users will use Roboto for captions. Though most users do not make the effort, it is possible to change Instagram captions using "Instagram font generators" such as Lingojam (Hill (2022)). It essentially generates Unicode (see Instafonts (n.d.)), which can, for example, be inserted using the Tailwind app (Figure 6).

Secondly, the Instagram platform encourages text

FIGURE 6:

How to change fonts on Instagram. Image courtesy of Hill, Tailwind Blog 2022. Screenshot by author.



overlays on plain backgrounds or on images for stories and reel formats. These offer more typographic options, through layout tools such as "Type", introduced in 2018, or adding "Stickers". These include Instagram Sans, "a contemporary remix of grotesque and geometric styles," which was designed by the Colophon Foundry (Instagram (2022), para. 2). Text overlays are also typically used for memes. While the social media service Buffer has recommended the use of text overlay within the Pinterest platform (Lee (2015)), marketing research has indicated that Instagram audiences favor posts without text overlay (Ayres (2020)).

Finally, text can also be shared by posting an image of a text of any form or kind: *Snapshots of Text*. Text-based carousels with bold typography became especially popular throughout the 2020 Black Lives Matter protests, a trend referred to as "social justice slide-shows" and "PowerPoint activism" (Nguyen (2020)). Images of texts can also, for example, include images of flyers, handwritten notes, newspapers, or screenshots of webpages.

Research of Instagram practices has predominantly focused on text *or* images, the multi-modal interplay of text *and* images, or text *with* images. Visual analysis has focused on image content and its aesthetics and symbolic, and phatic functions (Rose (2016), Mirzoeff (2016), Rogers (2021), Jewitt and Leeuwen (2021), Lobinger (2016, 2017), Miller (2008). It includes content explorations of proportions, filters, the types of formats (such as carousels, reels, and stories), scheduling, and sequence, but also affordances and affective impact. Textual analysis has investigated readability, style, and meaning as well as the use of hypertexts such as hashtags and handles (Cantoni and Tardini (2006), Sand (2021), Karamalak et al. (2021)). Textual analysis in communication studies has also focused on affordances (Erz et al. (2018), Karamalak et al. (2021)), vocabulary (Cantoni and Tardini (2006)), and readability (Klare (1963)) as well as syntactic composition (Temnikova et al. (2015)). Emoji analysis (Siever et al. (2020)) is situated as multi-modal, as they are images typed into captions. Multi-modal analysis, rooted in the work of Kress and Van Leeuwen (2001), focuses on the interplay of image and text. It has addressed argumentation and intent (Rigotti and Greco (2019), Kruk et al. (2019), as well as the fluidity of meanings and affordances, anchored within specific contexts.

The use of *Snapshots of Text* has been contextualized in the domain of social semiotics (Kress and van Leeuwen (1996, 2001)), graphic design (Swann (1991), Walker (2001)) and advertising semiotics (Barthes (1977), Goffman (1981)). Within the social media marketing domain, images as text have been addressed in terms of the addition of Alt texts (alternative texts) to improve their accessibility for the sight-impaired and for search engines (Macready (2022)).

2.2. Museology

Detailed guidelines have been established for both the content and layout of object labels and captions in exhibitions were reviewed (Bitgood (1989, 2000), Ham (1992), Ravelli (2007), Severell (2015), Getty (2011), Donnelly-Smith et al. (n.d.), V&A (2021)). A review of museum studies points to striking similarities between Instagram users and museum visitors. For one, both are surrounded by distractions. Not all visitors will stop and read an entire sign, just as Instagram users are likely to skim text. In both cases, the way they experience content is not linear, although partially guided by the museum or the platform infrastructure.

Museum studies scholar Ham (1992) divides museum label design into the conceptual component (text) and the artistic component (the design of the text copy). He further points out that the artistic component encompasses numerous factors, including layout, typography, illustrations, photographs, and other graphics; the inclusion of multisensory components; color choice; and the physical shape and dimensions of the sign. He then identifies four key qualities of interpretive communication: it should focus on a central message, be relevant to the visitors' own lives, and the visitors should be able to understand it easily and enjoy it. Museum labels need to be interesting, engaging, and accessible for wide audiences, while Instagram recommends content that will "educate, engage, and excite" (Instagram (2019)). These findings are echoed in museum guidelines, of which the V&A, among those cited, proved to be the most reflexive, recent, and engaging.

Despite the many learnings each domain could provide to the other, social media recommendations for curators are scarce. Within the domain of museology, social media research is focused on institutional approaches (Allen-Greil (2023), Drotner (2013, 2019); Bosello (2022). A guide for "cultural managers" is available from ENCATC, the European network on cultural management and policy, which, considering the rapid pace of social media developments, is highly dated and not fashion specific. Its Instagram recommendation is simply "to inform and educate as well as entertain or nourish artistically" (Hogg et al. (2017), 21). It makes no reference to the practice of using text as an image. While there are recommendations for Instagram influencers who promote fashion products for sale, there remains a lack of guidance on the specifics of social media use for exhibition curators. A research gap also remains for the use of variations of text as an image, which can include handwriting, images of publications, images of or screenshots of posters, and flyers. Their impact on viewer engagement on Instagram in fashion communication has so far been unexplored, despite their frequent use.

