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Kim Knowles
Anna Katharina Schaffner
Ulrich Weger
Andrew Michael Roberts

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a silent tongue sounding
an eye scanning
does a blank page not have a duration
is it silence or noise
we tongue it with our eyes
polyphonic skin of event
on the pool of meaning making

Bob Cobbing, 'Random and System'¹

1. Theorizing spatial values in visual poetry

In written texts, spaces between chapters, paragraphs and other units of meaning normally express structural hierarchies and create semantic groupings. Spaces in texts demarcate the boundaries of words, headers and sub-headers, paragraphs and sections. They visually reinforce the conceptual organization of a given text, and at the same time facilitate the process of perception by guiding the eye and the mind of the reader. In linearly arranged literary texts, in particular poetry, the function of spaces between words, verses and stanzas is more complex, in that they also create rhythmical sequences and more subtle units of meaning within the parameters of regular syntactical structures. As Andrew M. Roberts et al. have shown, where poets use large spaces within the lines of lineated poetry, the spaces perform a role analogous to that of punctuation.² However, in visually arranged poetry that breaks with linear and sequential patterns of organization, such as concrete poetry, the function and effects of spaces between units of meaning — be that sentence groups, phrases, words or even individual letters — are even

more complex to determine, and will be explored in the course of this article both from a literary-theoretical and an empirical perspective.

Russell West-Pavlov states in the opening lines of *Space in Theory* that attention to space in literature is a recent phenomenon generated by new communication technologies: 'It is perhaps only in the age of the word processor or PC that, as writers, we have begun to pay attention to the spaces between the words'.³ However, not only does West-Pavlov eliminate the reader from the equation, but he also disregards the fact that questions about the function of empty spaces in literary texts were already asked long before he raises the issue, most famously so in 1897, when the French Symbolist poet Stéphane Mallarmé published his influential poem *Un Coup de dés jamais n'abolira le hasard*. The poem appeared in the French journal *Cosmopolis*, and was preceded by a preface in which Mallarmé explicitly directs the reader towards an awareness not only of the spaces between words, but of the entire space of the printed page. 'Les "blancs", en effet, assume l'importance, frappent d'abord', Mallarmé states ['the "blanks" take on importance, and are what is the most immediately striking'].⁴ In his manifesto-like preface, then, Mallarmé puts forth a counter-intuitive claim, challenging the notion that the black type reigns supreme.

By problematising the conception of the physical surface of the page as merely a neutral setting for the text, Mallarmé subverts established notions of background and foreground. His revolutionary deployment of the page space opens up new avenues for poetic expression: he turns spatial values, such as the topographical position of words and their distance to other words or word groups, into a signifying force in their own right. Moreover, he also dramatises typographical design by equipping words with distinctive visual features, deploying a wide variety of different typefaces and sizes, ranging from large, bold upper case characters to thin, small, italicised ones. Topographical and typographical values thus become additional expressive tools, and readers of *Un Coup de dés* have to take these visual factors into account when interpreting the textual meanings.⁵

Poets have encroached on the territory of the spatial arts by equipping their texts with a visual, mimetic gestalt since the age of antiquity.⁶ Critics such as Jeremy Adler and Ulrich Ernst, however, argue that Mallarmé was the first to use spatial values in a conceptual manner: he moved away from figurative forms, such as George Herbert's famous *Easter Wings*, which still privilege the text and shape it in such a manner

that it resembles concrete objects. Instead, he created abstract textual 'constellations', in which the locations of words and the spaces between them are as important as the words themselves.⁷ Mallarmé's poem has been a key source of inspiration for generations of visual poets, particularly for the concrete poets active predominantly in the 1950s and 60s, such as the Noigandres group in Brazil and the Swiss-Bolivian poet Eugen Gomringer in Germany.⁸ After the Second World War, concrete poets in Europe and Brazil continued the genre-crossing experiments of the historical avant-garde poets initiated by Mallarmé, developing further the structural and communicative potential of spatial values in textual productions. While the conceptual, and, in a few cases, mimetic use of spatial parameters is the hallmark feature of concrete poetry, little critical attention has been paid to their more specific functions and effects. This holds true for older as well as more recent discussions of concrete poetry, which focus primarily on semiotics and language philosophical questions.⁹

The conceptually significant deployment of spaces between units of meaning of varying sizes in linguistic productions, however, situates the works following Mallarmé's tradition in a borderland between word and image genres. In more traditional word-image combinations, verbal and visual materials are merely juxtaposed and exist separately side by side, as for example in René Magritte's famous painting *La trahison des images* (1928-9), which stages a conflict between the verbal and the visual message in order to prompt viewers to reflect on the ontological basis of representations. In visual poetry, in contrast, verbal signs perform pictorial tasks: they signify both by referring to an external signified and via their topographical position on the page and their structural interactions with other elements.

In their famous 'Pilot Plan for Concrete Poetry' from 1958, the Noigandres poets formulate their own conception of poetic space and the new reception patterns they hope to stimulate in their readers. 'Concrete poetry', they state, 'begins by being aware of graphic space as structural agent [...] proportioning new spatio-temporal modes of apprehension of the text by the reader'.¹⁰ With the concrete poem, the Noigandres poets maintain, the phenomenon of meta-communication occurs, the simultaneous apprehension of different codes and sign-systems, and the 'coincidence and simultaneity of verbal and nonverbal communication'. This new form of visual poetry, they write, 'deals with a communication of forms, of a structure-content, not with the usual message communication'.¹¹ It is interesting to note that even the

concrete poets' own poetics remain curiously unspecific when it comes to the precise nature of the 'new spatio-temporal modes of apprehension' they wish to generate in the viewer/reader.

However, it does seem to be the case that concrete poetry and other abstract, non-mimetic visual poetry following Mallarmé's model, by using words both as linguistic and at the same time visual signifiers, generate a confusion about the dominant symbol system that is in effect. The required mode of perception is thus rendered uncertain: are these works to be viewed like a picture (be that an abstract or a mimetic one), or decoded from left to right, top to bottom? Which is the dominant and which is the supporting code? Does the inclusion of spatial values enhance, complement or complicate the semantic message of a text, and does it render meaning more trivial or more ambiguous?

Up to now, there is little empirical data on how spatial values in visual poetry are actually 'read' and integrated into the interpretative process. Criticism on concrete poetry, for example, often simply ignores this issue, or reproduces claims about the desired effects of the spatial aspects of concrete poetry made by the poets themselves, or else draws on abstract semiotic paradigms in order to explore the interaction of the different sign systems (that is, words and pictorial signs) on a purely theoretical level.¹² We wish to address this lacuna and to introduce some much-needed empirical considerations into the debate.

In the context of the AHRC-funded research project 'Poetry Beyond Text: Vision, Text and Cognition', we conducted a number of empirical studies involving eye tracking and questionnaires to find more specific answers to the questions outlined above.¹³ Our research built on the work of an earlier project that used eye-tracking to study the modes in which spatial values are apprehended in poetry. This work, as reported in Roberts et al., posed the questions of how and whether we 'read' space in poetry. It focused on the 'semantic and expressive' effects of (i) long spaces or displaced lines within lineated poetry (using examples from the work of Geoffrey Hill) and (ii) 'post-linear poetry' which 'uses space in a more radically visual way, dispersing words around the page, so that pattern becomes more important and lineation is called into question' (using examples from the work of Susan Howe).¹⁴ The Howe text analysed is found within a long sequence, 'Pythagorean Silence', much of which is lineated. This study did not address concrete or primarily visual poetry, but rather investigated the irruption of space into lineated poetry, and the effects of a break into post- or non-linear

poetry.¹⁵ Using eye-tracking of original and manipulated versions of Hill poems, it found that extended spaces within lines (or half-lines displaced from the left-hand margin) served in some instances to articulate and clarify syntactical structures, in accord with the theory of Richard Bradford, in which 'the phonocentric hierarchy is [...] maintained: spacing operates as a secondary system of punctuation which must defer to the dominance of a temporal syntactic structure'.¹⁶ For some readers, however, such spacing promoted richer interpretation by encouraging cross-linear semantic connections. In Hill's poetry the use of space did not 'go so far in disrupting the normal conventions of page layout as to call into question the possibility of sequential reading, top to bottom and left to right'.¹⁷ However, Howe's internal shift from linear to post-linear poetry had more radical effects. Eye-tracking records showed that readers began with a conventional top-to-bottom, left-to-right reading strategy, but that this was disrupted by specific effects of space, shape and pattern, such as a sloping left margin, or a centrally-placed, repeated and overlapping word. These effects led to a tracing of shape, pattern and verbal links across and around the page, and to associated interpretative strategies and aesthetic responses.

