

Look Before You Leap:

How Enjambment Affects the Processing of Poetry

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Ruth Koops van 't Jagt*

Center for Language and Cognition Groningen, University of Groningen

P.O. Box 716, 9700 AS Groningen, The Netherlands

Email: r.koops.van.t.jagt@rug.nl

Phone: +31 50 363 6996

Fax: +31 50 363 6855

John C. J. Hoeks

Center for Language and Cognition Groningen, University of Groningen

Gillis Dorleijn

Department of Dutch Language and Literature, University of Groningen

Petra Hendriks

Center for Language and Cognition Groningen, University of Groningen

* Corresponding author

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Abstract

This study describes two eye tracking experiments investigating the processing of poetry with and without enjambments. In Experiment 1, poetic fragments with authentic prospective (syntactically incomplete) or retrospective (syntactically complete) enjambments were investigated; in Experiment 2, enjambments were created - for the purpose of the experiment - from poetry that did not originally contain enjambments. We hypothesized that the layout of the text in poetic fragments would affect the degree to which integrative processes take place: in case of prospective enjambments, the syntactic incompleteness may preclude integration at the end of the line (before going to the next line), whereas retrospective enjambments may cause considerable re-interpretation at the next line. We indeed found significant differences in reading patterns between prose and poetry, poetry with and without enjambment, and poetry with prospective and retrospective enjambment. We interpret these results as favoring a dynamic model of language processing, where the amount and type of integration is determined by syntactic (in)completeness, semantic (in)completeness, but also the physical layout of the text.

Keywords: Eye tracking; reading; poetry; prose; enjambment

Introduction

The initial stages of poetry reading are highly influenced by the linguistic and textual structure of the poem, as is pointed out by Hanauer (2001) in his discussion of empirical studies on reading poetry. Readers use these structures ‘to categorize the text as a poem’ (Hanauer, 2001: 125-126). The aim of this study is to add to our understanding of the processes of poetry categorization and poetry reading by experimentally investigating the influence of the characteristic visuospatial presentation of poetry on how poetry is read. In our eye tracking study, we focus on a particularly poetic phenomenon, namely enjambment. We investigate whether readers are sensitive to the specific visuospatial presentation of poetry and the presence or absence of enjambments, and whether the non-coincidental line breaks that are characteristic of enjambment elicit specific reading patterns.

To illustrate the effect of the visuospatial presentation of text on the reader, consider the following fragment of poetry, taken from the poem ‘The Right of Way’ from William Carlos Williams:

Why bother where I went?
for I went spinning on the

four wheels of my car
along the wet road until

I saw a girl with one leg
over the rail of a balcony

There are several ways in which the reader of this poem can structure the text. Take, for example, the last stanza: Is it ‘a girl with one leg’, or ‘a girl with one leg over the rail of a balcony’? This ambiguity disappears if the same text is presented as prose:

Why bother where I went? For I went spinning on the four wheels of my car along the wet road until I saw a girl with one leg over the rail of a balcony.

Besides the interpretational possibilities, also the rhythm of the text changes. In the presentation as prose, there is no longer the pause after ‘until’ suggested by the line break in

the first fragment. Finally, the first fragment is easily recognized as a poem, while the second fragment could very well be taken from a novel.

This example illustrates that the visuospatial presentation of the text is an important aspect of poetry: Poetry is ‘language in lines’ (Hartman, 1980). Not the width of the page or screen determines where a line breaks, but rather the poet does. In effect, lineation in free verse poetry is not a coincidence but a choice by the poet. This becomes especially manifest in the case of enjambments. An enjambment occurs when a line break does not coincide with a syntactic boundary. With enjambment, the pause as suggested by the line break divides a syntactic unit. This results in a conflict between the syntactic properties of the text and the visuospatial presentation of the text. Thus, the question arises whether readers conform to the syntactic boundaries when processing and interpreting the text, or alternatively conform to the boundaries as suggested by the visuospatial presentation of the text, or perhaps are sensitive to both types of information.

In poetry, a distinction can be made between two types of enjambment (Golomb, 1979): prospective and retrospective. In the case of a prospective enjambment, the tension between the line as a poetic unit and the syntactic unit that spills over to the next line is already visible and recognizable at the end of the first line, as is the case in the second line of the cited fragment from Williams (‘the / four wheels of my car’). In the case of a retrospective enjambment, the first line is a potentially syntactic complete one. Only when the reader continues, he realizes that the next line should be integrated with the previous line. An example of this kind of enjambment is found in the last two lines of the cited fragment (‘a girl with one leg / over the rail of a balcony’). With prospective enjambment, the syntactic expectations of the reader are confirmed, as the next line continues with the expected completion of the incomplete syntactic unit. With retrospective enjambment, on the other hand, the syntactic expectations of the reader are not met, because the syntactic phrase that was assumed to be complete turns out to be incomplete. Hence, readers should adjust their interpretation of the sentence. Because of these differences in syntactic expectations, it is reasonable to expect that these two types of enjambment are processed differently.

Reading is a complex cognitive process in which the reader constructs the meaning of a sentence. Apart from aspects of linguistic structure and aspects of sentence processing, in reading poetry an important role is played by the perception of the visuospatial presentation. Do readers perceive the significance of this visuospatial presentation? And if so, do they adjust their reading accordingly? In this study, we aim to shed more light on the process of reading poetry. Using eye tracking methodology, we set forth to answer the following three

research questions: (1) Do readers process poetry differently from prose?, (2) Do enjambments influence readers' processing of poetry?, and (3) Do prospective enjambments influence readers' processing of poetry differently from retrospective enjambments?

Earlier research on reading poetry suggests that readers indeed use textual information to decide whether they are dealing with a poem (Hoffstaedter, 1987, Hanauer, 1996).