2.2. Snapshots of Text in digital fashion communication

Fashion curation practices are evolving as fashion exhibitions and museums are becoming digitalized (Castells (2013), Loscialpo (2016), Parry (2013)) and mediatized (Drotner (2019), Jenss (2019), Torregrosa and Sánchez-Blanco (2021)). Fashion curators and historians increasingly have personal Instagram accounts, which they use for research and sharing content (Sikarskie (2016, 2020); Sand (2019b)). While larger GLAM institutions employ staff dedicated to social media marketing (Angel and Fuchs (2018), Kidd (2011)), independent fashion curators and those working for smaller fashion spaces often participate in the promotion of

FIGURE 7:

Instagram account ICOM Costume Institute Committee, and Instagram account ICOM (International Council of Museums), 2023. Screenshot by the author.

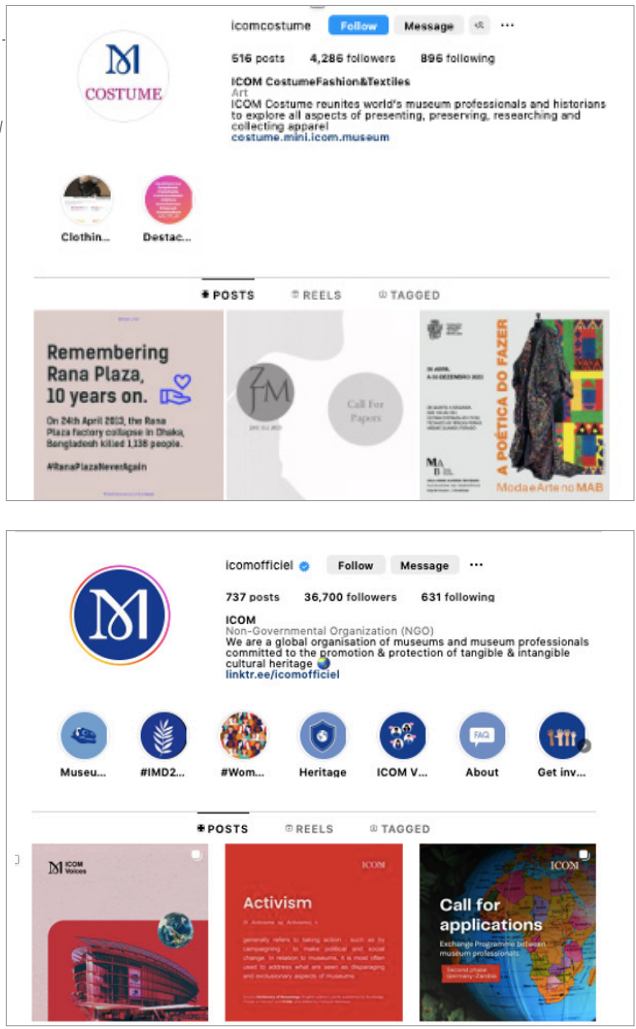
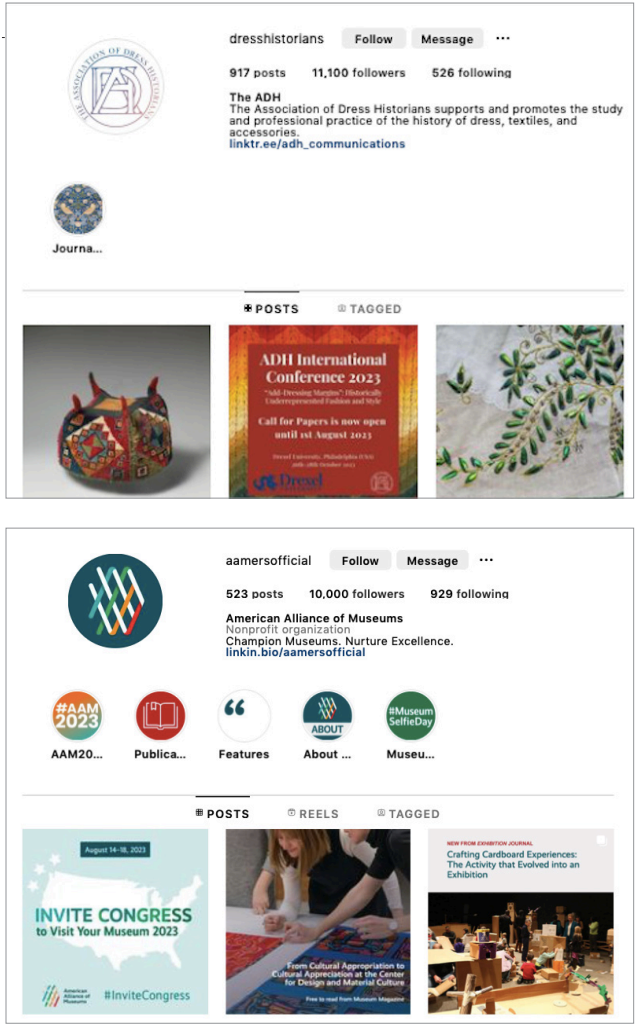