While this earlier eye-tracking study addressed space within linearity, and the disruption of linearity, we sought to address the questions outlined in our introduction about spatiality and modes of perception in relation to the distinctive genres and traditions of concrete and visual poetry, in which linearity is not the starting point. In their conclusion, Roberts et al. comment that '[t]he further enquiry to which this points is a more systematic study of how readers look at pattern poetry, at concrete poetry, and at the whole field of modern and postmodern poetry', and we sought to take up one part of this challenge in the 'Poetry Beyond Text: Vision, Text and Cognition' project. In a series of experiments carried out between December 2009 and January 2010, we recorded the eye movements of postgraduate student participants while they read a selection of visual poems. Based on the eye tracking data, we analysed the order, intensity and duration of the students' modes of attention during the perception process. Furthermore, we related aesthetic ratings of and interpretative responses to these poems to the eye movement behaviour of the students.

In section two of this article, key positions from word and image studies and existing conceptions of the role and function of space in visual poetry are assessed critically. Part three presents existing empirical perspectives on the phenomenon, as well as original data and a number

of case studies obtained from our experiments. Our unique juxtaposition of critical and empirical approaches and the data we collected on specific modes of attention related to the perceptual and cognitive processing of spatial values in visual poetry allows us to make an original contribution to the existing word and image discourse.

2. Space in literary theory

2.1. Metaphorical and literal gaps

In an article on 'Cognitive Literary Studies: The "Second Generation"', H. Porter Abbott considers the divide between 'scientific truth and fictional truth' and argues that

unlike scientific truth, fictional truth comes with no language we can take back and redeploy. This is because the language it uses is a language of the absolute particular, making use, as Sternberg and Iser have shown so well, of empty spaces as much as or more than marks on the page. At the moment of reading, we inhabit those blank spaces, each of us filling them up in his or her own individually distinct way.¹⁸

Abbott here fails to differentiate clearly between the literal and the metaphorical meanings of 'gaps', that is, what can be described as 'material' empty space (literal gaps or white spaces on the page) and conceptual gaps (the scope which a literary work allows for interpretation and meaning construction by the reader). The reader-response theorist Wolfgang Iser argues that all texts contain 'Leerstellen' [empty spaces, gaps] which the reader has to fill with recourse to his or her own imagination and experience. According to Iser, textual meaning is not a stable given but is generated in the process of aesthetic response to a specific work, in the process of interaction between author, reader and text. As Meir Sternberg has pointed out, however, Iser's concept remains a problematic one, as it covers a diverse miscellany of phenomena.¹⁹

It is far from self-evident, moreover, that 'material' and conceptual gaps coincide. For example, the gaps between chapters in a printed novel can be closely correlated with either gaps in the story (what Gérard Genette would term an 'ellipsis' in narratological terms), or spaces for meaning-construction in Iser's and Sternberg's sense. If a chapter begins ten

years after the end of the preceding chapter, that might signal an ellipsis, but such an ellipsis could equally occur in the middle of the sentence, with no material gap. However, in the case of poetry, and especially in visual poetry, the impulse for correlating material and interpretative gaps seems even stronger, as all aspects of poetic form invite the attribution of significance, and visual poetry appears to equip material gaps with semantic meaning.

In visual poetry, the white space of the page is turned into what Nelson Goodman describes as a 'dense' signifying field in his study *Languages of Art: An Approach to a Theory of Symbols*, which theorizes the different characteristics of verbal and pictorial signifying systems. Spatial values expand the poetic repertoire by introducing pictorial codes into the textual realm, and thus take us beyond the limits of linguistic expression and into the domain of iconic signification. Visual poetry mixes together the aesthetic properties of what Goodman refers to as 'dense', 'replete' and 'continuous' sign systems (images), and those of differentiated symbolic systems that operate with gaps (words). Pictorial signs are context-bound; their meaning depends on their relation to all other marks, while alphabetic signs are transferable. Images, Goodman argues, are analogue sign systems in which every single mark signifies, while written signs are digital, disjunctive and constituted by gaps.²⁰ Goodman posits that the idiosyncratic aesthetic characteristics of each signifying system invite their own specific modes of perception — a claim that has been corroborated by experimental psychologists studying reading and viewing behaviour (see part three of this article). Yet the question remains: what happens on a perceptual and cognitive level when verbal and visual codes are fused together? How do we 'read' spatial values in visual poetry, and how do we interpret the gaps that signify?

Traditionally, language is designated as an arbitrary, convention-based symbolic system, while painting is seen as iconic in nature, working via resemblance rather than denotation and signifying in an immediate rather than an indirect, mediated manner. In *Art and Illusion*, Ernst Gombrich, for example, argues that the signs of painting are natural, direct, and universally understandable, while linguistic signs are artificial and depend on acquired cultural knowledge.²¹ Goodman, however, challenges the notion of a 'metaphysical divide' between the different systems of representation. Adopting a radically relativist semiotic stance, he argues that both systems of representation are equally arbitrary and convention-based, and that the differences between sign-

types, the boundary line between texts and images, are matters of habit which can be explained by practical differences in the use of symbolic marks.²²

W. J. T. Mitchell sums up Goodman's argument thus:

A paragraph may be turned on its side and 'read' as a city skyline; a picture may be riddled with alphabetic characters, and may be constructed to be read from left to right in a descending series of sequences. The particular marks or inscriptions do not dictate, by virtue of their internal structure or natural essence, the way in which they must be read. What determines the mode of reading is the symbol system that happens to be in effect, and this is regularly a matter of habit, convention, and authorial stipulation — thus a matter of choice, need, and interest.²³

The question of which symbol system 'happens to be in effect' and which generic mode of perception has been stipulated by the author is precisely what is at stake in visual poetry, where habitual modes of reading and viewing are rendered problematic as a consequence.

2.2. Presence, absence and silence

Virginia La Charité's book-length study of Mallarmé's *Un Coup de dés* is one of the very few studies that engages with the elusive phenomenon of spatial values in poetic texts:

Space is the abstract which cannot be explained, the pure which cannot be experienced, the authentic which cannot be derived: it is formless, not enclosed [...] sterile, unlimited, original and complete within itself [...] Space has no direction; it is anti-linear and open or free.²⁴

In a similar vein, West-Pavlov argues that 'space is not a sign, it has no meaning, it does not make sense [...] Space, like silence, is feared'.²⁵ The threatening nature of spaces in poems as a void of signification would seem to derive precisely from the ambiguity they embody and their resistance to explanation. The open-ended possibilities of meaning to which they give rise — the relative absence of interpretative clues —

is a source of conflict for the reader. This crisis of interpretation that space engenders is all the more evident when literature breaks free from its traditional linear form, as is the case with visual poetry. But before going on to explore this aspect of visual poetry, let us briefly consider the relationship between space and silence, evoked by West-Pavlov.

Mallarmé's poetry plays on the concept of white and its association with both the blank space of the page and its counterpart in silence. In a famous passage of 'Crise de vers' ['Crisis of Poetry'], the poet states:

Tout devient suspens, disposition fragmentaire avec
alternance et vis-à-vis, concourant au rythme totale,
lequel serait le poème tu, aux blancs; seulement
traduit, en une manière, par chaque pendatif.