Furthermore, in one of the earliest empirical studies on reading poetry, Van Peer (1986) found evidence that readers notice foregrounded elements of poetry and remember the surface structure of these elements. Hanauer (1998) further investigated to which extent readers are sensitive to the visuospatial presentation of poetry. He found that when a poetic text is visuospatially presented as a poem, readers remember these texts better. Hanauer (2001) postulates two possible explanations for this effect. Firstly, it is possible that readers use the visuospatial presentation as a visual frame to recall the surface structure. Secondly, he suggests that the visuospatial presentation activates a genre specific processing. Evidence for the latter explanation is provided by a study by Zwaan (1991, 1994) in which he shows that there are differences in reading time and surface representations depending on whether a text is presented as a newspaper article or a poem. This second explanation is further supported by a study by Fisher, Carminati, Stabler and Roberts (2003). They compared overall eye movements during the reading of authentic poems presented in their original layout and in a prosaic layout. When readers were faced with a poetry layout, they generally had slower reading rates, made more and longer fixations, and made shorter progressions and more and longer regressions compared to the prose layout.

Based on this literature, we expect to find longer fixations and more regressions for fragments presented as poetry compared to prose. However, the studies reviewed above only looked at reading behavior at a global level, and reported on more general measures such as reading rate and average number of fixations. They do not inform us about the dynamics of reading poetry, such as where in the text readers spend more time, and where they go faster, at what point in the sentence they regress to earlier parts, or quickly progress to the next word. The design of the present study does enable us to make such observations, as it uses very tightly controlled stimuli, where each word that occurs in a poetic format is compared to the identical word appearing in a prose setting. This allows us to investigate whether there are specific differences in reading processes between poetry without and with enjambment.

An ERP study on the processing of commas by Steinhauer and Friederici (2001) suggests that comma's can serve as visual cues for increases in processing. Perceiving visual boundaries in written text seems to involve the same processes as the perception of prosodic

boundaries in spoken language. Brouwer, Fitz, and Hoeks (2012) argue that these processes are indeed identical and reflect the effort invested in integrating information across words or phrases, which they assume is more intense at clause and sentence boundaries in both written and spoken language processing. In the case of an enjambment, the prosodic boundary as suggested by the line end conflicts with the syntactic unit. Research on the reading aloud of poetry by actors (Reuven, 1998) shows that readers realize both continuing and separating cues when they encounter an enjambment. If readers do the same in the silent reading of poetry, there may be longer end-of-line reading times (~separating cue) in prospective enjambments compared to prose and poetry without enjambment. Alternatively, the incompleteness of the syntactic structure of prospective enjambments may also pull the reader to the next line (~continuing cue), which would predict shorter end-of-line reading times for prospective enjambments compared to poetry without enjambment. Because *retrospective* enjambments resemble poetry without enjambment at the end of the line, one would expect readers to treat them similarly to poetry without enjambment, at least at the line end.

Because of the different syntactic expectations between poetry with prospective and retrospective enjambment, we expect to find differences in online reading processes as reflected by readers' eye movements during reading. With retrospective enjambments, the first line is a potentially complete one, so we expect retrospective enjambment to resemble end-stopped lines at the end of the first line. However, when readers proceed to the next line, they will realize that their expectation is not fulfilled, as the words on the next line are syntactically connected to the previous line. The exact form this processing difficulty takes depends on the problem solving strategy that is used, which may be different for individual readers. For instance, readers may go back when they encounter an unexpected or problematic word, which will lead to an increase in number of regressions and to an increase in regression-path duration. Alternatively, readers may remain in the problematic region, which will give rise to an increase in duration of first fixations, gaze, and total gaze. Finally, readers may detect a problem and decide to go 'fast forward', hoping the problem may be resolved by later information. This strategy is associated with an immediate decrease in the duration of first fixations, gaze, and total gaze, and sometimes with later increases in reading times duration or number of regressions. With all of these strategies, we expect the eye tracking measures to reflect greater processing difficulty at the words following retrospective enjambments than following prospective enjambments, because readers will have to revise their previously held interpretations.

Experiments

We conducted two eye tracking experiments to investigate the on-line processing of poetry. In our study, we combine authentic textual materials with manipulated textual materials by selecting poems that originally contained enjambments (Experiment 1) as well as poems that originally contained no enjambments and fragments that were originally prose fragments (Experiment 2) (see table 1). We manipulated the authentic fragments by adjusting line breaks, resulting in different versions of each fragment. The combination of original and manipulated materials allows us to carry out controlled experiments while at the same time maintaining some degree of ecological validity. Although the two experiments were run concurrently in one session with the same participants, we present them separately for reasons of clarity.

In the first experiment, we investigated the processing consequences of naturally occurring enjambment as found in the original poems. In the second experiment, we constructed enjambments from sources without enjambment. In the two experiments, we focused on the difference between prose and poetry and on the difference between prospective and retrospective enjambments. The original poetry fragments were selected from an anthology of young Dutch poets (Komrij, 2010) to avoid readers already being familiar with the poems.

Table 1. Design of Experiment 1 and Experiment 2.

	Item group (origin)	Condition (presentation)			
		Poetry with a prospective enjambment (pro)	Poetry with a retrospective enjambment (retro)	Poetry without enjambment (without)	Prose (prose)
EXPERIMENT 1	Poetry with a prospective enjambment (1)	PRO1*	-	WITHOUT1	PROSE1
	Poetry with a retrospective enjambment (2)	-	RETRO2*	WITHOUT2	PROSE2
EXPERIMENT 2	Poetry without enjambment (3)	PRO3	RETRO3	WITHOUT3*	PROSE3
	Prose (4)	PRO4	RETRO4	WITHOUT4	PROSE4*

Note. *=original format

The original and constructed line breaks in our materials occurred in a variety of syntactic units, for example in prepositional phrases and transitive predicates. Ideally, we would be able to distinguish between these various types of syntactic units and compare the processing of enjambments in these different syntactic units. However, the way we selected our materials did not permit such a comparison. Furthermore, apart from the type of syntactic unit, enjambments can also differ in other important aspects, such as line length. For future research into the processing of enjambments, it would be interesting to put together a database of naturally occurring enjambments in poetry and investigate their similarities and differences.

