Measuring the flow of poetic time
(Identification of latent structures in poetry)

Stefania Mancone
University of Cassino, Italy
Department of Human and Social Sciences,
Via Mazzaroppi, snc, 03043 Cassino (FR), Italy
Tel: 0039 0776 2993438 Fax: 0039 0776 2993434 E-mail: stefaniemancone@libero.it

Vladimir M. Petrov
State Institute for Art Studies
5 Kozistky per, Moscow 125009, Russia
Tel./Fax: +7 [495] 9164453 E-mail: vmpetr@yandex.ru

Abstract
The direction and the speed of subjective time flowing while the reader perceives a poem, was measured in the course of psychological experiments involving 103 participants. Stimuli were two texts by Alexander Pushkin and one poem by Ossip Mandelshtam. Two principal tasks occurred to be solved: to measure the flux of sensual associations over the entire text and to identify links between adjacent stanzas. The results of measurements permitted to identify 24-hour associative temporal circles in the poems studied, as well as to fix associative links (‘gluing means’) at the borders between stanzas. Both textual peculiarities provide ‘due’ flow of poetic time and ‘harmonious’ perception of the texts.

Keywords: Poetry, flux of associations, psychological experiments, ordering, rank correlation, textual structures

1. Introduction
Temporal organization of the perception of each work of art is one of the most substantial means providing due functioning of the work – in accordance with its ‘genuine destination’ [1]. Such structures are especially important for poetry (at least for contemporary one): the time of perception of each poem (as well as its elements and parts, e.g., syllables, morphemes, words, lines, stanzas) is commensurable with principal temporal constants of the recipient’s psychological and physiological processes. [That is why, for instance, sometimes the poem is considered to be a ‘device to control the breathing’ of the reader.] Exactly under the condition of due flow of perceptual time, we can come not only to ‘by-product aims’ of poetic perception, but to its ‘genuine’ one. But what is this perceptual time? how it is possible to organize this time? and how to measure it?

2. General requirements to poetic temporal structures
Discrete perceptual elements each poem consists of, presuppose their temporal sequence capable of organizing certain ‘harmonious’ perception both of the entire poem and each of its parts. As it is known (see, e.g., [1]), the perception of the speech flux is a result of joint functioning of three semantic mechanisms:

– ‘associative mechanism’ which leads to the appearance of definite sensuous images, evoked by discrete elements of a speech (i.e., by different words or morphemes); e.g., the word ‘table’ evokes visual associations concerning an object with a flat surface and four legs;

– ‘correlational mechanism’ which checks whether a certain pair of discrete elements of the flux, has been met together in a previous speech experience of the given recipient; for instance, this mechanism checks whether the combination of the words ‘table’ and ‘big’ has occurred in the previous communications, or maybe it is quite new for the given subject;
– ‘grammatical mechanism’ which helps the recipient to look for appropriate pairs of elements to be checked; e.g., in a sentence: ‘I saw a big table’ certain grammatical rules determine the pairs to be checked, including the pair ‘big’ and ‘table,’ but not ‘saw’ and ‘big.’

Due to joint functioning of these three mechanisms, the so-called ‘sense of communication’ is transmitted, in particular, the ‘logical content’ of the given poetic text. The leader in this process is the correlational mechanism which transmits ‘genuine language information’ of each text. However, in order to provide due sensual perception of poetic texts, it is desirable to involve also the associative mechanism. In such a case the process of perception becomes ‘harmonious’ and hence, more effective.

To apply the associative mechanism, it is necessary, first of all, to organize due temporal sequence of associations – sensual images accompanying perception of the text. So, we should take into account those principal temporal structures which are inherent to most poetic texts.

One of the principal peculiarities of poetic texts (at least contemporary ones) consists in their strict division into small segments, responding to quite definite temporal constants of the human memory:

A. Lines; the perception of each line is optimal when it does not exceed the time limit of the second step of the memory [1], which is about 3-4 seconds.

B. Stanzas (though this kind of division is not obligatory, however it is desirable for optimal perception). Here the capacity of the first step of the memory should be involved to provide the holistic perception of each stanza. As far as this capacity is 8 units, the desirable time of perception of each stanza should not exceed 8 × 4 = 32 seconds, or maybe less.

Hence, there exist two temporal problems to be solved:

a) to unite (glue) adjacent lines, as well as all the elements of the poem, in order they would form a certain integrity;

b) to unite adjacent stanzas (when the poem consists of more than one stanza), in order the poem would also possess the holistic features.

When both kinds of uniting links are present, “due” flow of time is provided. Because the important peculiarity of poetry is its ‘immediate sensual’ nature (i.e., generating images while perceiving), to organize these links, it is desirable to use appropriate associative rows. Here the help can be expected, from objects (or phenomena) of reality when they are depicted in the poem: they are capable of generating appropriate rather ordered associations (images, mainly visual). Two kinds of experimental psychological procedures were derived for such situations, in order to measure the time flow.