[Everything will be hesitation, disposition of parts,
their alternations and relationships — all this
contributing to the rhythmic totality, which is the
very silence of the poem, in its blank spaces, as that
silence is translated by each structural element in its
own way].²⁶

For Mallarmé, then, silence constitutes the basic structural framework of the poem, that which imposes on the text a rhythm of presence and absence. Similarly, in the work of the American poet e. e. cummings, silence is evoked both literally, in the repeated use of the word, and conceptually, through the irregular use of spaces in the visual layout. Eugen Gomringer, too, expresses the correlation between space and silence in his concrete poem 'silencio' from 1954.

silencio silencio silencio
silencio silencio silencio
silencio silencio silencio
silencio silencio silencio
silencio silencio silencio

Figure 1: Eugen Gomringer, 'silencio' (1954)

Here, the repetition of the word silence presented in three vertical columns is pierced with an empty space at the centre. The proficiency of linguistic signification is thrown into question, since, ironically, silence is expressed far better by the void of signification than by its actual signifier. For Wendy Steiner, this generates a paradox, a problem of presence and absence, which lies at the heart of concrete poetry: 'When concretists represent what might be taken as a Mallarméan silence [...] what they in fact achieve is a reification of silence itself, an inversion of the very absence marking the conventional attempt to make a poetry of presence'.²⁷ Typographic absence, she argues, 'does not stress a Derridean *différence* but the extreme concreteness of language'.²⁸ Furthermore, as Marjorie Perloff has pointed out, the fundamental question is whether poems such as Gomringer's, 'charming and witty as they are, especially the first time we read/see them, can continue to hold our attention'.²⁹ Unlike the all-encompassing silence of Mallarmé's *Un Coup de dés*, which seems to evoke the abyss of nothingness of which the poem repeatedly speaks, the majority of concrete poems, such as 'silencio' and 'the black mystery is here', also by Gomringer, do not, perhaps, elicit such an ambiguous, complex silence. That the silence is 'contained' within the game of signification makes its presence less ambiguous and less threatening. In *Un Coup de dés* there is no such closed structure. However, Gomringer's use of containment ensures that the silence is 'heard' and that the space is 'read'. If Mallarmé's silence is one of disorientation, then that of Gomringer is one of reassurance — a silence, or mystery that can be understood by the paradoxical presence of absence.

2.3. Reading empty space

The question of duality, of presence and absence, is at the heart of psychological approaches to visual perception. As Alan Kennedy argues in *The Psychology of Reading*, '[t]o see an object [...] involves a decision, albeit an unconscious one, not to see it simultaneously as something else'.³⁰ Thus, a general tendency in viewing the world around us — and this applies also to the act of reading — is to see either one thing or another. Ludwig Wittgenstein's duck-rabbit scenario is a well-known example of how this works in the perception of images. On first viewing, one version of the image is comprehended, and even when the dual nature of the image is revealed, it is very difficult to see both at the same time. How can this be applied to the understanding of visual poetry, in which two modes and codes of perception are suggested by the same work? Is it possible to simultaneously see an image and read a

text, and how does this fusion of representational strategies affect the reader/viewer's comprehension of and interaction with the work?

Kennedy suggests that readers of linear texts do not, as a rule, pay attention to the gaps between the words.³¹ This is partly because gaps do not contribute to the meaning, but also because focusing on empty space would interrupt perceptual fluency. In visual poetry, however, the case is different. The distinction between figure and ground, explored by Peter Stockwell in *Cognitive Poetics: An Introduction*, seems relevant here. Drawing upon premises from gestalt theory, Stockwell argues that the part of a visual or textual field that is most likely to be seen as the figure will have some of the following features: 'it will be regarded as a self-contained object or feature in its own right, with well-defined edges separating it from the ground'; 'it will be a part of the ground that has broken away, or emerges to become the figure'; and 'it will be on top of, or in front of, or above, or larger than the rest of the field that is then the ground'.³² This is consistent with experimental evidence for perceptual prioritization of the figure over the ground.³³ In certain types of visual poetry, space does indeed cease to be the ground and assumes the status of a figure, as it is turned into a 'self-contained object or feature in its own right'. The relation between foreground and background in visual poetry is, however, not a static condition but rather a dynamic process, in which text and space take on constantly shifting roles.

The most sustained examination of the function of space in visual poetry is La Charité's study of *Un Coup de dés*, mentioned earlier. La Charité argues that space in Mallarmé's poem is 'not just an object (something to be viewed), but also the actual subject of the text'.³⁴ Taking Mallarmé's statement that the blank spaces are an integral part of the work and should be 'read', La Charité explores the different ways in which space imposes itself on, and indeed dictates, the reading process. One of her most radical claims is that space determines the viewer's attentional strategies, and that it is through the space, not through the text itself, that the reader navigates:

Because space is the primary element of the text, it is by, in, with, and through space that the reader must pursue relationships and seek to establish points of contact which confer meaning upon the units of the text. Space is thus the authorial controlling factor which directs the reader and

orders the accumulation of data which may be read and interpreted [...] To read *Un Coup de dés* demands a reading of the space which supplies its order and confers on the text its ultimate form.³⁵

However, La Charité's argument is vague about the *actual* reading of space. For instance, many of her observations about the reading process are based on rather abstract notions of how space directs the gaze and effectuates a deeper understanding of the text itself. This is exacerbated by the frequent references to a supposed typical reader, ignoring the problematic implications of such a generalization:

The typical reader follows the type. In his determination and decision to decode or read the text, reading attention passes from space as the controlling element of the structure to type as the visible form which permits an encounter with meaning.³⁶

Although this claim highlights the delicate interchange between space and text, figure and ground, and evokes a constantly shifting focus, the complexities of how space is perceived and how it may be read as an expressive element in itself are unelaborated.

La Charité's argument is ultimately self-contradictory. She claims, for example, that the 'white blanks multiply the possibilities of interpretation', for space enhances the opacity of the text 'through an arbitrary placement of words and groupings which disorient the reader'.³⁷ A little later, however, she seems to argue the opposite, and asserts that the '[p]oetic manipulation of space determines the reading of the text [...] Space controls the combination of meaning through groupings, dispersion, and isolation, and at the same time it multiplies their possible combinations. The eye and mind move together'.³⁸ On the one hand, then, she contends that the space of the page determines and dictates meaning, and on the other hand, she claims that space renders meaning more ambiguous and in fact disorients the reader. Space, she writes,

heightens the impenetrability of the text by interrupting groupings, multiplying the possibilities of convergence and divergence, aborting events, undermining units. The space negates differentiality,

as it destroys associations, interrogates lexical and semantic meaning, places syntactical principles in doubt, and reverses all expectations of the printed page or written text. Space distracts, disrupts, interrupts, distorts, destabilizes, and invalidates the fixity of the form or design which it alone can make possible. The immediate effect is displacement, confusion, disorder, and detachment. Space destructs what the printed unit composes.³⁹

Given the self-contradictory nature of La Charité's statements on Mallarmé, and the absence of any sustained discussion of the function of space in criticism on concrete poetry, it seems that more specific evidence is required to elucidate the function of space during the processes of perception and interpretation of works in which visual and verbal codes are blended together.

3. Empirical perspectives on theoretical questions

3.1. Methodology

We decided to investigate these questions further by recording modes of attention during the process of reading different examples of visual poetry, by analysing reading directions and intensity and duration of attention. To further document the effect of spacing manipulations on aesthetic appreciation of the poems our participants had seen, we asked them to fill out two questionnaires relating to aesthetic value judgments.

Fourteen postgraduate students of varying ages and nationalities from different humanities disciplines participated in this experiment. Fourteen visual poems were selected in order to cover a broad range of approaches to space and layout. Space plays a central role in all of these works, but is used in a variety of ways. Some of the poems feature empty spaces within, which are defined by the surrounding textual material, while in other poems, space is used conceptually or even mimetically. The poems chosen for the experiment fall into four broad categories related to the form and the function of their spatial elements: 1) poems in which space is used conceptually, such as in Mallarmé's *Un Coup de dés* and 'Trip' (1914) by Guillaume Apollinaire [figure 9]; 2) poems in which space is used mimetically, such as in Alan Riddell's 'The Honey Pot' (1972) [figure 4]; poems in which space is deployed to create abstract patterns, such as in 'if to be born' by Haroldo de Campos (1958) [figure 2]; and 4) poems which feature a space within that is

shaped by the surrounding text, such as in Claus Bremer's 'is the text the text left out' (1964) [figure 8] and Pierre and Ilse Garnier's 'marie' (1965) [figure 6].⁴⁰

Participants were instructed to view the poems on a computer screen in an eye tracking laboratory, looking at each one for as long as they wished, and moving on to the next when they were ready.⁴¹ When all fourteen poems had been viewed, the participants were asked to complete two questionnaires in which they were questioned about their interpretative and critical evaluations of the poems. Following the first section of the first questionnaire, participants were allowed to look through paper reproductions of the poems. Participants were also asked whether they had any personal preferences, and which of the poems made the most effective use of space in their opinion. The second questionnaire featured a series of general statements about the function of space and visual layout and the interaction of pictorial and linguistic elements. Participants were asked to select the poems to which these statements most closely applied.