In our two experiments, which were run concurrently, participants read fragments of text presented on a computer screen. During reading, their eye movements were recorded. The two experiments were run in the same session with the same participants and the materials from the two experiments were mixed together. Twelve experimental lists were created using a Latin Square, with no list containing more than one version of a given item. The order in which items appeared in each list was determined semi-randomly (such that one type of item did not appear more than twice in succession) and was the same for all four lists. Each list was presented to an equal number of participants and each participant only saw one list.

Experiment 1

Materials and design

For Experiment 1, we selected original extracts of free verse poetry with prospective and retrospective enjambments. To assess the processing consequences of enjambments, we manipulated the selected fragments such that there were three versions of each extract: the original poetry version with enjambment (either prospective or retrospective), a derived poetry version without enjambment and a derived prose version. The fragments were presented in Verdana font size 10 at the left hand side of the screen, with a left margin of 125 pixels and a top margin of 10 pixels. Character length of the prose lines was on average 95, including interspacing. In Experiment 1, participants were presented with 30 text fragments (5 presented as poetry with prospective enjambment, 5 as poetry with retrospective enjambment, 10 as poetry without enjambment, and 10 as prose).

Table 2 provides examples (translated from Dutch, the language used in this study) of the six conditions used in Experiment 1. The first fragment, with prospective enjambment (PRO1), is from the poem ‘Naar buiten’ (Go outside) by Lerner Engelberts (in Komrij, 2010); the second fragment, with retrospective enjambment (RETRO2), is from ‘In een verder lege coupé’ (In an otherwise empty compartment) by Krijn Peter Hesselink (in Komrij, 2010).

Table 2. Examples of the fragment types used in Experiment 1.

ITEMGROUP	FRAGMENT TYPE	EXAMPLE OF FRAGMENT
ITEMGROUP 1	PRO1*	The light of the lantern does not // throw suspicious long shadows on the street.
	WITHOUT1	The light of the lantern / does not throw suspicious long shadows on the street.
	PROSE1	The light of the lantern does not throw suspicious long shadows on the street.
ITEMGROUP 2	RETRO2*	As long as you keep cycling you won't lose // your balance, he said.
	WITHOUT2	As long as you keep cycling / you won't lose your balance, he said.
	PROSE2	As long as you keep cycling you won't lose your balance, he said.

Note. *=original format; PRO1=prospective enjambment condition item group 1; WITHOUT1=condition without enjambment created from item group 1; PROSE1=condition without line breaks; "//"=critical line break; "/"=noncritical line break

Table 2 shows two extracts of poetry: one with a prospective enjambment and another one with a retrospective enjambment. In poetry with a prospective enjambment, the line break does not coincide with a syntactic boundary. The reader will be able to detect this type of enjambment already at the end of the first line. In poetry with a retrospective enjambment, the line break and the syntactic boundary do not coincide either, but this will become clear only at the beginning of the second line. In poetry without enjambment, or end-stopped poetry, which we derived from the original extracts with an enjambment, the line break coincides with a syntactic boundary.

Participants

The participants were 31 undergraduate students from the Faculty of Arts of the University of Groningen (6 male, age range 18-27, mean 21;4) who participated voluntarily. All were native speakers of Dutch with normal or corrected-to-normal vision. The majority of participants were language majors and all of them read poetry on a regular basis.

Procedure

Participants were tested in the Eye Lab of the Center for Language and Cognition Groningen of the University of Groningen. Eye movements were recorded using a Tobii T120 eye tracker (sampling at 120 Hz). The participants sat facing the eye tracking monitor at approximately 65 cm distance. They were told that they would be presented with fragments of poetry and prose and were instructed to read each fragment as they would normally read poetry or prose. Participants had no clues, other than visuospatial presentation (e.g. line breaks and width of the screen), that prose items were prose and poetry items were poetry. After each fragment, participants had to answer an evaluation question (“How beautiful do you think this fragment is?”) to make them read carefully. At the beginning of each trial, a fixation cross appeared on the screen. When participants fixated on the cross for at least 1 second, a red square appeared around the cross and the experimental item was presented on the screen. Participants were instructed to push the space bar once they had finished reading the item, after which the evaluation question appeared on the screen. They were asked to try to avoid blinking during the reading of the fragments to minimize blink-related disruptions of the eye tracking data. After 35 trials, the participants had the opportunity to take a short break. The test items were preceded by a practice trial of three items. At the end of the experiment, participants carried out a memory task, in which they had to complete incomplete versions of the fragments they had read earlier. These fragments were cut off at the end of the first line. Participants were not told about the memory task until the end of the experiment, because we felt this could influence their reading.

Analysis

We computed five eye tracking measures (cf. Hoeks, Hendriks, Vonk, Brown, & Hagoort, 2006): first fixation duration, first pass gaze (i.e., the time spent in a region – in our experiment corresponding to one word - for the first time without having read any later material and excluding regressions), first pass total gaze (which equals the first pass gaze plus all fixations and saccades following regressive eye movements), proportion of regressions, and regression path duration (time spent in a region for the first time, including regressions and fixations on preceding regions). Reading behavior was examined at four critical words: the two final words on the first line (pre-break and break), and the first two words immediately after the ‘leap’ of the reader’s eyes to the next line (post-break1 and post-break2).