3. Measurement of the sequence of temporal associations evoked by all the words

Due organization of associative rows is especially important when dealing with poems devoted to certain abstract matters, i.e., apparently ‘image-free’ poems. In general, the best version of semantic organization for most poems is a ring, i.e., the beginning of the poem and its end should be close on their character (see, e.g., [2]). So, we may expect a ‘circular’ flow of associations, forming a ‘ring’ which ‘appeals’ to the most widespread circular structure – 24-hour cycle. Due to such ‘sensual support’ realized by the associative mechanism, the perception of the abstract content becomes more vivid and hence, more effective.

The poem ‘To Chaadayev’ by Alexander Pushkin (1818) belongs exactly to this kind of poetry: though it is devoted to rather ‘abstract matters’ (freedom, fatherland, glory, etc.) it seems to be very sensuous. Does it contain such 24-hour associative structure? So, in one of psychological experiments 25 participants (12 males and 13 females) were involved, each being asked about his/her temporal associations connected with ‘stimuli’ – 59 ‘meaningful’ words (nouns, adjectives, verbs, and adverbs) constituting this poem. Each participant was given a set of 59 cards, on each card one of these words was printed. Before being presented
to each new participant, the cards were shuffled, in order to make the sequence of words random. The participants’ answers – temporal associations – were fixed in the records of the experiment, using 24-hour clock-face scale. If a participant indicated a certain temporal range, its middle value was taken into account in further calculations. [If the range indicated exceeded 12 hours, the value was not involved in further calculations.] Then the averaging of the values obtained was fulfilled, firstly separately for males and females (in order to eliminate possible gender influences), and afterwards for the totality of the participants.

When averaging, two extreme points were excluded for each stimulus – those two points, without which the scattering of the remained points would be minimal. Thus, for the word ‘gnyot’ (‘oppression’) in a group of 13 female participants, the following 9 values were obtained (4 participants showed no temporal associations connected with this word): 16-18 hours, 17 hours, 19-23, 23, 12, 20, 19, 14, and 22 hours. After excluding two extreme points: 12 and 14 hours – we came to the mean value about 19.8 hours.

If after such an exclusion, the remaining points revealed scattering more than 12 hours, the word considered to be too ‘vague’ (uncertain) in relation to temporal associations, and it was not included in further calculations. However, there were only 6 words ‘without resulting temporality’ in the group of female participants, and only 1 word in a group of male participants (it was the word ‘svyataja’ – ‘sacred’). For each of other words, averaging over all participants’ scores was fulfilled, firstly separately for males and females, and then for all the participants of the experiment.

First of all, the reproducibility of the values fixed, was estimated. To do this, we checked the associations evoked by 4 words which were used twice in the poem. (These four words were: ‘son’ – ‘slumber,’ ‘dusha’ – ‘soul,’ ‘otchizna’ – ‘fatherland,’ and ‘minuta’ – ‘minute.’) Each of these words was presented twice to each participant, in accordance with the procedure of random choice. As a rule, the difference between associations (responding to two presentations of the same word) was negligible. We characterized each participant by an ‘index of instability’: a participant was ascribed a 1-point ‘penalty’ when he/she showed two associations (for the same word) without overlap and the distance between their values (or between the borders of their intervals) was more than 2 hours. (And if one of the presentations generated temporal associations, and another presentation showed no associations, a subject was ascribed half a ‘penalty’ point.) After appropriate calculations, only 1 subject got a 2-point penalty, 4 subjects – 1.5 point, 6 subjects – 1.0 point, 2 subjects – .5 point, and 12 other subjects got no penalty. So, average penalty was about .6 point; as far as the mean value of temporal associations is about 12 hours, the error can be estimated as 2×0.6/12 = .1, i.e., 10% which seems to be admissible for the measurements dealing with such rather delicate ‘substrate’ as recipients’ associations.

Then all the words studied were ordered (ranked) in accordance with the mean values of their temporal associations, and this ranking was compared with real sequence of these words in the poem. At the preliminary stage such rankings were built separately for male and female participants. However, these two rankings occurred almost identical: Spearman coefficient of rank correlation about .85, calculated over 52 ‘overlapping’ words – those ones which had definite temporal associations both in the group of males and females (1%-level of significance). That is why final calculations were made for all 25 participants.

In Table 1 a fragment of the results obtained are presented – the real sequence of the first 6 words of the poem (left column), the words themselves, their average temporal associations in the group of 13 female participants, and ranks of these words in appropriate temporal (associative) ordering (last column). Spearman coefficient between the two columns (first and last) over 53 words with definite temporal associations, equaled .74. Analogous calculations for 12 male participants came to Spearman coefficient .76 (over 58 words with definite temporal associations). Both values are statistically significant at 1%-level.
Table 1. Fragment of the results of the experiment on temporal associations and their ordering.