3.2. Eye tracking data analysis

High-resolution vision is confined to a relatively small area of the retina, the so-called fovea centralis. To make an object in the outside world accessible to high-resolution vision, the eyes need constantly to move to bring that information into focus. Such eye movements (called saccades) are extremely rapid, and they alternate with periods of relative stability (so-called fixations), during which visual information is picked up. Not every word is fixated, and others are fixated several times, that is, via regressions of the eyes. The scan-path of eye fixations can be characterized in temporal and spatial parameters: where we fixate and for how long. Both parameters are influenced by various variables, such as the difficulty of a text or the complexity of a scene. When text is more difficult, readers typically need more time to make sense of the information that is accessible at a given eye fixation. As a result, these fixations are longer. They are also more densely populated around difficult portions of a sentence or around more complex areas of a scene.

Eye movements are a relatively unobtrusive signature of online cognitive processes: overt eye movements are closely correlated with covert cognitive processes, so that observations can be made unobtrusively while the participant is performing a task (as opposed to looking only at outcomes/results, as is the case with more traditional behavioural

measures such as reaction times or accuracy rates). For these reasons, eye-movements have been referred to as a 'window to the mind'.⁴²

There are particular patterns of eye movements that are reflective of people dealing with a particular genre. During reading, for instance, average fixation durations are around a quarter of a second (225ms) and the average saccade size is about 2 degrees of visual angle (approximately 8 letter spaces).⁴³ Fixations during visual scene perception are markedly longer (around 330ms) and saccades also stretch across a much larger area (4 degrees of visual angle, which is equivalent to 16 character spaces).⁴⁴ This observation indicates that attention is distributed across a much wider span during scene perception than during reading, reflecting the obvious fact that information is much more densely packed in text (and hence needs more closely distributed fixations) during reading as opposed to scene perception. When a reader decides to approach a visual poem as a text or as a visual scene, this decision may be reflected in signature eye-movement patterns that are characteristic of that particular medium. For example, a decision to read might be reflected in a systematic fixation pattern from the upper left to the lower right of the poem, mimicking classical reading-direction patterns. When approaching as a visual scene, by contrast, one would not expect such a sequential scanning pattern but a more varied and multi-directional one with larger saccades and longer fixation durations.

The data-patterns typically obtained from such experiments can be aggregated into various formats — for example, graphs demonstrating directions and durations of the fixations, or heatmaps that give a global reflection of viewing behaviour. In a first overview we looked at the distribution of fixations on the poem as well as in the spaces between. A more or less sequential pattern of fixations, for instance, is reflected in the initial inspection-pattern of Haroldo de Campos' 'if to be born' poem. Although this poem has a striking visual shape, participants typically focused on the words in the first instance. Here we selected two participants' datasets to illustrate this.⁴⁵

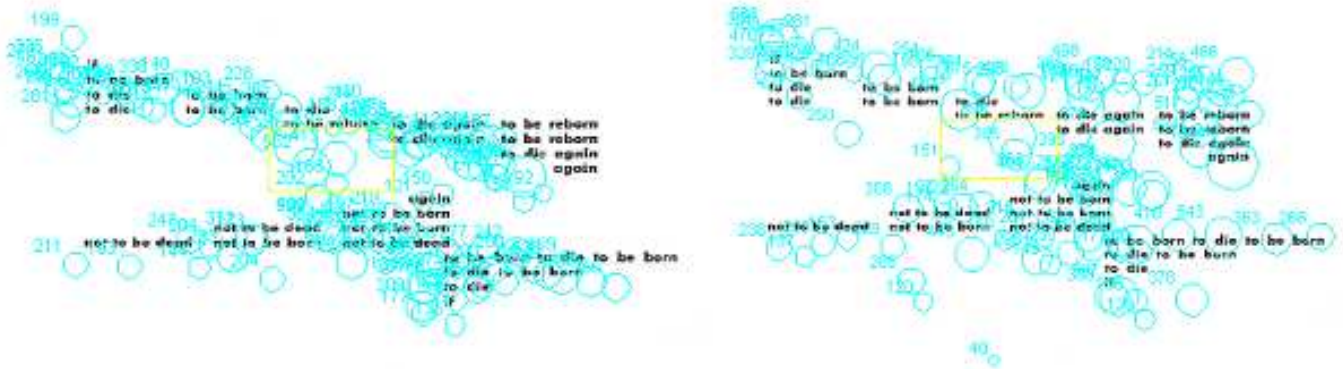


Figure 2: Fixations on Haroldo de Campos' 'if to be born' (1958)

In a consecutive analysis, we investigated the distribution of fixations on a vertical axis, to investigate whether readers 'read' poems in a more or less sequential pattern from top to bottom, or whether they 'scan' across a text (see figure 3). The numbers on the vertical line (Y-axis) indicate the pixel position on screen — with zero being the pixel at the top. The numbers on the horizontal line (X-axis) indicate an aggregate of 20 fixation data-points. In this case, for example, participant 1 made at least 400 fixations, while many other participants discontinue looking at the poem sooner.

By looking at the graph it is apparent that the initial five time-windows (representing a total of 100 fixations) do indeed reflect a downward reading pattern, consistent with both the habitual reading direction and the physical alignment of the text on the screen (note that the pixel-wise analysis does not take horizontal eye movement shifts into consideration). Soon after that, this more systematic reading direction breaks down and participants show a more erratic pattern, which indicates that the formal properties of the poem were addressed only in the later phase of its inspection. There are also significant inter-individual differences — with some people reading the text very thoroughly, showing a very intense fixation pattern (such as participant 1), while most others make only a few fixations:

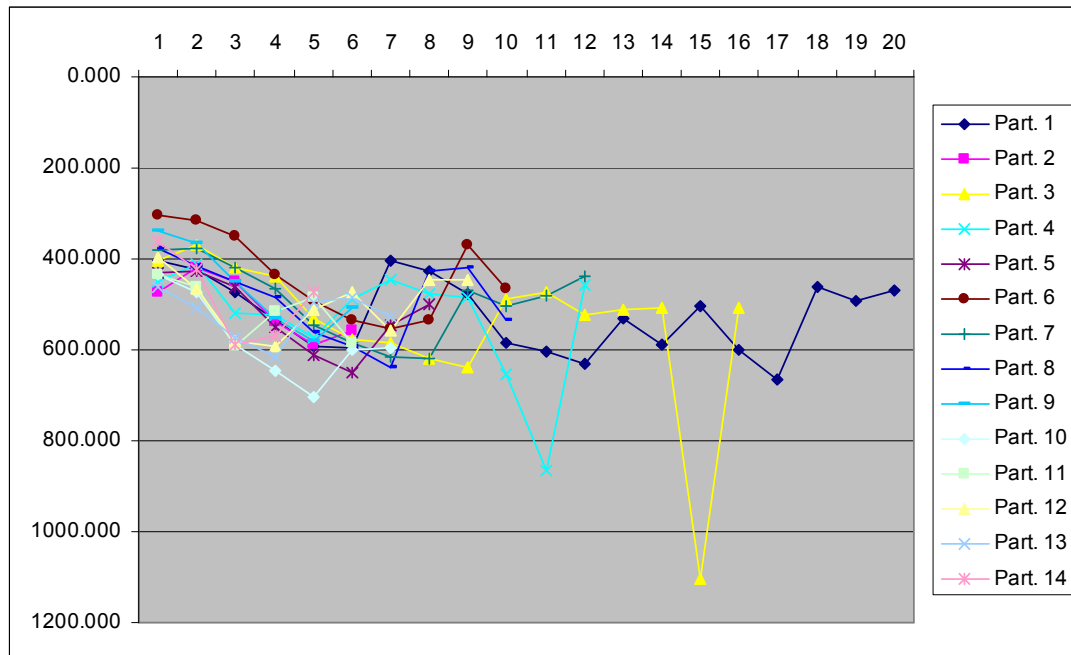


Figure 3: Fixation patterns for 'if to be born'

