Oculomotor everyday communication: How to pick a good metric

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Abstract

This paper contributes to the research field of bimodal linguistics that explores two modalities involved in everyday communication – vocal and kinetic. When exploring almost any scientific phenomenon, one addresses two opposite issues: individual differences, on the one hand, and general patterns, on the other. We have focused on the individual differences and proposed a "portrait" approach to communication. We are faced with a difficult task to find a good metric for analyzing oculomotor behavior of people in everyday communication. In previous papers, starting from [14], the authors were looking for oculomotor patterns, but their results depend critically on the metric used. In this paper, we compared the most common metrics and showed that individual differences have a much more serious weight than general patterns. We then identified four coefficients that determine these individual differences: k_{aside}, k_{vip}, k_{chain}, and dur_{75}. By comparing these Core Oculomotor Portraits, we were able to make these individual differences more clear. However, a fact is a fact: there are far more individual differences than general patterns between our Narrators behavior. The proposed coefficients, in our opinion, clearly show (and even explain and predict) the observed individual differences.

Keywords: bimodal communication; eye tracking; gaze; fixation; metric
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Окуломоторное повседневное общение: как выбрать хорошую метрику

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Аннотация

Данная работа вносит вклад в исследовательскую область бимодальной лингвистики, в которой исследуются две модальности повседневной коммуникации – вокальная и кинетическая. Исследуя практически любой феномен, мы сталкиваемся с двумя противоположными явлениями: индивидуальными различиями, с одной стороны, и общими закономерностями, с другой. В данной работе мы сосредоточились на индивидуальных различиях и предложили «портретный» подход к коммуникации. Мы поставили сложную задачу найти хорошую метрику для анализа окуломоторного поведения людей в повседневном общении. В предыдущих работах, начиная с [14], авторы искали окуломоторные паттерны, но их результаты критическим образом зависели от используемой метрики. В данной работе мы сравнили наиболее распространенные метрики и показали, что индивидуальные различия имеют гораздо более серьезный вес, чем общие закономерности. Затем мы ввели четыре коэффициента, определяющих эти индивидуальные различия: k_{aside}, k_{vip}, k_{chain} и dur_{75}. Сравнив базовые окуломоторные портреты, мы смогли сделать наблюдаемые индивидуальные различия более ясными. Однако факт остается фактом: между поведением испытуемых гораздо больше индивидуальных различий, чем общих паттернов. Предложенные коэффициенты, на наш взгляд, ясно показывают (и даже объясняют и предсказывают) наблюдаемые индивидуальные различия.

Ключевые слова: бимодальная коммуникация, регистрация движений глаз; взгляд; фиксация; метрика

1 Introduction. Bimodal communication: Oculomotor component

This paper contributes to the research field of bimodal linguistics. Bimodal linguistics explores two modalities involved in everyday communication – vocal and kinetic, see Fig. 1[1]. Vocal modality (from the perspective of an addresser; or auditory modality from the perspective of an addressee) consists of the segmental verbal structure and non-segmental prosody. Kinetic modality (from the perspective of an addresser; or visual modality from the perspective of an addressee) includes all kinds of movements – with eyes, face, head, hands, etc. Since only two modalities are included into consideration in contemporary research (but cf. [23] on the touch modality), we consider the widely circulated notion of multimodality an overstatement and prefer the notion of bimodality (for multimodality see [15], [22], [8], [24], [5], [9], [11], inter alia).

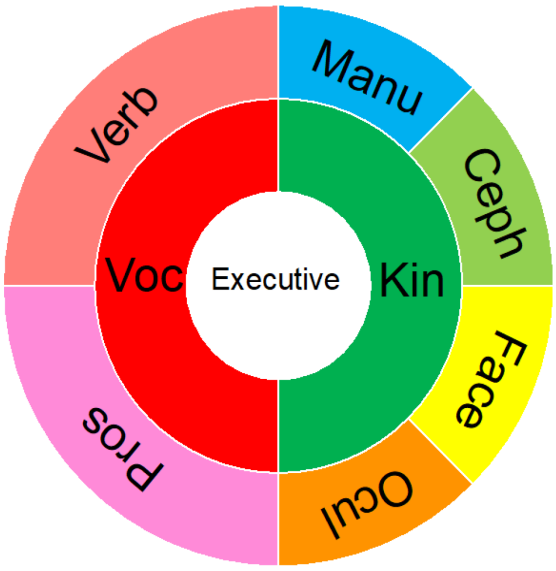

Figure 1: Bimodal communication from the addresser's perspective

In this paper, we consider "oculomotor" component of the kinetic modality, i.e. eye movements[2] ([14], [1], [21], [12], [10], [13], [3], [19]). Studying eye movements provides unique insights into what the participant found interesting or important, that is, what drew his/her attention, and provide a clue as to how he/she perceived the scene he/she was viewing. (Note that although eye movements and the visual attention are closely related, the nature of this relationship is not yet fully understood; see e.g. [26]).