FIGURE 8:

Instagram Account, Association of Dress Historians, 2023. Instagram account, American Alliance of Museums, 2023. Screenshots by the author



fashion exhibitions on social media (Sikarskie (2020), NEMO (2018)). Yet, Instagram practices by fashion curators have been a neglected field of research, and there are currently no Instagram guidelines for the profession.

Communication researchers, marketing experts, and influencers provide recommendations for creating digital communication for commercial fashion promotion (Song (2016), Bendoni (2017), Huggard and Cope (2020), Noris et al. (2021), Nobile et al. (2021)). Museum studies have conducted extensive audience engagement research to establish guidelines for exhibition labels (Hooper-Greenhill (1992, 1999, 2006), Dufresne-Tassé (2016), Serrell (1999, 2015); Bitgood (1989, 2000); Getty (2011), V&A (2018)). Although both processes contextualize visuals through text, the two

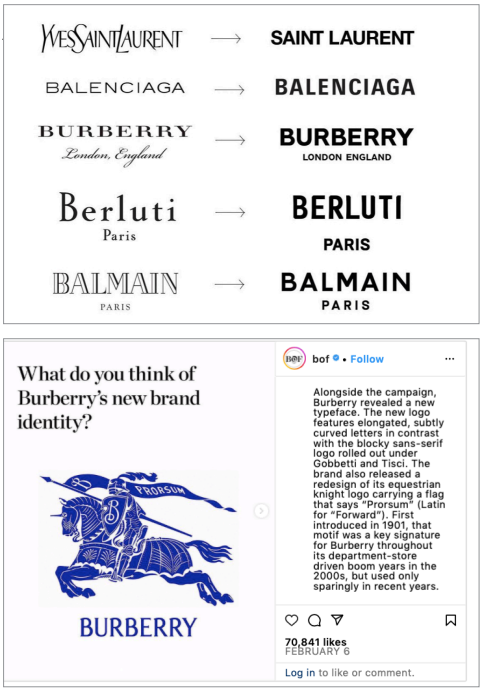
approaches have not been combined. This is particularly surprising, given the rising popularity of fashion exhibitions and their increased mediatization (Calinao and Lin (2018), Torregrosa and Sánchez-Blanco (2021)).

A previous study of communication practices of fashion curators (Sand et al. (2022)) indicates a frequent use of images of texts, or *Snapshots of Text* on Instagram. These include images of flyers, articles, book covers, and images of museum labels. A review of the Instagram accounts of the ICOM Costume Institute Committee, ICOM, the ADH (Association of Dress Historians Instagram), as well as the American alliance for Museums, all key professional associations of fashion curators and fashion historians, showed similar content preferences (*figures 7 and 8*). Their posts between May 30th, 2020, to May 30th, 2023, also confirm that the use of images of text is a prevalent practice in the profession.

Within fashion communication, the topic of images of text on Instagram has predominantly been linked to discussions surrounding the impact of IG on the typography of brand logos (Sand (2019a)). The sans-serif adaptations of logos to make them more legible on Instagram can be described as mediatization (Colucci and Pedroni (2021), Rocamora (2016, 2023)). Examples include Burberry, Saint Laurent, Balenciaga, and Balmain in 2018 (Stanley 2018, Whelan 2019). The adaptations (*figure 9*) created heated discussions in the domain. So did the reversal in the case of the Burberry logo in 2023 (Willson (2023)).

FIGURE 9:

Logo changes as reported by Willson, courtesy Highsnobiety, 2019; Instagram post by Business of Fashion, 2023, courtesy @bof. https://www.instagram.com/p/CoUWHEQIWjf. Screenshots by the author.

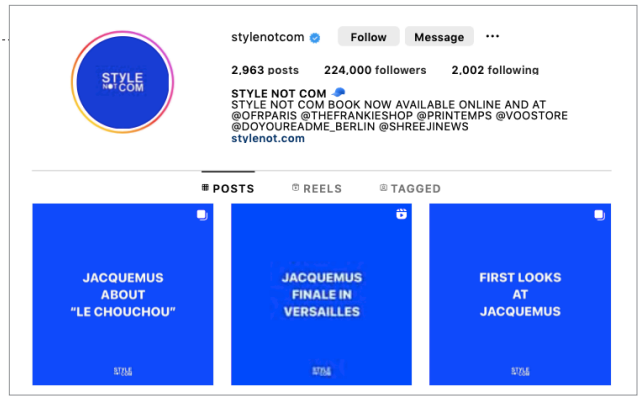


Furthermore, the practice of posting images of text has garnered new attention since 2022 through the rising popularity of the text-based Instagram account "@stylenotcom" by Beka Gvishiani. Gvishiani began featuring posts with a white sans-serif font text on a cobalt blue background (*figure 10*). Within the social media marketing domain, recommendations for images of text address typographic content specifically designed for Instagram, featuring specific fonts and sizes as well as templates (Godavarthi (2021), Canva (n.d.)).