Generally speaking, eye-movement patterns are correlated with the spatial characteristics of a mental image with strong spatial features. This suggests that internal representations of space are projected onto external coordinates. In one study, for example, Spivey and Geng had stories read to participants.⁴⁶ The stories contained strong spatial associations (such as a story about describing a high-rise building, a deep canyon, a train going to the left etc.), while surreptitiously recording their eye movements. Eye movements were reliably oriented in a direction compatible with the direction described in the story. For example, participants spontaneously produced predominantly vertical eye movements while listening to the description of the high-rise building.⁴⁷ There is also evidence for the opposite direction of influence — namely from the visual/spatial domain to cognition. Research suggests that action can also guide and inform cognition. Although this research was not conducted in a poetry context, it illustrates the influence that the (spatial) arrangement of material in the outside world has on our cognitive processes. In one set of experiments, Grant and Spivey investigated what areas of a difficult visually presented problem people look at just prior to finding the solution. (In this case it was Duncker's Famous Radiation Problem in which people have to find a

solution to destroy a tumour with a laser without destroying the surrounding tissue). In a next step, they then directed the attention of a group of different participants to this exact same area — and found that their problem solving skills were systematically enhanced from performing these instructed eye movements. As an explanation, the authors propose that in directing the eyes in a certain fashion, participants ‘act out’ a solution and find it easier to subsequently ‘think of the solution’. It is in this sense that ‘guiding attention guides thought’⁴⁸ — guiding the eyes in a particular fashion leads to a particular cognitive experience or insight. This assumption has subsequently been supported by follow-up research,⁴⁹ which showed that this mediation of thought-elements via eye-movements can also be effective when participants are not aware of it. In our own research we employed a similar logic by hypothesizing that inducing a particular scanning strategy (via the insertion of spaces) leads to a particular cognitive experience. In this sense, we expected that the spaces in text add to a distinct cognitive experience.

Pierre and Ilse Garnier’s poem ‘marie’ consists of a single word — and a reader would be able, in principle, to recognize this with just a handful of fixations. Yet, participants made an average of 61 fixations. This is even more evident in Alan Riddell’s poem ‘The Honey Pot’, which consists of the letter ‘b’ scattered repeatedly across the page, the shape of the scatter plot evoking the impression of bees swarming towards a honey pot. The letter is immediately recognizable, yet the poem attracted on average 53 fixations, with different individuals going well beyond that. This pattern suggests that people do not merely collect verbal information dictated by the symbolic entities (the letters) on the page. Rather, they relish the arrangement of the letters while forming an interpretation and judgment. Or, as Bob Cobbing puts it, ‘we tongue [the poem] with our eyes’.⁵⁰

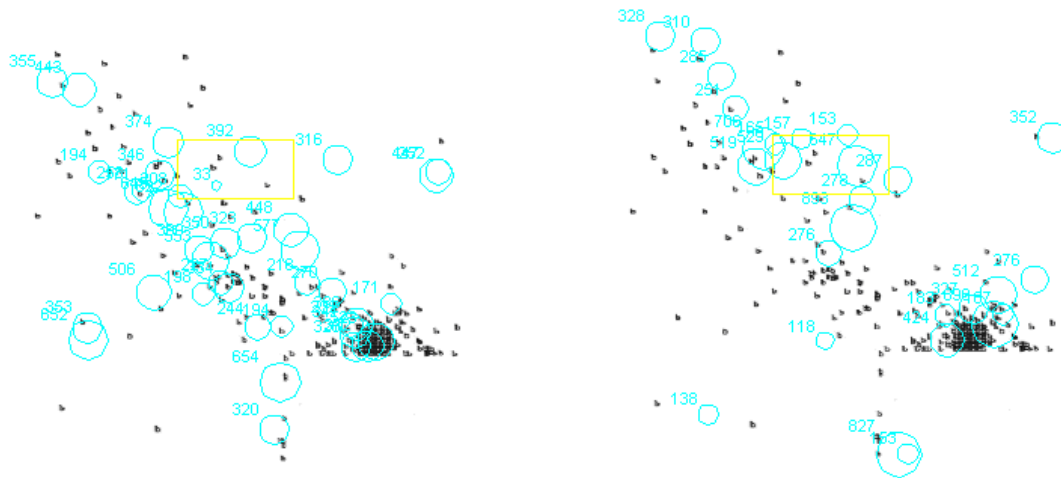


Figure 4: Fixation pattern from two individual participants on Alan Riddell's 'The Honey Pot' (1972)

We also found that 'The Honey Pot' attracted particularly long fixation durations, suggesting that it is rather at the 'picture' end of the 'text-picture-continuum', since these long fixation durations are more typical for 'pictures' as opposed to words. Average fixation durations during reading are approximately 225ms, while those during picture viewing are approximately 330ms. Likewise, the average size of saccades during reading is approximately eight character spaces long, while it is roughly twice that amount during picture viewing (cf. Rayner 1998).⁵¹ From the fourteen visual poems used in our experiment, 'The Honey Pot' attracted the longest fixation durations. Other poems in which there was more spatial than verbal information, such as 'marie', also attracted longer than usual fixation durations.⁵²

In contrast to the fixation durations, readers' average saccade sizes point more in the direction of a reading pattern where saccades are typically around 8 characters in length (see figure 5).

Poem	Fixation Duration	Saccade Size (in characters)	Number of Fixations
is the text the text left out	299	6.79	95
The Honey Pot	342	9.86	53
if to be born	276	7.08	111
Trip	271	7.70	130
marie	300	7.61	61

Figure 5: Eye movement parameters for five case study poems, averaged across participants

Since reading pattern and fixation distribution and density is not related to the textual information alone, this suggests that a ‘scanning’ as opposed to a ‘reading’ mode of visual poems is adapted as soon as the linear decoding approach seems unsuitable. This stage of exploration strategy also occurs when textual information is interspersed with non-mimetic or irregular spaces. It can be inferred that fixations are not guided simply by textual information — the more scattered fixation patterns are an indication that readers try to ‘feel what is out there’ — and given that it is not the verbal/textual element, it is inevitably the visual-spatial component that the reader tries to integrate with what she or he has learned from the words.

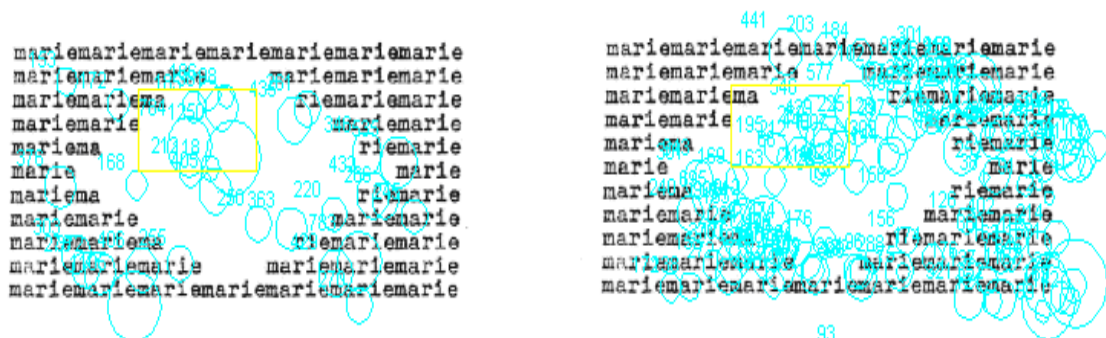


Figure 6: Fixation pattern from two individual participants on Pierre and Ilse Garnier’s ‘marie’ (1965)

In a separate investigation, we also looked at the actual fixations on empty space in different poems more directly by studying the fixation pattern on empty locations in the text. People fixate on empty space when it is associated with meaning in one way or another. In one study, for instance, Richardson and Spivey presented information in a certain corner of a computer screen.⁵³ The information then disappeared, and

people were then asked to recall certain facts. In recalling facts, they looked at the corner of the screen that was associated with the memorized information. Spivey, Richardson and Fitneva refer to this behaviour as 'externalism' and propose that the 'outsourcing' of information into external movements offloads memory in the same way in which the use of our fingers in counting objects at a distance helps us keep track of what we do.⁵⁴ Similar mechanisms are at work during reading. When people integrate information with earlier passages in a text, in thinking about these earlier portions they often return there with their eyes, even if the space is empty.⁵⁵