Our previous fine-grained qualitative and quantitative analyses of a 10-min fragment of communication between three interlocutors showed that the use of different metrics of oculomotor analysis – the number and duration of fixations or the number and duration of gazes[3] – gives fundamentally different results ([6]). In this paper we address individual differences and propose a "portrait" approach to the oculomotor component of bimodal communication, see section 3. We address this issue with the help of the bimodal corpus "Russian Pear Chats & Stories" ([16], https://multidiscourse.ru), see section 2.

[1] The "Executive" is the central controlling component of the system (cf. similar executive components in theoretical models such as in [2] or [20]).

[2] When we look at a scene our eyes move around continually, locating some definite points. Rapid movements of the eyes are known as saccades. Saccades normally take about 20-150 ms, depending on their amplitude. Little or no actual visual processing occurs during saccades. Between the saccades, our eyes remain relatively still during fixations for about 100-1500 ms.

[3] Gaze typically consists of several fixations within an area of interest (AOI) and may include some short saccades between these fixations. A fixation occurring outside the AOI marks the beginning of a different gaze. AOIs are defined by the researcher, not by the participant. For example, if we describe a person, it is possible to draw separate AOIs around his/her body, his/her face, and his/her hands, see below.

2 The corpus "Russian Pear Chat & Stories"

2.1 Recording set-up

For collecting the corpus the well known Pear Film (Chafe ed. 1980) is used. Each session involved four participants with fixed roles: three main interlocutors – the Narrator (N), the Commentator (C), and the Reteller (R) – and the Listener (L). At the very beginning N and C each watched the film, trying to memorize the plot as precisely as possible. Then the main stages began. First, N told the R about the plot of the film; this is a monologic stage – "*First Telling*". During the subsequent interactive stage – "*Conversation*" – C added details and corrected the N's story where necessary, and R checked her/his understanding of the plot, asking questions to both interlocutors. Then L joined the group and another monologic stage – "*Retelling*" – followed, during which R was retelling the plot of the film to L. Finally, L wrote down the content of the film.

2.2 Recording software

The participants' speech was recorded with the help of a six-channel recorder ZOOM H6 Handy Recorder (96 kHz / 24 bit). Three industrial video cameras JAI GO (100 frames per second and 1392x1000 pixels) recorded three participants, shooting individually from a frontal perspective. In addition, the camera GoPro Hero was used to record the whole scene.

In order to record eye gaze, two head-mounted eye trackers were used (Tobii Glasses II, 50 Hz and 1920x1080 pixels); N and R were wearing eyetrackers. The eye trackers provide two types of data: videofiles produced by an inbuilt scene camera and data files representing eye movements. The screenshots in Fig. 2 result from an overlay of videofiles from the scene camera and the gaze coordinates from the data files; the circles are generated by the eye trackers and indicate the targets of interlocutors' gaze.

a. From the N's eye tracker

b. From the R's eye tracker

Figure 2: Screenshots of video scenes from eye trackers

2.3 Participants and corpus size

The full corpus includes 40 recordings with 160 Russian native participants aged 18–36. Our subcorpus includes seven recordings (##04, 06, 16, 21, 22, 23, 24) with 28 Russian native participants, 9 men and 19 women, recruited from the Moscow population. The subcorpus consists of 2 hours 40 minutes of recording and about 50,000 words. The distribution of the recordings' duration by stages see in Fig. 3.

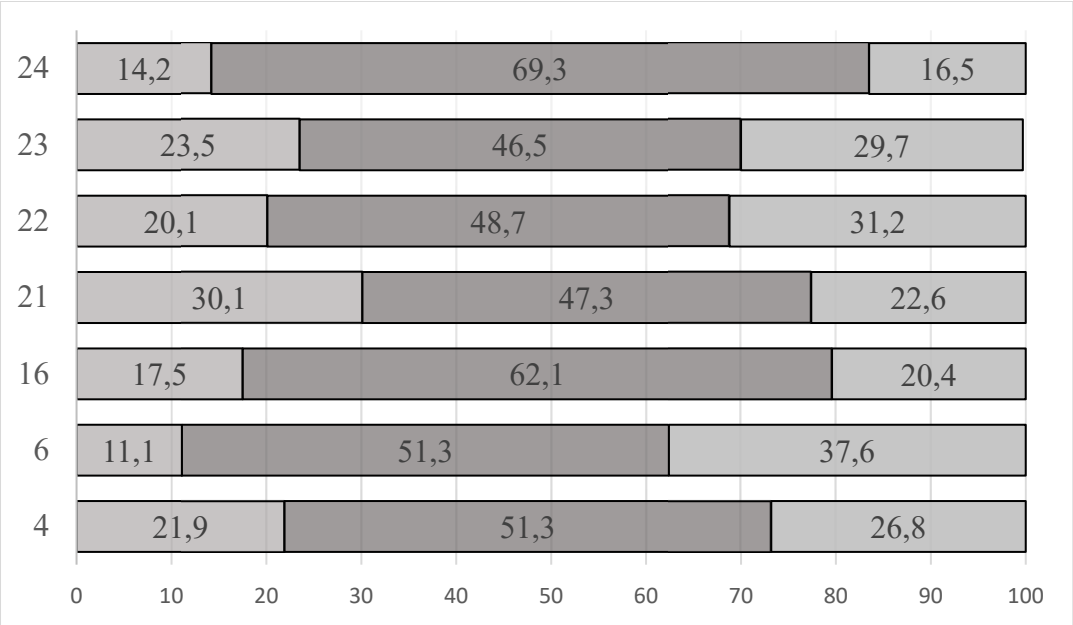

Figure 3: The distribution of the recordings' duration by stages ("*First Telling*" / "*Conversation*" / "*Retelling*"), in %