Meta, which owns Instagram, recommends "using a modern, clean font in a large enough type size and a contrasting hue" (Meta Business Suite (2023) para. 4). It also advises not to obstruct the visuals and to avoid communicating too many messages. *Images of text* in the sense of Alberti's open window, that is text as a pictured aesthetic object, has not been theorized in fashion communication.

FIGURE 10:

Instagram account "@stylenotcom" by Beka Gvishiani, 2023. Screenshot by the author.



3. Method

The mixed-methods exploratory study investigates a selection of six Snapshots of Text Instagram posts, their impact on user engagement, and their alignment with museum label guidelines. It employed a combination of netnography (Kozinets (2010, 2015)) to select the content creator and the posts, reception analysis, and then reviewed the results based on museum guidelines. The reception was evaluated using qualitative eye-tracking with Oculid software (now Tobii), combined with multiple choice surveys, an engagement evaluation, open-ended qualitative interviews about post preferences, as well as the analytic tools Fanpage Karma and Modash. It builds upon the recommendations of Lobinger (2016) regarding mixed methods to gauge image reception complexity and research by Marchiori and Cantoni (2015, 2020) regarding eye-tracking. The study expands a previous Q-Methodology review of fashion curator content,

which indicated both a surprisingly frequent use of *Snapshots of Text* by curators and surprisingly low engagement rates for these posts (Sand et al. (2022)). The study aims to identify engagement levels for six visual variations. Engagement was rated by the study participants following the review of the images on a scale of 1 to 5 and qualified by semi-structured questions. This was compared with the engagement levels by Instagram audiences to the posts in terms of views and likes.

3.1 Curator and Post Selection

Through preliminary netnographic studies (Sand (2019b, 2021), Sand et al. (2022)), Alexandra Cunningham Cameron, curator of contemporary design at the Cooper Hewitt Museum New York, was identified as a particularly frequent user of *Snapshots of Text* in a wide variety of formats and, upon request, consented to the use of content for the analysis. By reviewing the posts of a single curator, the study was able to gauge interest levels from both the usual group of followers through analytic tools and study participants not familiar with the accounts. Following an in-depth analysis of the curator's 306 posts over the 3 years from Jan 2020 to Jan 2023, 6 posts were selected for the study. They included two posts that had received particularly high and low engagement for this account within the previous Q-methodology study. The other posts were chosen for their variety. They represent differences in typography, spacing, sizing, contrast, and color use and include text used in a movie, carousels, and single image posts. The posts feature images of a newspaper article, a vintage magazine article, a journal chapter, a manually annotated slide, a colorful animated event flyer, and an exhibition announcement. The selection was limited to six posts to avoid viewing fatigue and encourage vivid recollection during the post-viewing interviews.

3.2 Participant Selection

Twelve participants were recruited at the USI (Università della Svizzera italiana) Lugano campus through the distribution of flyers, emails, and in-person recruiting in exchange for refreshments. Convenience sampling was used within the framework of a higher education environment which provided a high degree of analytical skills and and participants used to articulate observations. There was an equal number of female and male participants, with 70 % aged 25 or younger and 30 % between 26 and 40 years old. The data was collected on April 21, 2023, within the same setting.

According to the preliminary survey, all participants read an average of 1–2 hours of print materials daily. Half spend over 2 hours and half spend under 2 hours on Instagram daily, equally divided between male and female participants. One female spends more than 3

hours daily on Instagram. One male and one female participant each spent less than an hour on Instagram. One participant was farsighted. All spoke English as a second language.

4. Data Collection

The eye-tracking tool Oculid was used to counter the subjectivity of self-reporting. It tracks eye-movement with the help of the smartphone camera, the habitual setting for Instagram engagement. The Oculid app provides the opportunity to gage reactions within the distinctive environment of mobile Instagram use, as it uses the smartphone camera to track eye movement. To optimize privacy for the participants and ensure anonymization, the eye-tracking app was downloaded on two study devices: an iPhone 13 Max and an iPhone 8. Eye-tracking recordings distinguish what attracts the most attention by what is fixated first and how long the gaze is fixated. Fixation times can, however, indicate either positive or negative attention, and a short fixation time can also mean that the object of the gaze is familiar, or "understood". A qualitative review of the recordings was therefore combined with ratings of posts and recorded qualitative interviews.