Based on an earlier experiment, in which our participants read Eugen Gomringer's 'silencio' on the eye tracker screen, we had already found that people sometimes fixate quite intensely on an empty space if it is assumed that it carries meaning, as indicated by some of the heatmaps that summarize the fixation density ('heat') on a given area:



Figure 7: Sample heatmaps of fixations on Eugen Gomringer's 'silencio'

In our more recent experiment we found this pattern replicated: in the case of those poems with a meaningful enclosed empty space, this space does attract substantial amounts of fixations/attention — as is the case for Claus Bremer's 'is the text the text left out':

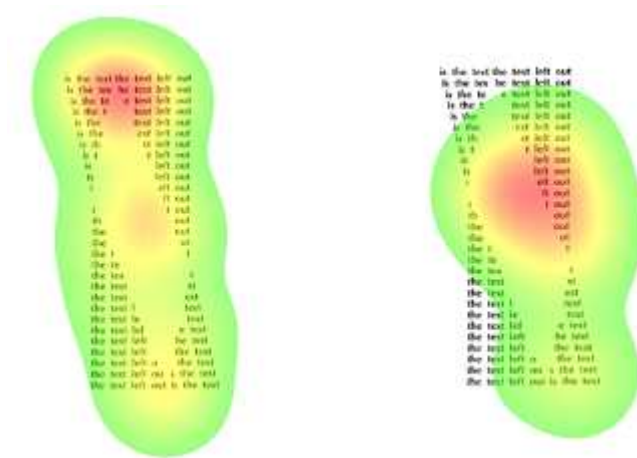


Figure 8: Sample heatmaps of fixations on Claus Bremer's 'is the text the text left out' (1964)

While the fixation patterns differed for individual participants and our data are based on our selective sampling, the results from these participants suggest a pattern in which space carries overt meaning that attracts fixations from the viewer.

3.3. Interpretative responses and aesthetic ratings

In a second step, we related the ratings from the questionnaires to the eye-movement data. The general response to the poems was positive. All of the participants rated their liking of the works as six or higher on a scale of one to ten (with higher ratings indicating higher liking). The average score was seven and a half. Interestingly, those participants who, in their written and spoken responses, referred to the poems in terms of difficulty or confusion, or as requiring some kind of unusual cognitive effort, tended to rate their experience highly, with scores of eight, nine and ten. Half of the participants reported liking the poems more when they were presented to them on paper, with two people referring to tactility as a contributing factor. A more sustained form of viewing seemed to reinforce preferences for particular poems. Some participants highlighted that the simpler works seemed even more banal on second viewing.

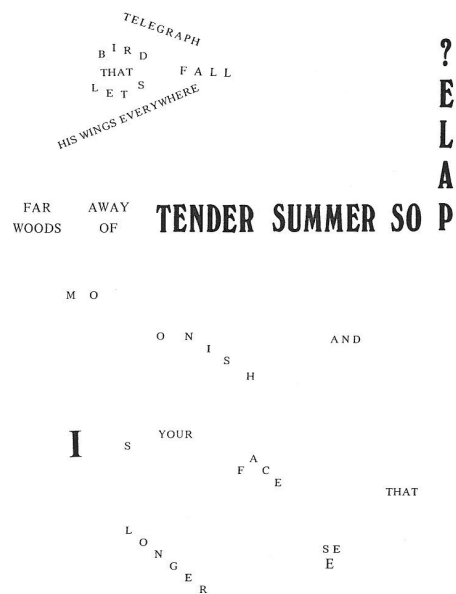


Figure 9: Guillaume Apollinaire's 'Trip' (1914) [extract]

When relating different statements about the function of space to particular poems in the second questionnaire, the participants were most in agreement with the statements 'the visual layout is frustrating' and 'the spatial layout complicates and disrupts the reading process' in relation to Apollinaire's 'Trip'. In fact, eleven out of fourteen participants mentioned Apollinaire's 'Trip' in relation to frustration and disruption of the reading process. Six out of fourteen also mentioned Mallarmé in this context. The fact that eleven out of fourteen perceived Apollinaire's poem as disruptive and frustrating corroborates the results from the eye-tracking data: that poem seemed to have elicited the most visible oscillation between a viewing and a scanning mode; here, linear decoding approaches were thwarted, and perceptual fluency was visibly violated. There are some counter-intuitive linguistic elements in that poem, such as the section which forces readers to read upwards rather than downwards.

Participant responses were divided in relation to the question 'Were there any poems that you liked more than the others?'. Only Apollinaire's 'The Tie and the Watch' was repeatedly cited in this

context, with six people out of fourteen saying it was their favourite poem. Interestingly, this is a mimetic poem, meaning its shape corresponds to recognizable objects (a tie and a watch). Four out of fourteen participants cited 'The Honey Pot' as their favourite poem, and six out of fourteen thought it was the poem in which space was used most effectively. This poem is also mimetic, and rather humorous — another quality which participants generally seem to like. The ability to associate the shapes with some kind of recognizable image seems to be linked to liking, suggested by the fact that mimetic poems attract higher evaluative scores than abstract ones.

4. Conclusions

The material we analyzed suggests that relatively linear visual poems are also more likely to attract a linear reading pattern (reading direction from top to bottom). The more irregular visual poems, in contrast, in which space plays a more prominent role, such as 'Trip' and 'The Honey Pot', elicited more diverse and subjective responses from the participants, and it was more difficult to detect any general patterns.

These results suggest four points. First, when participants encounter linguistic signs that are arranged in pictorial but ordered fashion, the primary instinct is still to adopt a classical reading approach. Only if that is not possible, or not informative, do they opt for a more varied scanning approach. This seems to corroborate the findings of a much older experiment, the famous Stroop test. The Stroop test established that linguistic information is automatically accessed, even when readers direct their attention to visual information. In other words, automatized codes (the meaning of the word) cannot be ignored or inhibited easily, even while participants attend to the visual aspects of words, which in this particular case were colours.⁵⁶

Secondly, when the sign systems are mixed together in a more radical fashion, and when readers are perplexed and uncertain about which of them dominates (that is, the verbal or the visual elements), the confusion as to which perceptual mode they should adopt is visible in their eye movements. Nelson Goodman, as discussed in section two, asserted that reading modes are ultimately a matter of convention and authorial stipulation, and that they are independent of the internal structure of the sign systems. In the case of visual poetry, it is often unclear which sign system dominates, and which reading mode has been specified by the author. The eye-movements of our participants seem to

mirror their cognitive confusion. Often, the eye-movements alternate rapidly between reading and viewing modes. The systematic generation of cognitive rupture by disrupting habitual responses to poetry is a key aim of many avant-garde writers, and our data shows that when readers are confronted with non-mimetic and non-linear visual poetry, an oscillation between linear decoding and spatial scanning occurred. Visual poems thus create confusion on numerous levels: about the relationship between figure and ground, about genre affiliations, about reading/viewing modes, and about the relationships of the linguistic parts to each other.

Thirdly, in those poems where conceptual and material empty spaces overlap, where an empty space enclosed within a poem signifies, such as in 'silencio', 'marie' or 'is the text the text left out', participants often fixate on the empty space while they ponder the meaning of the poem. While they are preoccupied with meaning construction and problem solving, their eyes dwell on the material gaps which seem to hold the clue to the mystery, and thus function simultaneously as empty projection planes and as a signifying fields in their own right.

Finally, aesthetic ratings of these poems seem to be related to the connection between liking and recognizing, and to the amount of cognitive effort poems require. Mimetic poems like Apollinaire's 'The Tie and the Watch' and Alan Riddell's 'The Honey Pot' were the most popular ones. As early as in the 4th century B.C., Aristotle already suggested in his *Poetics* that human beings respond to likeness with pleasure, meaning that mimesis and recognition elicit positive responses. Similarly, he diagnoses an epistemophilic drive in humans, asserting that they derive pleasure from the act of understanding (that is, cognition and problem-solving). Both the acts of *recognition* and *cognition*, Aristotle posits, are pleasure-inducing mental processes. This applies to visual poems, too, but they operate on a very fine line between a complexity that can be experienced as threatening and a simplicity that can be experienced as predictable or banal. While the conceptual, non-mimetic deployment of space in Mallarmé, or in Apollinaire's poem 'Trip', seems to engender a crisis of interpretation, since many readers experience spaces in these poems as too ambiguous, too open, and thus intimidating, many simpler concrete poems in which space signifies just one idea seem banal in contrast, and were unable to hold the participants' attention for long. Once participants understood the visual-verbal crux proposed by a particular poem, they moved on quickly. While concrete poetry may be challenging

on a theoretical level, for it forces us to oscillate between viewing and reading modes and thus to re-evaluate basic assumptions about the functions of and conventions associated with different sign systems, close readings of specific poems suggest that Perloff's concern about the one-trick-pony nature of some concrete poems might not be unjustified after all.