It is important to note that the four critical words in each of the four poetry conditions (i.e., the conditions PRO1, WITHOUT1, RETRO2 and WITHOUT2) are compared to their counterparts in the prose condition. Consider for example the first fragment in Table 2: the word ‘not’ in the PRO1 condition is compared to ‘not’ in the PROSE1 condition; the word ‘lantern’ in the WITHOUT1 condition is compared to ‘lantern’ in the PROSE1 condition, etc. In this way, words that are compared will be *identical* in terms of word characteristics and semantic fit of the word in its context, and only differ in presentation format. Thus, the six fragment types presented in Table 2 form the basis for eight experimental conditions: for the first item group we have prospective enjambment (‘not’ PRO1) and its prose control (‘not’ PROSE1), and without enjambment (‘lantern’ WITHOUT1) and its prose control (‘lantern’ PROSE1); for the second item group we have retrospective enjambment (‘look’ RETRO2) and its prose control (‘look’ PROSE2), and without enjambment (‘way’ WITHOUT2) and its prose control (‘way’ PROSE2).

First, we removed outliers (i.e., observations exceeding item or participant means with 2.5 standard deviations), and then computed means per participant for the five eye tracking measures, for each of the four critical regions (corresponding to the four critical words), in each of the eight conditions. These means were entered into a Repeated Measures ANOVA with Genre (poetry versus prose), Enjambment (with versus without), and Item group (1: originally with prospective enjambment, 2: originally with retrospective enjambment) as within-participants factors. We conducted such an ANOVA for each of the four critical regions.

We will only discuss statistical effects that involve the factor Genre (poetry versus prose), as findings that do not involve comparison with the prose controls are theoretically less informative. Thus, we focus on 1) main effects of Genre (poetry versus prose), 2)

interaction effects of Genre and Enjambment (poetry versus prose in fragments with and without enjambment), and 3) interaction effects of Genre, Enjambment and Item group (poetry versus prose in fragments with and without enjambment, compared between item groups). Note that degrees of freedom may differ across analyses due to the occurrence of empty cells (as a result of, e.g., absence of fixations, track loss, blinks, or outlier exclusion) for some participants, in some regions, for some eye tracking measures.

Results

For Experiment 1, we present the results of the five eye tracking measures we looked at (first fixation duration, first pass gaze, first pass total gaze, proportion of regressions, and regression path duration).

Table 3. Means (and SEs between brackets) of first fixation duration (*First Fixation*), first pass gaze (*Gaze*), first pass total gaze (*Total Gaze*), proportion of regressions (*Regressions*) and regression path duration (*Regression Path Duration*) for each of the conditions in Experiment 1.

REGION	FRAGMENT TYPE	First Fixation (ms)	Gaze (ms)	Total Gaze (ms)	Regressions (%)	Regression Path Duration (ms)
pre-break	poetry with enjambment	249 (26)	260 (27)	293 (29)	10 (02)	505 (103)
	prose counterpart (with enjambment)	234 (17)	243 (17)	296 (19)	10 (2)	462 (52)
	poetry without enjambment	261 (31)	318 (32)	367 (34)	21 (3)	469 (47)
	prose counterpart (without enjambment)	214 (14)	241 (22)	327 (35)	16 (2)	759 (126)

break	poetry with enjambment	226 (20)	236 (21)	270 (22)	15 (2)	530 (85)
	prose counterpart (with enjambment)	224 (22)	228 (22)	293 (28)	11 (2)	772 (139)
	poetry without enjambment	200 (17)	225 (18)	299 (33)	24 (3)	607 (115)
	prose counterpart (without enjambment)	203 (15)	223 (14)	254 (18)	14 (2)	508 (90)
post-break 1	poetry with enjambment	302 (35)	329 (35)	329 (35)	0 (0)	346 (34)
	prose counterpart (with enjambment)	244 (14)	253 (15)	287 (25)	13 (2)	604 (131)
	poetry without enjambment	343 (46)	387 (50)	387 (50)	1 (1)	440 (75)
	prose counterpart (without enjambment)	264 (29)	281 (24)	313 (23)	9 (2)	484 (86)
post-break 2	poetry with enjambment	264 (12)	279 (14)	305 (16)	11 (2)	407 (46)
	prose counterpart (with enjambment)	249 (15)	304 (59)	352 (59)	16 (3)	495 (94)
	poetry without enjambment	279 (20)	290 (21)	302 (19)	7 (1)	335 (26)
	prose counterpart (without enjambment)	244 (20)	248 (20)	282 (22)	10 (2)	511 (86)

Before the leap: pre-break and break

Pre-Break

In the pre-break region, there was a significant interaction between Genre and Enjambment in Regression Path Duration $F(1,14)=4.691$; $p<.05$); fragments with enjambment (regardless whether enjambment was prospective or retrospective) showed longer Regression Path Durations than their prose controls, fragments without enjambment showed shorter Regression Path Durations than their prose controls. There were no significant three-way interactions between Genre, Enjambment and Item group, nor were there main effects of Genre (all p-values $> .10$).

Break

At the final word of the first line, there was a marginally significant interaction between Genre and Enjambment in Total Gaze ($F(1,19)=3.591$; $p=.07$) that was the mirror image of the interaction at the pre-break region; fragments with enjambment were read *faster* than their prose controls, whereas fragments without enjambment took *longer* to read than their prose controls. There was also a main effect of Genre for Regressions ($F(1,29)=16.094$; $p<.001$); poetic fragments elicited a higher percentage of regressions to earlier parts of the fragment ($M=20\%$; $SE=2\%$) than their corresponding fragments with a prose layout ($M=13\%$; $SE=1\%$). No other effects were (marginally) significant.