As Instagram does not allow for a stable link directly to the original posts, or to an account that reposts content, a graphic design professional rebuilt the posts within the Figma Design Application. This allowed for interface characteristics such as moving images, the swiping through multiple image sequences of carousel posts, showing previous "likes", and the possibility to scroll down over comments. (It should be noted that these are physical interactions with the texts, executed by movement of the fingers, not just the eyes).

To avoid distraction, the data was collected in a quiet room with closed blinds. Each participant filled out a consent form and replied to a survey regarding their age, gender, eyesight evaluation, daily reading time on Instagram, and print content. Participants were briefed on the use of Oculid and the rating form, with an engagement scale from 1 (least engaging) to 5 (most engaging). They reviewed and then rated each post with no time constraint. Depending on the network connection delays, each spent an average of one minute on each post. Following the tasks, each participant was recorded answering two open-ended questions regarding their content preferences (the image they preferred and why), leading to follow-up questions if answers were unclear (such as if whether responses referred to preferences of informative content or visuals). The interviews ranged from 53 seconds to 7 minutes and 40 seconds. It should be noted that twelve participants were recruited and answered the surveys, but only ten data sets were retained after cleaning the data.

The expected outcomes were:

> Bright images receiving the longest fixation duration and highest fixation frequency

> Larger typography generating significantly higher amount of fixation duration and fixation frequency than small typography, regardless of fonts used

> Colorful fonts attracting more attention

> Photographs of text (printed or handwritten) receiving less attention than IG specific layouts

> Handwritten text generating higher fixation duration but less engagement

The recordings were reviewed first with an Oculid employee for expert qualitative evaluation, and the individual gaze recordings with heatmaps were selected as most indicative of engagement. Slow motion viewing revealed the first fixation, along with fixation duration, movement patterns, and fixation frequency. The recordings were reviewed again, both in correlation with the rating questionnaires and the comment recordings. The reviews confirmed an unusually high interest in text, both for text in the images and in the captions overall, except for one of the participants. All participants viewed the captions and read at least the first sentence of the longer captions. One participant also reviewed the entirety of the comments, whereas one participant's fixation duration showed an overall disinterest in the content.

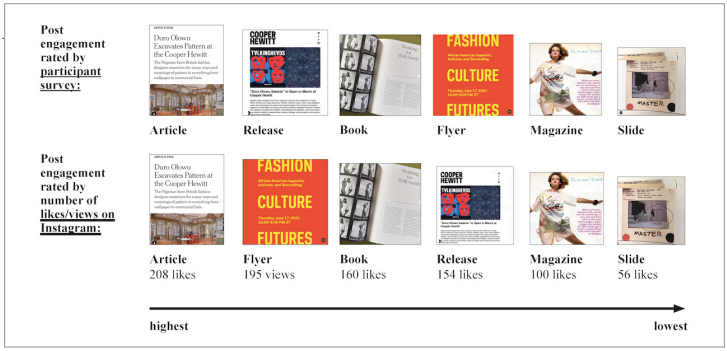
5. Results

Results showed that fixation time was not a reliable indicator of engagement. Firstly, because it included the fixation on the image as it was uploading, which was often lengthy, and secondly because longer fixation time on a post in numerous instances signaled either confusion or frustration with the content, including the attempt to decipher small writing. The strongest indicators of confusion are the fixation of image borders, or the frequent jumping from one fixation point to another searching for information to absorb. This confusion was reflected in the ratings and in the answers to the open-ended questions.

Overall, the post that received the most positive participant rating was *Article* (*figure 11*). This carousel post of 3 posts, featured first a New York Times article, which started with a serif font (NYT Cheltenham) and a clear headline, a subheader, then text in a sans-serif

FIGURE 11:

Ratings of participants from highest (left) to lowest (right) engagement, compared to engagement of accounts' Instagram Followers.



font, both surrounded by a fair amount of negative space. They were positioned over an image in warm, muted colors, followed by two high-quality exhibition images in the same hues, contextualized by a 590-word caption. The caption is enthusiastic (including the words "celebrate," "joy," "delight," "exuberance," and "brilliant") and informative (listing a series of key objects), describing the article and the exhibition design process. It refers to the authority of the New York Times critic. It describes the contributions made by several staff members in installing the exhibition. It concludes with a call to action ("please come for a visit") and the argument that each detail has "a designer behind it". It should be noted that it received the highest number of comments on Instagram, with a wide variety of emojis, and 208 likes. The eye-tracking study mainly showed attention to the headline, the subheading, and the image, following principles of visual hierarchies. The caption was read at least partially, then the images swiped through. Several participants then returned to the captions and the images repeatedly. The interviews confirmed that participants liked the colors, preferred the caption length and the balance of images and text, that the layout felt familiar to them, and that they liked the ability to swipe through.