In *Toward a Theory of Cognitive Poetics*, Reuven Tsur, with recourse to Keats, reflects on 'negative capability' — the 'capability of being in uncertainties, Mysteries, doubts, without any irritable reaching after fact & reason'.⁵⁷ Various works of visual poetry demand different degrees of tolerance of ambiguity and cognitive dissonance: it seems that in some cases, spatial elements complicate or even obscure meaning, rendering it too open, too ambiguous, by multiplying the possibilities of relating and comparing the linguistic elements ad infinitum. In other poems, in contrast, spatial elements trivialize, restrict and narrow down meaning. Both experiences were perceived as frustrating by our participants. Only very few works seem to operate successfully in a space between over-complexity and triviality by deploying conceptual and material gaps in a manner that engenders a dynamic dialogue between the signifying regimes which results neither in cognitive anxiety nor in boredom.

Dr Kim Knowles is a lecturer in Film at Aberystwyth University; **Dr Anna Katharina Schaffner** is Senior Lecturer in Comparative Literature at the University of Kent and Co-Director of the Centre for Modern European Literature; **Dr Ulrich Weger** is Senior Lecturer in Psychology and Director of the Centre for Research on Social Climate at the University of Kent. All are members of the 'Poetry Beyond Text: Vision, Text, and Cognition' project, funded by the UK Arts & Humanities Research Council. **Dr Andrew Michael Roberts** is Professor of Modern Literature at the University of Dundee, and is Director of the 'Poetry beyond Text' project.

Notes

- 1 Bob Cobbing, *VerbiVisiVoco: Selected Poems 1942-2001*, ed. by Michael Lentz (Vienna: edition selene, 2003), s.p.
- 2 Andrew Michael Roberts, Jane Stabler, Martin H. Fischer & Lisa Otty, 'Space and Pattern in Linear and Postlinear Poetry: Empirical and

- Theoretical Approaches', *European Journal of English Studies*, 17 (forthcoming, 2013).
- 3 Russell West-Pavlov, *Space in Theory: Deleuze, Kristeva, Foucault* (Amsterdam; New York: Rodopi, 2009), p. 15.
 - 4 Stéphane Mallarmé, *Œuvres complètes* (Paris: Gallimard, 2003), p. 391.
 - 5 For critical literature on Mallarmé, see, for example, Malcolm Bowie, *Mallarmé and the Art of Being Difficult* (Cambridge: Cambridge University Press, 1978); Maurice Blanchot, *The Space of Literature*, trans. by Ann Smock (Lincoln, NE: University of Nebraska Press, 1982); Robert Greer Cohn, *Mallarmé's Prose Poems: A Critical Study* (Cambridge: Cambridge University Press, 1987); and Graham Robb, *Unlocking Mallarmé* (New Haven: Yale University Press, 1996).
 - 6 For examples and discussions of visual poetry and its development from antiquity to the present day, see, for example, Jeremy Adler & Ulrich Ernst, *Text als Figur. Visuelle Poesie von der Antike bis zur Moderne* (Weinheim: VCA, 1987); Klaus Peter Dencker, *Text-Bilder. Visuelle Poesie International. Von der Antike bis zur Gegenwart* (Cologne: M. DuMont Schauberg, 1972); and Dick Higgins, *Pattern Poetry: Guide to an Unknown Literature* (Albany: State University of New York Press, 1987).
 - 7 Adler & Ernst, *Text als Figur*.
 - 8 For more general discussions of concrete poetry, the Noigandres Group and Eugen Gomringer, see, for example, Johanna Drucker, *Figuring the Word: Essays on Books, Writing, and Visual Poetics* (New York: Granary, 1998), pp. 110-36; Heinz Ludwig Arnold (ed.), *TEXT + KRITIK. Zeitschrift für Literatur. KONKRETE POESIE II*, 25 (1970); Heinz Ludwig Arnold (ed.), *TEXT + KRITIK. Zeitschrift für Literatur. KONKRETE POESIE*, 30 (1971); Michael Backes, *Experimentelle Semiotik in Literaturavantgarden. Über die Wiener Gruppe mit Bezug auf die Konkrete Poesie* (Munich: Wilhelm Fink, 2001); Lenora De Barros and João Bandeira (eds), *Grupo Noigandres. Arte Concreta Paulista* (São Paulo: Cosac & Naify, 2002); Gomringer, Eugen, (ed.), *konkrete poesie deutschsprachiger autoren. anthologie* (Stuttgart: Reclam, 1972); Eugen Gomringer, *theorie der konkreten poesie. texte und manifeste 1954-1987* (Vienna: Edition Splitter, 1998); Eugen Gomringer, *zur sache der konkreten. eine auswahl von texten und reden über künstler und gestaltungsfragen 1958-2000* (Vienna: Edition Splitter, 2002); Wolf Haas, *Sprachtheoretische Grundlagen der Konkreten Poesie* (Stuttgart: Akademischer Verlag Stuttgart, 1999); Oliver Herwig,

Wortdesign. Eugen Gomringer und die bildende Kunst (Munich: Iudicium, 2001); K. David Jackson, Eric Vos & Johanna Drucker (eds), *Experimental-Visual-Concrete: Avant-Garde Poetry Since the 1960s* (Amsterdam; Atlanta: Rodopi, 1996); Thomas Kopfermann (ed.), *Theoretische Positionen zur Konkreten Poesie* (Tübingen: Max Niemeyer, 1974); Thomas Kopfermann, *Konkrete Poesie — Fundamentalpoetik und Textpraxis einer Neo-Avantgarde* (Frankfurt am Main; Bern: Peter Lang, 1981); Michael Lentz, *Lautpoesie/-musik nach 1945. Eine kritisch-dokumentarische Bestandsaufnahme*, 2 vols (Vienna: edition selene, 2000); Pedro Reis, 'Concrete Poetry: A Generic Perspective', in Jackson, Vos & Drucker (eds), *Experimental-Visual-Concrete*, pp. 287–302; Wendy Steiner, 'Res Poetica: The Problematics of the Concrete Programme', *New Literary History*, 12:3 (1981), 529–45; Christina Weiss, *SEH-TEXTE. Zur Erweiterung des Textbegriffes in konkreten und nach-konkreten visuellen Texten* (Nürnberg: Institut für moderne Kunst, 1984); and Emmett Williams (ed.), *An Anthology of Concrete Poetry* (New York; Stuttgart: Something Else Press, 1967).

- 9 See, for example, Backes, *Experimentelle Semiotik in Literaturavantgarden*; Haas, *Sprachtheoretische Grundlagen der Konkreten Poesie*; Lentz, *Lautpoesie/-musik nach 1945*.
- 10 Augusto de Campos, Haroldo de Campos & Decio Pignatari, 'Pilot Plan for Concrete Poetry', in *Concrete Poetry: A World View*, ed. by Ellen Mary Solt (Bloomington: Indiana University Press, 1970), p. 71.
- 11 de Campos, de Campos & Pignatari, 'Pilot Plan for Concrete Poetry', p. 72.
- 12 See, for example, Arnold (ed.), *TEXT + KRITIK. Zeitschrift für Literatur. KONKRETE POESIE II*, 25; Arnold (ed.), *TEXT + KRITIK. Zeitschrift für Literatur. KONKRETE POESIE*, 30; Backes, *Experimentelle Semiotik in Literaturavantgarden*; Haas, *Sprachtheoretische Grundlagen der Konkreten Poesie*; Jackson, Vos & Drucker (eds), *Experimental-Visual-Concrete*; Kopfermann (ed.), *Theoretische Positionen zur Konkreten Poesie*; Kopfermann, *Konkrete Poesie*; Lentz, *Lautpoesie/-musik nach 1945*; Reis, 'Concrete Poetry'; Solt, *Concrete Poetry*; Steiner, 'Res Poetica'; Weiss, *SEH-TEXTE*; and Williams (ed.), *An Anthology of Concrete Poetry*.
- 13 The research project 'Poetry Beyond Text: Vision, Text and Cognition' (2009–2011) was funded by the UK Arts and Humanities Research Council, as part of the their *Beyond Text* Programme, 2009–2012. Involving researchers from English Literature,

Comparative Literature, Psychology, and Fine Art at the University of Dundee and the University of Kent, it studies critical, cognitive and creative responses to works combining text and image. Project team members included: Professor Andrew Michael Roberts (English, University of Dundee), Dr Anna Katharina Schaffner (Comparative Literature, University of Kent), Professor Martin Fischer (Psychology, University of Dundee), Dr Ulrich Weger (Psychology, University of Kent), Ms Mary Modeen (Fine Art, University of Dundee), Dr Kim Knowles (Film, Aberystwyth University), Dr Lisa Otty (English, University of Dundee). For more information, please consult our website at: <http://www.poetrybeyondtext.org>.