After the leap: post-break 1 and post-break 2

Post-break 1

At Post-break 1, the first word of the new line, there were main effects of Genre in Gaze ($F(1,10)=6.403$; $p<.05$) and Regressions ($F(1,29)=62.143$; $p<.05$), with poetry ($M=358$ ms; $SE=38$) taking longer to read than prose-formatted fragments ($M=267$ ms; $SE=17$), and leading to fewer regressions ($M=1\%$; $SE=0\%$) than their prose controls ($M=11\%$; $SE=1\%$). The main effect of Genre on Regressions was qualified by a marginally significant interaction between Genre and Enjambment ($F(1,29)=4.161$; $p=.05$). This interaction was most probably due to the strong reduction of number of regressions in the enjambment condition ($M=0\%$; $SE=0\%$) versus prose controls ($M=13\%$; $SE=2\%$), and a smaller reduction in the fragments

without enjambment ($M=1\%$; $SE=1\%$) as compared to their control words in fragments formatted as prose ($M=9\%$; $SE=2\%$). No other effects were (marginally) significant.

Post-break 2

At Post-break 2, there was only a main effect of Genre on Regressions. There were more regressions in prose ($M=13\%$; $SE=2\%$) than in poetry ($M=9\%$; $SE=1\%$) ($F(1,29)=4.323$; $p<.05$). No other effects were (marginally) significant.

Discussion Experiment 1

First of all, we had expected to find differences between prospective and retrospective enjambments, at least before the ‘leap’. As prospective enjambments are syntactically incomplete at the end of the first line, unlike their retrospective counterparts, this could have led to qualitatively different reading behavior for the two types of enjambment. However, we did not find any three-way interaction involving Item group (i.e., prospective versus retrospective enjambment) either before or after the line break. This suggests that readers are not really sensitive to the difference between prospective and retrospective enjambment, and treat them as much of the same: just an end of a line.

However, the significant interactions between Genre and Enjambment (i.e., with versus without enjambment) we found at various regions indicate that readers are sensitive to something that prospective and retrospective enjambment have in common, as compared to poetry without enjambment. Possibly, the first lines of poetic fragments with enjambment are perceived as being less ‘finished’, either syntactically (prospective) or semantically (retrospective), than fragments without enjambment. For instance, at the word before the break, although there is no difference in percentage of regressions, the duration of the regression path is significantly longer for fragments with enjambment than for fragments without. Although the reader might generate syntactic and semantic expectations from the length of the line, at this specific point (i.e., the pre-break) the reader does not have any information about the nature of the enjambment, except through so-called ‘parafoveal’ viewing, where information is processed not only of the fixated word, but also of (parts of) immediately adjacent words (see Rayner, 1998). Thus, we may assume that readers process syntactic and semantic information from the word *following* the word they are currently fixating, and encounter some kind of processing difficulty, or at least some degree of uncertainty about how to interpret this first part of the poetic fragment. At the actual break

point this pattern is reversed: after having given rise to longer regression paths at the previous word, the presence of enjambment makes processing *faster* (i.e., in terms of Total Gaze) compared to fragments without enjambment. It is possible that readers apply the ‘fast forward’ strategy and try to solve any processing ‘problems’ by moving forward, hoping that the encountered problems are resolved by the following words. Alternatively, it may be the case that some of the problems elicited by enjambment are already solved at the end of the line.

This latter interpretation is further supported by the pattern of reading times after the leap. There, the percentage of regressions from post-break1 after having read an enjambment is close to zero, which is significantly less than the 13% found at the same words in prose format. This reduction in percentage first-pass regressions for fragments with enjambments was significantly greater than for fragments without enjambment. These results show that there is something to enjambment that clearly affects the reader’s eye movement pattern. It cannot just be the contrast between words being end-of-line (poetry conditions) or not (prose conditions). We did see many main effects of Genre, in various measures and in various regions. But we also consistently found Genre x Enjambment interactions, showing that these end-of-line effects were qualified by the presence of enjambment. The first lines of fragments with enjambment may have a certain as yet undefined poetic quality. Readers might recognize the (intentionally fabricated) incompleteness of those lines, which certainly holds for prospective enjambments and might even be true for retrospective enjambments (though in a more ‘semantic’ manner). Recall that both item groups were originally created as either containing a prospective or a retrospective enjambment by the poets who wrote them. To further investigate this explanation, we will turn to Experiment 2.

Experiment 2

In Experiment 1, we used original fragments from poems with either a prospective or a retrospective enjambment. As it was impossible to create a retrospective version from each poetry fragment with prospective enjambment and vice versa, the experimental design of Experiment 1 was necessarily incomplete. In addition, fragments from poetry that originally contained enjambments may be different from poetic fragments without enjambment in terms of choice of words and linguistic structure. In Experiment 2, that was run concurrently with Experiment 1, we therefore used poetic materials that did not originally contain enjambments as a basis for constructing our experimental items.

Materials and design

For Experiment 2, we selected authentic extracts of free verse poetry without enjambment and prose texts written by some of the same poets (not all writers of the poetry extracts also wrote prose). We used these to create eight fragment types, see Table 4. The first fragment (WITHOUT3) is from a poem by Jan Willem Anker ‘Als jij er niet bent raak ik in de dood verzeild’ (‘If you are not there, I get lost in death’; Komrij, 2010). The second fragment (PROSE4) comes from the collection of short stories ‘Echte slechte mensen’ (Real(ly) bad people) by Lernert Engelberts (Engelberts, 2008). In Experiment 2, participants were presented with 40 text fragments (10 presented as poetry with prospective enjambment, 10 as poetry with retrospective enjambment, 10 as poetry without enjambment, and 10 as prose).

Table 4. Examples of the fragment types used in Experiment 2.