The second most engaging post, *Release, (figure 11)* was again a carousel, of seven posts. The headline is the Cooper Hewitt logo (in bold sans serif capitals). Underneath it sits a combination of two exhibition images, one embedded with a reverse embedded font, then a smaller headline, followed by a small text. This introductory post is followed by six images of exhibition objects, including a patterned jar/vase, fabric, and an infographic of the city of Chicago. The caption is informative, describing the exhibition concept in language that includes the audience: "how we make patterns and how patterns make us", which it argues "invites you to think." It includes an evocative and inspirational quote by the designer Duro Olowu, followed by a detailed bullet-point list with information for each object. It adds personal value through emotion: "excited about this show and honored." The caption length was 227 words. On Instagram, it also received a fair number of comments, with some

variety in emojis, and 154 likes. Eye-tracking showed confusion regarding the images, with eyes not finding a place to rest and participants nearly immediately seeking information in the caption. Certain images received a higher amount of attention, including the jar and the infographics, which were also mentioned in the interviews.

Two posts received equal ratings: one is *Book,* a carousel showing 5 black and white photographs of pages in a printed journal, including the chapter title, a legible large font citation in serif, and the cover of the book with its title in serif. The pages are positioned at an angle, with larger headlines positioned decentered towards the upper right-hand corner. The caption length was a brief description of 44 words. It explains the content of the chapter and argues for the importance of preserving and surfacing queer culture. It includes the words "beating heart" and "exquisitely." On Instagram, it received 160 likes and four comments with one type of emoji. The eye-tracking shows strong attention to the chapter title, the citation, and the journal title, as well as the caption.

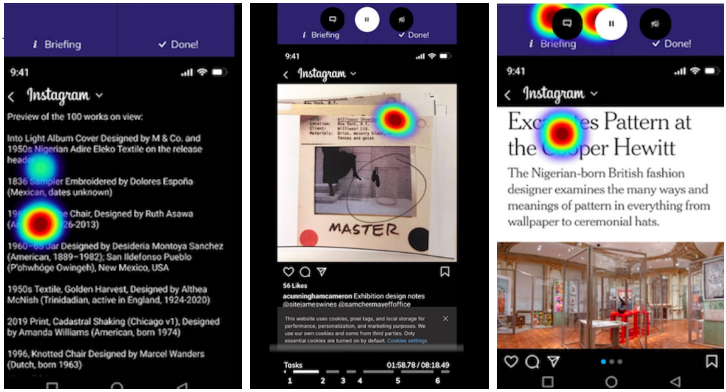
The same rating was achieved by *Flyer,* a movie animating a flyer, which shows a series of 10 posts with bright color backgrounds and large sans serif fonts, featuring the portraits of a series of upcoming speakers, with their names in a smaller font. The caption is brief (11 words) and refers to a specific event: "counting down to noon." On Instagram, it was viewed 190 times but only received 11 likes and no emojis feedback. In the eye-tracking study, the large fonts primarily attracted attention, even though according to Oculid experts, viewers tend to favor images of people. The rapid progression of images results in agitated eye movements trying to read the words as images advance, with few being able to also read the smaller typography with the names of the speakers being announced. Comments showed that with one exception ("I liked that I did not have to scroll"), viewers were frustrated by the speed ("too flashy," "could not read") and not being able to control the movement of the images. They indicated that they liked the larger font size.

The carousel post *Magazine*, of pages from a vintage magazine from the 1980s, did not perform well in terms of engagement. The five cool and colorful images in cool pastel colors featured a fashion shoot with different multi-color lettering styles (handwritten, typographic, and graffiti) on the pages and the outfits. The caption length was 21 words. It references a 1984 event for a designer T-shirt launch, and refers to handles of a renowned graffiti artist, museum, gallery, photographer, and designer. These would be known by fashion insiders; there is no additional context or explanation about them. On Instagram, it received 100 likes. In the eye-tracking study, this post showed confusion. In the interviews, it received several criticisms for the colors and style.

The least engaging post *Slide,* was an image of a black and white slide with a small typographic label and a handwritten

FIGURE 12:

Oculid eye-tracking study results of images from Instagram account of Alexandra Cunningham Cameron, 2022. Screenshots by the author.



annotation, and a very brief caption of 5 words. The caption refers to the handles of a renowned architecture firm and exhibition design colleagues, with no further explanation. Information about the photograph ("Williwear showroom, material: bricks, masonry, metal") is only visible on the typographic slide label in the image and is not mentioned in the caption. There is no explanation about what is represented or why, and there is no argumentation. On Instagram, it received 56 likes. The eye-tracking showed confusion, with a nervous jumping of fixations and a search for information in the captions and labels, with a preference for the typographic writing even though it was small. The post received the most negative rating and the most negative comments in the interviews, described as "poor," "just a slide" and "there was nothing to read." Surprisingly, the participants who indicated spending more than 3 hours daily on Instagram both rated the photograph of the journal chapter highest (respectively 4/5 and 5/5). The participants who indicated less than an hour rated the animated movie low, which may indicate less familiarity with the viewing of Instagram stories.