- 14 Roberts, Stabler, Fischer & Otty, 'Space and Pattern in Linear and Postlinear Poetry'.
- 15 The terms 'nonlinearity' and 'postlinearity' come from Marjorie Perloff, 'After Free Verse: The New Nonlinear Poetries', in *Poetry On & Off the Page: Essays For Emergent Occasions* (Evanston, Ill: Northwestern University Press, 1998), pp. 141–67.
- 16 Richard Bradford, *The Look of It: A Theory of Visual Form in English Poetry* (Cork: Cork University Press, 1993), p. 40.
- 17 Roberts, Stabler, Fischer & Otty, 'Space and Pattern in Linear and Postlinear Poetry'.
- 18 H. Porter Abbott, 'Cognitive Literary Studies: The "Second Generation"', *Poetics Today*, 27:4 (2007), 719.
- 19 Meir Sternberg, *Expositional Modes and Temporal Ordering in Fiction* (Bloomington: Indiana University Press, 1993), p. 311 n.29.
- 20 Nelson Goodman, *Languages of Art: An Approach to a Theory of Symbols* (Indianapolis; Cambridge: Hackett, 1976).
- 21 Ernst Gombrich, *Art and Illusion: A Study in the Psychology of Pictorial Representation* (Princeton: Princeton University Press, 2000).
- 22 Cf. W.J.T. Mitchell, *Iconology: Image, Text, Ideology* (Chicago: University of Chicago Press, 1986).
- 23 Mitchell, *Iconology: Image, Text, Ideology*, p. 70.
- 24 Virginia A. La Charitié, *The Dynamics of Space: Mallarmé's Un Coup de Dés Jamais n'Abolira le Hasard* (Lexington, Kentucky: French Forum Publishers, 1987), p. 13.
- 25 West-Pavlov, *Space in Theory*, p. 16.
- 26 Mallarmé, *Œuvres complètes*, p. 211.
- 27 Steiner, 'Res Poetica', 538.
- 28 Steiner, 'Res Poetica', 538.

- 29 Marjorie Perloff, *Radical Artifice: Writing Poetry in the Age of Media* (Chicago: University of Chicago Press, 1994), p. 116.
- 30 Alan Kennedy, *The Psychology of Reading* (London; New York: Methuen, 1984), p. 34.
- 31 Kennedy, *The Psychology of Reading*, p. 127.
- 32 Peter Stockwell, *Cognitive Poetics: An Introduction* (London; New York: Routledge, 2002), p. 15.
- 33 See, for example, Eva Wong & Naomi Weisstein, 'A New Perceptual Context-Superiority Effect: Line Segments are More Visible Against a Figure than Against a Ground', *Science*, 218 (1982), 587–89.
- 34 La Charitié, *The Dynamics of Space*, p. 88.
- 35 La Charitié, *The Dynamics of Space*, p. 44.
- 36 La Charitié, *The Dynamics of Space*, p. 108.
- 37 La Charitié, *The Dynamics of Space*, p. 9.
- 38 La Charitié, *The Dynamics of Space*, p. 37.
- 39 La Charitié, *The Dynamics of Space*, p. 43–4.
- 40 The other poems used in the experiments include Larry Freifeld's 'Sleep like a log' (1966), Edwin Morgan's 'Seven Headlines' (1966) and e. e. cummings' 'The sky' (1916) in group one; Guillaume Apollinaire's 'The Tie and the Watch' (1914) in group two; Eugen Gomringer's 'o grow' (1954) and Adriano Spatola's 'Invitation' (1966) in group three; and Gomringer's 'the black mystery is here' in group four.
- 41 In our experiment we made use of an Eyelink 1000 eye tracker, which measures eye position remotely with high temporal and spatial resolution through an infrared camera. The poems were displayed on the screen one at a time; reading was self-paced, and participants were asked to move on to the next poem as soon as they were ready. We subsequently used the eye-link data-viewer software to aggregate and analyse our data.
- 42 Terminology from Albrecht Inhoff, SUNY Binghamton.
- 43 Cf. Keith Rayner, 'Eye Movements in Reading and Information Processing: 20 Years of Research', *Psychological Bulletin*, 124 (1998), 372–422.
- 44 For a more detailed overview, see Rayner, 'Eye Movements in Reading and Information Processing'.
- 45 The figures in this paper were graphically altered and resized and were chosen from the pool of available graphs to demonstrate/highlight a particular point.

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- 46 Michael Spivey & Joy J. Geng, 'Oculomotor Mechanisms Activated by Imagery and Memory: Eye Movements to Absent Objects', *Psychological Research*, 65:4 (2001), 235–41.
 - 47 Spivey & Geng, 'Oculomotor Mechanisms Activated by Imagery and Memory'.
 - 48 Elizabeth R. Grant & Michael J. Spivey, 'Eye-Movements and Problem Solving: Guiding Attention Guides Thought', *American Psychological Society*, 14:5 (2003), 462.
 - 49 For example, Laura E. Thomas & Alejandro Lleras, 'Moving Eyes and Moving Thought: On the Spatial Compatibility Between Eye Movements and Cognition', *Psychonomic Bulletin & Review*, 14:4 (2007), 663–68.
 - 50 Bob Cobbing, *VerbiVisiVoco: Selected Poems 1942-2001*, s.p.
 - 51 Cf. Rayner, 'Eye Movements in Reading and Information Processing'.
 - 52 'The Honey Pot' attracted the longest fixation durations, followed by 'the black mystery', 'The Tie and the Watch', 'o grow', 'marie', 'is the text the text left out', 'Un coup de dés' (extract one), 'Seven Headlines', 'The sky', 'if to be born', 'Trip', 'Un coup de dés' (extract two), 'Sleep like a log', and 'Invitation', which attracted the shortest fixation durations.
 - 53 Daniel Richardson and Michael Spivey, 'Representation, Space and Hollywood Squares: Looking at things that aren't there anymore', *Cognition*, 76 (2000), 269-295
 - 54 Michael Spivey, D.C. Richardson & S. A. Fitneva, 'Thinking Outside the Brain: Spatial Indices to Visual and Linguistic Information', in *The Interface of Language, Vision and Action*, ed. by Fernanda Ferreira & John Henderson (London: Routledge, 2000), pp. 161–90
 - 55 See, for example, Alan Kennedy & Wayne Murray, 'Spatial Coordinates and Reading: Comments on Monk', *Quarterly Journal of Experimental Psychology*, 39 (1985), 649–56; and Ulrich Weger & Albrecht Inhoff, 'Memory for Word Location During Reading: Eye Movements to Previously Read Words are Spatially Selective but not Precise', *Memory & Cognition*, 33:3 (2005), 447–61.
 - 56 In the Stroop test, 'color names (e.g., "yellow") are written in different-colored ink (e.g., blue). If the participants are required to read the word, they have little interference from the ink color, but if they are required to name the ink color, they have great difficulty because of interference from the color name. Again, this suggests that the relationship between a verbal stimulus and its name is much more direct than the description of a nonverbal stimulus in words'.

Reuven Tsur, *Toward a Theory of Cognitive Poetics*, 2nd ed.
(Brighton; Portland: Sussex Academic Press, 2008), p. 111.

57 Tsur, *Toward a Theory of Cognitive Poetics*, p. 511.