ITEM-GROUP	FRAGMENT TYPE	EXAMPLE OF FRAGMENT
ITEM-GROUP 3 (poetic origin)	PRO3	slowly I stray off to // the shore of a lake / where I once saw you sitting, silent and illuminated.
	RETRO3	slowly I stray // off to the shore of a lake / where I once saw you sitting, silent and illuminated.
	WITHOUT3*	slowly I stray off to the shore of a lake / where I once saw you sitting, silent and illuminated.
	PROSE3	slowly I stray off to the shore of a lake where I once saw you / sitting, silent and illuminated.
ITEM-GROUP 4 (prose origin)	PRO4	The men drink their beers like // children unwrap their Christmas gifts.
	RETRO4	The men drink their beers like children // unwrap their Christmas gifts.
	WITHOUT4	The men drink their beers / like children unwrap their Christmas gifts.
	PROSE4*	The men drink their beers like children unwrap their Christmas gifts.

Note. *=original format; "//"=critical line break; "/"=noncritical line break

Analysis

As in Experiment 1, the critical words in each of the six poetry conditions (i.e., PRO3, RETRO3 and WITHOUT3, and PRO4, RETRO4 and WITHOUT4) are compared to their counterparts in the prose condition. The eight fragment types presented in Table 4 form the basis for twelve experimental conditions: for item group 3, we have fragments with prospective enjambment (PRO3) and their prose controls (PROSE3), fragments with retrospective enjambment (RETRO3) and their prose controls (PROSE3), and fragments without enjambment (WITHOUT3) and their prose controls (PROSE3). The same goes for the other item group, where all fragment types were created from prose. So in total there were 6 'experimental' conditions, with their 6 control conditions.

For each participant, we computed means for the same eye tracking measures as in Experiment 1, for each of the four critical regions, in each of the twelve conditions. These means were entered into a Repeated Measures ANOVA with Genre (poetry versus prose), Enjambment (pro versus retro versus without), and Item group (3: with a poetic origin, 4: with a prose origin) as within-participants factors. We conducted such an ANOVA for each of the four critical regions.

We will only discuss statistical effects that involve the factor Genre, as findings that do not involve a comparison with the prose controls are theoretically less informative. Thus, we focus on 1) main effects of Genre (poetry versus prose), 2) interaction effects of Genre and Enjambment (poetry versus prose in fragments with prospective enjambment, with retrospective enjambment and without enjambment), and 3) interaction effects of Genre, Enjambment and Item group. For analyses involving the factor Enjambment (now with three levels), Huynh-Feldt correction was applied (and original degrees of freedom will be reported) whenever sphericity assumptions were violated.

Results

For Experiment 2, we present the results of the five eye tracking measures we looked at (first fixation duration, first pass gaze, first pass total gaze, proportion of regressions, and regression path duration).

Table 5. Means (and SEs between brackets) of first fixation duration (*First Fixation*), first pass gaze (*Gaze*), first pass total gaze (*Total Gaze*), proportion of regressions (*Regressions*) and regression path duration (*Regression Path Duration*) for each of the conditions in Experiment 2.

REGION	FRAGMENT TYPE	First Fixation (ms)	Gaze (ms)	Total Gaze (ms)	Regressions (%)	Regression Path Duration (ms)
pre-break	poetry with prospective enjambment	250 (20)	258 (18)	280 (17)	14 (2)	414 (57)
	prose counterpart (with prospective enjambment)	217 (14)	231 (17)	272 (22)	12 (2)	429 (53)
	poetry with retrospective enjambment	297 (27)	310 (25)	352 (26)	19 (3)	472 (48)
	prose counterpart (with retrospective enjambment)	225 (16)	242 (20)	269 (19)	11 (2)	441 (72)
	poetry without enjambment	232 (14)	243 (15)	262 (17)	16 (3)	389 (54)
	prose counterpart (without enjambment)	206 (12)	218 (12)	260 (15)	12 (2)	412 (57)
break	poetry with prospective enjambment	243 (17)	251 (17)	271 (22)	11 (2)	322 (32)

	prose counterpart (with prospective enjambment)	241 (20)	248 (21)	285 (22)	11 (2)	561 (99)
	poetry with retrospective enjambment	230 (13)	252 (14)	293 (23)	15 (2)	414 (75)
	prose counterpart (with retrospective enjambment)	206 (8)	215 (10)	239 (17)	10 (2)	485 (93)
	poetry without enjambment	235 (16)	263 (16)	317 (26)	22 (3)	483 (61)
	prose counterpart (without enjambment)	199 (9)	208 (9)	251 (14)	17 (3)	416 (75)
post-break 1	poetry with prospective enjambment	322 (48)	399 (57)	407 (58)	2 (1)	409 (54)
	prose counterpart (with prospective enjambment)	185 (33)	185 (33)	259 (28)	12 (2)	566 (95)
	poetry with retrospective enjambment	460 (119)	550 (115)	558 (109)	1 (1)	547 (116)
	prose counterpart (with retrospective enjambment)	261 (51)	278 (48)	300 (43)	14 (2)	463 (88)
	poetry without enjambment	387 (68)	448 (65)	448 (65)	1 (0,4)	448 (65)
	prose counterpart	305 (51)	305 (51)	305 (51)	06 (1)	484 (210)

	(without enjambment)					
post-break 2	poetry with prospective enjambment	270 (16)	295 (23)	316 (25)	13 (2)	408 (54)
	prose counterpart (with prospective enjambment)	220 (13)	231 (15)	256 (20)	13 (2)	405 (54)
	poetry with retrospective enjambment	262 (10)	283 (11)	300 (16)	10 (2)	410 (54)
	prose counterpart (with retrospective enjambment)	222 (12)	228 (13)	248 (14)	11 (2)	546 (89)
	poetry without enjambment	248 (18)	250 (18)	279 (27)	7 (2)	338 (45)
	prose counterpart (without enjambment)	255 (21)	259 (20)	273 (20)	7 (2)	321 (33)