In sum, the study revealed that:

> Warm rather than bright images received the longest fixation duration and highest fixation frequency

> Larger and bold typography generated a significantly higher amount of fixation duration and fixation frequency than small typography, with a preference for serif fonts

> Colorful fonts did not attract more positive engagement

> Photographs of text (printed or handwritten) received more attention than IG-specific layouts

> Handwritten text generated the lowest fixation duration and engagement.

Content analytics on Instagram show that although the participants were not design experts, their interactions correlated with those of the followers of the curator's account. The highest and lowest rated posts were the same for both groups. Content analytics from Modash reviewing the accounts' 1702 posts, indicate that the average rate of likes on the account is 226, with 625 being the highest amount of likes. The selected text as image posts therefore rate below average. A review of all 1702 posts by the account shows that the two posts with the highest engagement contain both text and a portrait of the curator, one being an announcement of the curatorial team for a project accompanied by a bold headline in the Cooper Hewitt sans-serif font. The caption is brief: only 17 words, out of which five are tags. The photograph has warm color tones. The photograph received 195 comments, out of which half were replies with an emoji by the curator. The second is a magazine feature on the curator, with a sans-serif headline, a subheadline and text body in serif font, a portrait in dark but warm hues, and three small images, including one black and white image. The caption is 72 words long with one emoji. It received 61 comments, including seven replies by the curator. Both captions are enthusiastic, and tag others as well as the museum. Three out of the overall top post feature the curator; one is a portrait of her with her child.

6. Discussion

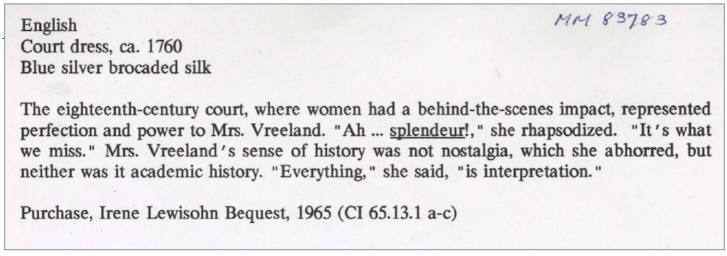
The current findings align with museum label literature. The success of the New York Times post aligns with observations by museum label expert Serrell that typography plays an integral role in the overall aesthetics and mood of an interpretive exhibit (Serrell (2015), 3). The typeface, size, design, and placement all become vital in an environment in which text must be legible and understandable within an instant. Its font ensures the ideal contrast of black type on a white background, making it easy to read, and respects white space between the headline, the subheadline, and the text body. A study at the Metropolitan Museum of Art on the perceived legibility of text and factors found that contrast between text and background exerted a significant effect on legibility ratings (Wolf and Smith (1991)). The fact that the New York Times headlines worked well may be due to the overall familiarity of the Times font family. On the one hand, the New York Times is a well-recognized newspaper and carries connotations of authority. On the other hand, as Mark Simonson (2001) has pointed out, Arial and Times New Roman fonts are free and available on every computer and are particularly easy to read because of their wide circulation (for over 50 years).

The fact that the follower engagement aligns with study participants for the highest and lowest engagement indicates that although engagement by followers may be partly phatic, multi-modal content engaged both groups in four out of six posts.

The results also parallel Ham's advice for museum labels (Ham 1992) which marry the artistic aspect (typography, size, color, white space) with the conceptual context (in this case the combination of text in the image and in the captions). The caption of the post featuring The New York Times describes activities by people, aligning with the following V&A label recommendations: "We know from the Getty and other research that people connect with people. This presents a problem in museums, where objects have been divorced from people. But there are ways we can reconnect people and objects. The first, and most obvious, is to include real individuals or to use quotations and humor." (V&A (2018), 34). A good example from a fashion exhibition would be a label conceived for the Metropolitan Museum's Costume Institute for a retrospective on the iconic curator Diana Vreeland in Figure 13.

The IG post showing the New York Times article detailed and informative mention of objects also lets the post stand alone, conforming to the Smithsonian's recommendations: "Each label should offer enriching information independently. Visitors can encounter labels in any order, and we can't guarantee that they'll read any given label before encountering the next (or that they'll read that label at all)." (Donnelly-Smith et al. (2021), 32). The museum environment can be as distracting, as the experience of Instagram content on a smartphone, and the narrative sequence is not a linear one. Just like museum labels, each Instagram post must therefore be able to stand alone.

The least engaging post, on the contrary, does not fulfill museum label guidelines. It does not, as the V&A guidelines suggest, engage with the object: "A good label should address the object. It should encourage visitors to look, to understand and to find their own reward, whether aesthetic, intellectual or personal…The first and most obvious aim of a label is to explain anything that might be puzzling in the object." (V&A (2018), 30). The combined results of the eye-tracking study, ratings, and


English
MM 83783
Court dress, ca. 1760
Blue silver brocaded silk

The eighteenth-century court, where women had a behind-the-scenes impact, represented perfection and power to Mrs. Vreeland. "Ah ... splendeur!," she rhapsodized. "It's what we miss." Mrs. Vreeland's sense of history was not nostalgia, which she abhorred, but neither was it academic history. "Everything," she said, "is interpretation."