<table>
<thead>
<tr>
<th>Rank in the real sequence</th>
<th>The word</th>
<th>Average temporal association (hours)</th>
<th>Rank in associative sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>lyubov’ (love)</td>
<td>20.7</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>nadezhda (hope)</td>
<td>10.6</td>
<td>19</td>
</tr>
<tr>
<td>3</td>
<td>tikhaya (calm)</td>
<td>19.0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>slava (glory)</td>
<td>13.2</td>
<td>24</td>
</tr>
<tr>
<td>5</td>
<td>nedolgo (not so long)</td>
<td>11.0</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>nezhil (indulged)</td>
<td>21.4</td>
<td>7</td>
</tr>
</tbody>
</table>

Such high values of the coefficient obtained, mean that the words within the text of this poem really have a sequence of temporal associations coinciding (statistically) with the movement of time; so we are dealing with the associative modeling of time. Besides, in the poem the flow of associative time starts early in the morning, passes through all 24-hour phases, and has its finish next morning (forming a ‘circle”).

Measurements of associations in other poems (e.g., ‘Impressionism’ by Ossip Mandelshtam – an experiment involving 14 participants [3]) confirmed the presence of similar time flowing. It means that in such cases the poetic text is really oriented on the organization of the reader’s subjective (sensual) time flowing in due direction and in accordance with habitual cyclic manner, in order to provide high effectiveness of perception.

4. Measurement of inter-stanza associative links

The organization of inter-stanza links is especially needed when dealing with poems of large duration, e.g., consisting of several hundreds lines and even more. One of experiments dealt with ‘word-induced’ associations [4, 5]. Here 40 participants were involved, in order to identify their associative links concerning 50 inter-stanza borders in the first chapter of the novel (in verse) ‘Eugeny Onegin’ by Alexander Pushkin. Stimuli were ‘suspected key words’ of each pre-border line, each participant was asked to choose the most associatively close word out of a set of 5 proposed ones, including one ‘suspected key word’ of the post-border line. [This set of proposed ‘reactions’ was always new, being formed by occasional choice from 50 potential words–candidates.] For instance, when presenting such a stimulus as the ‘suspected key word’ of the pre-border line “skala” (rock), among proposed versions of the response was the ‘suspected key word’ in adjacent after-border line “mor’e” (sea), presented together with 4 other words (out of 50 ‘suspected key words’ belonging to after-border lines), e.g., “rano” (early), “shum” (noise), “dusha” (soul), and “svoboda” (freedom). The participant’s choice was estimated as ‘true’ only if he/she indicated the word “mor’e” (sea) as the most associatively close to the word “skala” (rock). So, this part of the experiment dealt with ‘direct’ presentation of stimuli and reactions. As well, reverse associative links were also examined, by means of quite analogous procedure, with the only difference that stimuli were ‘suspected key words’ belonging to after-border lines, and proposed versions of choice included ‘suspected key words’ belonging to pre-border lines. The results of this experiment are presented in Table 2.

The results of these measurements evidence of rather high percentage of true choices: in each case the tolerance interval of this share (level of tolerance P=.995) exceeds the background value responding to accidental choice, i.e., 20%. Besides, associative links measured when inverse presentation, are stronger than when direct presentation (the difference is statistically significant at 5%-level, chi-square criterion). It means that for participants it is easier to elicit, from their memory, associations connected with the previous word, than keeping this word in the memory, to wait for its proper associative pair.
As well on the basis of this experiment 15 most associatively-close pairs of words were singled out – which showed 4 and more right choices (out of 8 presentations of each pair of words). These ‘very strong links’ are surely not accidental (the probability of 4 accidental right choices is about 0.046).

Taking into account these results, another experiment was realized dealing with ‘sentence-induced associations’: each of 24 participants was presented stimuli – 15 ‘subsequent’ lines together with a set of 5 ‘suspected key words’ including those ones which respond to appropriate lines. For instance, when the stimulus was the line “Ya pomny mor’e pred grozoyu” (‘I remember the sea before the thunder’), among reactions proposed was the word ‘skala’ (‘rock’), together with 4 improper words. The data on associations obtained (also presented in Table 2) again show rather high percentage of true choices which is higher than the above 20%-threshold for accidental choice (.995 level of tolerance).

<table>
<thead>
<tr>
<th>Type of experiment</th>
<th>True choices when direct presentation, %</th>
<th>True choices when inverse presentation, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word-induced associations</td>
<td>28</td>
<td>34</td>
</tr>
<tr>
<td>Line-induced associations</td>
<td></td>
<td>33</td>
</tr>
</tbody>
</table>

So, all ‘associative choices’ measured, are not accidental, they are ‘directed.’ Besides, the share of ‘very strong links’ identified, equaled 30%, which is in good agreement with optimal frequency of the usage of every regular device. (This optimal frequency should respond to the range between the relative threshold of perception and the threshold of realizing, i.e., between 12% and 39% [6].) Hence, the phenomenon of inter-stanza ‘gluing’ was clearly observed, evidencing of fluent (smooth) large-scale flow of time in the novel.

Analogous studies and measurements made on materials of prosaic works (James Joyce, Ivan Bunin) confirmed presence of similar structures providing due current of associative time in works of art, as well as the possibility to measure the flow of this subjective time.

References