Before the leap: pre-break and break

Pre-Break

In the pre-break region, there were main effects of Genre for almost every eye tracking measure: First Fixation ($F(1,17)=12.571$; $p<.005$), Gaze ($F(1,17)=9.735$; $p<.01$), Total Gaze ($F(1,17)=3.464$; $p=.08$), and Regressions ($F(1,30)=7.630$; $p<.05$); words in a poetic format took longer to read and elicited more regressions than the same words in prose format (*First Fixation*: $M(\text{poetry})=259$ ms, $SE=12$; $M(\text{prose})=216$ ms, $SE=11$; *Gaze*: $M(\text{poetry})=270$ ms, $SE=12$; $M(\text{prose})=230$ ms, $SE=12$; *Total Gaze*: $M(\text{poetry})=298$ ms, $SE=13$; $M(\text{prose})=267$ ms, $SE=12$; *Regressions*: $M(\text{poetry})=16\%$, $SE=2\%$; $M(\text{prose})=12\%$, $SE=1\%$). The main effect on Total Gaze was qualified by a significant interaction between Genre and Enjambment ($F(2,34)=4.207$; $p<.05$); fragments with retrospective enjambment showed longer Total Gaze ($M=352$ ms; $SE=26$) than their prose controls ($M=269$ ms; $SE=15$). Fragments with prospective enjambment and fragments without enjambment did not differ from prose controls.

Break

Also at the break word, there were main effects of Genre: First Fixation ($F(1,17)=4.268$; $p=.05$), Gaze ($F(1,17)=8.196$; $p<.05$), and Total Gaze ($F(1,17)=5.046$; $p<.05$); words in a poetic format took longer to read than their prose controls (*First Fixation*: $M(\text{poetry})=236$ ms, $SE=12$; $M(\text{prose})=215$ ms, $SE=8$; *Gaze*: $M(\text{poetry})=255$ ms, $SE=12$; $M(\text{prose})=224$ ms, $SE=9$; *Total Gaze*: $M(\text{poetry})=293$ ms, $SE=19$; $M(\text{prose})=258$ ms, $SE=11$). The main effect on Total Gaze was qualified by a significant interaction between Genre and Enjambment ($F(2,34)=2.805$; $p<.05$); fragments with retrospective enjambment showed longer Total Gaze ($M=293$ ms; $SE=23$) than their prose controls ($M=239$ ms; $SE=17$), and the same was true for fragments without enjambment (poetry: $M=317$ ms; $SE=26$, versus prose: $M=251$ ms; $SE=14$); fragments with prospective enjambment did not show a difference between poetry and prose format.

After the leap: post-break 1 and post-break 2

Post-break 1

At the first word of the new line, there were only few fixations, perhaps because first words that are not on the first line of a piece of text are often skipped. Nevertheless, we will present the outcome of the statistical analysis. At this first word, there were main effects of Genre: First Fixation ($F(1,4)=13.484$; $p<.05$), Gaze ($F(1,4)=19.782$; $p<.05$), Total Gaze ($F(1,4)=27.464$; $p<.01$), and Percentage Regressions ($F(1,30)=69.208$; $p<.001$); words in a poetic format took longer to read, but elicited fewer regressions than the same words in a prose format (*First Fixation*: $M(\text{poetry})=390$ ms, $SE=61$; $M(\text{prose})=251$ ms, $SE=26$; *Gaze*: $M(\text{poetry})=466$ ms, $SE=71$; $M(\text{prose})=256$ ms, $SE=25$; *Total Gaze*: $M(\text{poetry})=471$ ms, $SE=68$; $M(\text{prose})=288$ ms, $SE=39$; *Regressions*: $M(\text{poetry})=1\%$, $SE=0\%$; $M(\text{prose})=10\%$, $SE=1\%$). No other effects reached (marginal) significance.

Post-break 2

At Post-break 2, there were main effects of Genre on Gaze ($F(1,15)=4.114$; $p=.06$) and Total Gaze ($F(1,15)=4.321$; $p=.06$); words in poetry format take longer to read than their prose controls (*Gaze*: $M(\text{poetry})=276$ ms, $SE=15$; $M(\text{prose})=239$ ms, $SE=11$; *Total Gaze*: $M(\text{poetry})=298$ ms, $SE=18$; $M(\text{prose})=259$ ms, $SE=12$). The main effect on Gaze was qualified by an interaction between Genre and Enjambment ($F(2,30)=4.991$; $p<.05$). This interaction was brought about by longer gazes for prospective enjambment than prose controls, longer gazes for retrospective enjambment than prose controls, and the absence of an effect in the fragments without enjambment as compared to prose. This same pattern (longer times for poetry in both fragments with prospective and with retrospective enjambment) emerged in First Fixation duration, which was reflected in a marginally significant Genre x Enjambment interaction ($F(2,30)=2.991$; $p=.09$). The significant three-way interaction between Genre, Enjambment and Item group that was found in regression-path duration was most likely spurious, as it depended wholly on a disproportionately long regression path in one of the control conditions.

Discussion Experiment 2

As in Experiment 1, we found effects of enjambment before the line break, suggesting that information from the final word was available parafoveally at the pre-break word. Most of this effect (longer Total Gaze times than for controls) was caused by the *retrospective* enjambments. This is unexpected, as retrospective enjambments are predominantly defined by the words *after* the break, not at or before the break. At the break itself, the retrospective enjambments also took longer to process than controls (again in Total Gaze), as did fragments

without enjambment. Importantly, prospective enjambments did not show this effect. This suggests that whenever it is possible to interpret the fragment, readers will do so, leading to longer reading times due to integration; when the fragment is syntactically incomplete, however, as with prospective enjambment, there is no evidence for such integrative processing. At the first word of the next line there were no differential effects for the different types of enjambments. Only at the next word (i.e., post-break 2), we see interactions with Enjambment: both types of enjambment take longer to process (as compared to prose controls) than fragments without enjambment. Apparently, interpretation processes are more difficult, more spread out, or just different for poetry with enjambment than for poetry without enjambment. Interestingly, the effects are numerically larger for the prospective than for the retrospective condition, which may be attributed to a kind of ‘deferred maintenance’ taking place after the break, as prospective enjambments were read faster at the break itself than retrospective enjambments and poetry without enjambment.