Purchase, Irene Lewisohn Bequest, 1965 (CI 65.13.1 a-c)

FIGURE 13:

Diana Vreeland: (installation photographs, wall text) Immoderate Style exhibition, December 6, 1993-March 20, 1994. Courtesy The Metropolitan Museum of Art.

comments show that users responded most positively to posts that were visually easy to process and supported by easy-to-understand and captivating information. The results are triangulated by the engagements of the curator's followers on Instagram.

6.1 Research limitations

This study has numerous limitations. Firstly, it is an exploratory study with a limited number of participants. It is also limited to English-language content. Future research can include larger and more multicultural datasets, including a museum documentation from the Global South, and a wider multicultural array of participants. In this context, it should be noted that museum labels have become a contested topic in the context of museum inclusivity and the decolonization of museums (MacDonald (2022)). New processes of extended and visitor created labels are being developed (e.g., Rijksmuseum (2020), Nashashibi (2003)). Labels are also being increasingly mediatized, with additions such as QR codes, while museum mediatization has resulted in virtual museums and physical museums offering digital tours and exhibitions. How museum inclusivity and mediatization are entwined reaches beyond the scope of this study, but merits further research.

Furthermore, this research focused on only six different *Snapshots of Text* formats. An in-depth study may further use A/B testing to, for example, compare different caption options, still and moving versions of the same image, or different color schemes for the same posts. These may narrow indications for font size, contrast, spacing, and color. Complementary to the above, this study could be extended to consider the familiarity with typography of different audiences in different locations.

As the posts were selected from a 3-year dataset, future research could consider how content aligns with Instagram trends and practices over time. Finally, although the viewing took place in the "native" environment of the Instagram interface, namely on smartphones, the participants were not engaging with the content within their own Instagram feed on their personal phones. The posts were therefore missing the context of personalized algorithmic feeds as well as possible distractions from direct messages, notifications, and interferences by other smartphone apps and functions. However, this set-up increased internal validity by unifying the conditions for participants' attention. While future research is needed to expand this exploratory study, it nevertheless opens the door to previously unexplored parallels between museum visitor and social media audience communication strategies, as well as Instagram research and multimodal communication.

6.2 Practical and theoretical implications

The main contribution of the study is to provide deeper insights into engagement with text as image in digital fashion communication. The results can assist fashion curators in promoting their exhibitions and for self-branding purposes. The findings also indicate that digital fashion communication can draw on museum studies, in particular the in-depth visitor studies investigating text and image engagement in a distracting environment. Museum object label research may inform Instagram practices beyond this specific domain. Their review also reveals that these museum guidelines necessitate updates to reflect recent sociotechnical developments, including museum mediatization. Furthermore, this study contributes to theoretical literature by addressing the research gap between multi-modal communication analysis and communication design.

7. Conclusion

This paper contributes to the understanding of the design perspective in multimodal Instagram fashion communication. It provides insights into how images of texts may generate higher levels of engagement on Instagram. Participants viewing patterns, ratings, and interviews indicated a clear preference for larger fonts, preferably familiar fonts. Serif fared slightly better than sans-serif, although more importantly, black, and white or high contrast text fared better than colored fonts. The preferred format of text as image was in a carousel, which allows for additional context and viewer agency through swiping. The preferred number of carousel images was three. It was visually well organized, with a larger headline, a subheader, and an image, followed by more images in the carousel.

The caption text was, however, key in determining engagement. The highest rated post caption contained a word count under 250 words, and an enthusiastic and explanatory text with a call to action. Significantly, the preferred post not only garnered high ratings with participants from outside the fashion field, but also high engagement among the curator's own followers. In conclusion, although a previous study showed low audience engagement for image as text, their use can elicit high engagement when following visual guidelines and when paired with a clear, explanatory, and captivating caption.

A comparison with museology research indicates that the best practices align with interpretive sign design guidelines regarding the conceptual component and the artistic component (Ham (1992)). Results confirm higher engagement with content that

surprises, informs, and is relatable—also from a design perspective. This study examined the design attributes of *Snapshots of Text* such as typography, proportion, and color as a complement to factors such as the length, tone, and style of the captions and the number of hashtags, handles, and emojis.

More importantly, it indicates that fashion curators, exhibition institutions, and overall social media marketing experts can draw on the wealth of museum labeling guidelines regarding content and content design. While museum studies have a history of engagement research which can benefit digital fashion communication, the museology domain could benefit from digital fashion communication research, especially regarding the participatory nature of social media. Expanding the investigation with richer sets of data - including perceptions of text in multicultural environments - is an important goal. Nonetheless, the correlations in the preliminary and present studies highlight both the importance of a design perspective and the relevance of museum studies research for digital fashion communication. Overall, this study contributes to the literature regarding fashion curator content and audience engagement.

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