General Discussion and Conclusion

The aim of our study was to investigate whether poetry, particularly with different types of enjambment, elicits different patterns of processing compared to prose. The two experiments reported here show that poetry is indeed processed differently from prose, and that different types of enjambment are associated with different modes of processing. In Experiment 1, we observed that original poetic fragments that contained enjambment were read *faster* at the line break than fragments without enjambment. Importantly, this occurred in spite of words at the end of a line usually incurring *longer* reading times due to integration effects. We found a very similar effect in Experiment 2, where fragments with prospective enjambment did not show the same end-of-line integration effects as fragments with retrospective enjambment and fragments without enjambment. In this second experiment, the ‘speeding up’ was apparently later compensated for by increased processing time in the region after the break (i.e., at the second word on the new line). This difference between, on the one hand, fragments with prospective enjambments and, on the other hand, fragments with retrospective enjambments and fragments without enjambments may be attributed to the syntactic structure of these lines, which in the case of prospective (syntactically incomplete) enjambment does not allow for integration at the end of the first line. In Experiment 1 - where the enjambments were original, and not created by the experimenters, but by poets - we found no such difference in reading behavior between prospective and retrospective enjambments, suggesting that sometimes, retrospective enjambments can also have a certain ‘incompleteness’ quality. For instance, a

phrase might appear syntactically complete at the line end, but still make less sense to a reader compared to the elaborated phrase readers encounter when they continue reading the next line. Consider for example the last stanza of “The Right of Way” of William Carlos Williams.

I saw a girl with one leg
over the rail of a balcony

One could speculate that one-legged girls make less sense to readers, causing them to treat this line as incomplete, even if the syntactic structure does allow for a pause. On the other hand, people do tend to communicate about things that they think are noteworthy and newsworthy, and a one-legged girl certainly seems to be an interesting topic of conversation. Thus, the reader may think it is perfectly plausible that the poet talks about a one-legged girl.

Another important finding is that during the reading of our poetic fragments, readers use parafoveal information to guide their eye movements. In both experiments, enjambment conditions showed longer reading times one word before the break. Thus, syntactic but also some sort of semantic incompleteness can be recognized before the eyes actually fixate the final word on the line. It may be the case that the specific spatial layout of poetry encourages parafoveal processing.

Although our study has some limitations with regard to ecological validity (we used fragments of poetry instead of full poems, and reading poetry in an eye tracking lab may be different from reading in a natural context), we think we can draw a number of conclusions and point to fruitful areas of future research on the processing of poetry, and of reading in general.

For one thing, this study makes clear that the integration of linguistic information from a written stimulus is a far more complex process than often assumed. The exact point in the sentence where information is integrated is determined by the spatial layout that seems to encourage parafoveal processing, by the syntactic (in)completeness of the set of words on any specific line of the poem, but also the semantic (in)completeness (or even noteworthiness) of that same set of words. So in poetry, the *line* seems to be the organizing element and much more important perhaps than the *sentence*, as in prose texts. Previous theories have assumed that either integration takes place immediately, as soon as a word is encountered (the *immediacy hypothesis*, cf. Just & Carpenter, 1980), or that integration processes are most probable at the end of a sentence (cf. Steinhauer & Friederici, 2001). In our two experiments,

we have seen that integration is much more dynamic than suggested by these proposals. Future studies, for instance using ERP registration, may be able to investigate not only the temporal dynamics of reading poetry, but also the type of processing going on at different points in the stimulus (see Hoeks & Brouwer, in press, for a description of the ERP-'toolbox' that is available for investigating language processing).

Secondly, we believe this study informs us that the visuospatial presentation of poetry influences reading processes both at a global and a local level. Differences between the reading processes involved in prose and poetry show that participants were sensitive to the presence of non-coincidental line breaks and the typical layout of the poetry fragments and presumably used this global information to categorize these fragments as poems. Within the category of poetry, differences between the reading processes in fragments with and without enjambment show that participants were also sensitive to the more local phenomenon of enjambment. This study therefore seems to confirm that readers have structural genre knowledge of the typical appearance and characteristic line breaks of a poem and that this knowledge influences genre categorizations and subsequent genre-specific reading processes. Furthermore, contrary to what is predicted by narrative and text processing models, our study shows that readers not only pay attention to linguistic information while reading literary fragments, but also take into account the visuospatial presentation of the fragments. The occurrence of enjambments may increase the readers' awareness of the non-coincidental nature of line breaks in poetry and thus influence the readers' processing of poetry.

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Appendix A: Word-by-word translation of the examples used

Het the	licht light	van of	de the	lantaarn lantern	werpt throws	geen no	verdacht suspicious	lange long	schaduwen shadows	
op on	straat. street									
The light of the lantern does not throw suspicious long shadows on the street.										
Zolang as long as	je you	door PART	blijft keep	fietsen cycling	verlies lose	je you	je your	evenwicht balance	niet, not	
zo as	zei said	hij. he								
As long as you keep cycling you won't lose your balance, he said.										
langzaam slowly	dwaal stray	ik I	af off	naar to	de the	oever shore	van of	een a	meer lake	waar ik where I
je you	ooit once	zag saw	zitten, stil sitting silent	en and	oplichtend. illuminated					
slowly I stray off to the shore of a lake where I once saw you sitting, silent and illuminated.										
De the	mannen men	drinken drink	hun their	bier beer	zoals like	kinderen children	hun their			
kerstcadeaus Christmas gifts		uitpakken. unwrap								
The men drink their beers like children unwrap their Christmas gifts.										