2.4 Annotations

The vocal annotation used in the project follows the principles previously developed for spoken Russian discourse (https://spokencorpora.ru; [18]). For the kinetic annotation see https://multidiscourse.ru/annotation/?en=1.

The oculomotor annotation scheme includes five tiers:

(1) a fixations number *-oFixation

(2) "Interlocutor", with five possible values:

- "N" (fixation on N)
- "R" (fixation on R)
- "C" (fixation on C)
- "L" (fixation on L)

"Surroundings" (=Sur, fixation on another object)

(3) "Locus", with four possible values:

- "Face" (fixation on the face of the participant)
- "Hands" (fixation on the hands of the participant)
- "Body" (fixation on the body of the participant)
- "Surroundings" (=Sur, fixation on another body part of the participant, e.g. legs)

(4) a gaze number *-oGaze

(5) "Gaze", with five possible values: "N", "R", "C", "L", "Surroundings".

The oculomotor annotation was carried out in MS Excel. With the help of Tobii Pro Glasses Analyzer software, we automatically extracted information about the time base of all fixations and then manually applied the five-tier annotation scheme described above.

3 How to pick a good metric: Oculomotor Portrait

Eye tracking is a relatively simple measure, but the tricky challenge is what to do with the data it provides. In this section, we present new data called "Oculomotor portraits" obtained by seven Narrators at the monological stages of our subcorpus, i.e. the "*First Telling*" and "*Retelling*" stages. Thus, the analysis was performed on the basis of 14 fragments with a total duration of 1 hour 15 minutes.

The most common oculomotor metrics include:

(1) Number:
- Number of fixations, overall
- Number of gazes, overall
- Number of fixations on each AOI
- Number of gazes on each AOI

(2) Duration:
- Duration of fixations (=dwell time), overall
- Duration of gazes (=dwell time), overall (=Duration of fixations, overall)
- Duration of fixations (=dwell time) on each AOI
- Duration of gazes (=dwell time) on each AOI (=Duration of fixations on each AOI)

(3) Mean duration:
- Mean fixation duration, overall
- Mean gaze duration, overall
- Mean fixation duration on each AOI
- Mean gaze duration on each AOI

(4) %:
- Fixation % (ratio, proportion of number) on each AOI
- Gaze % (ratio, proportion of number) on each AOI
- Fixation % (ratio, proportion of time) on each AOI
- Gaze % (ratio, proportion of time) on each AOI

(5) Rate:
- Fixation rate, overall (fixations / seconds)
- Gaze rate, overall (gazes / seconds)
- Fixation rate on each AOI (fixations / seconds)
- Gaze rate on each AOI (gazes / seconds)

(6) Scan path, i.e. the spatial arrangement of a sequence of fixations or gazes

(7) Heatmaps, i.e. visualizations which show the general distribution of gaze points[4]. Red, yellow, and green colors represent in descending order the amount of gaze points that were directed towards some parts of the image

(8) Time to the first fixation on each AOI

(9) The first fixation duration on each AOI

(10) Regressions. During reading, readers often move their eyes forward to process new information. However, not all eye movements take the eyes forward in the text. About 15% of eye movements move backwards to reprocess information ([25]).

In our study the first four types of metrics are used, see the Oculomotor Portrait for N 04 in Table 1. Number of fixations or gaze[5], as well as (mean) duration could reflect the importance of a particular AOI. We have calculated also the minimal and maximal durations (overall and on each AOI), as well as 25%, 50%, and 75% quantiles. Basic comparisons were made for 75% quantiles (italicized in Table 1). We called the presented data “Full Oculomotor Portrait” (the preliminary ideas on this topic see [17]).

In [7] we, based on the number and overall duration of fixations, found that the typical listener looks at the speaker with long fixations, broken by brief fixations to the surroundings, while the typical speaker alternates long fixations at the listener with brief fixations to the surroundings. However, let’s look at the Full Oculomotor Portraits for our seven Narrators more closely (for all seven portraits see Appendix). We can see that they are very different in all respects, that is, individual differences are very large. To be able to compare these data, we have introduced the following coefficients (highlighted in bold):

[4] Gaze points show what the participant is looking at. Our eye tracker collects data with a sampling rate of 50 Hz, thus we have 50 gaze points per second.

[5] Counting the number of gazes (i.e., successive fixations within the same AOI) is often considered more meaningful than counting the number of individual fixations.

Overall			
duration		1157.167	
R duration, ratio		849.006, 0.73, $\mathbf{k_{aside}}$ **0.3**	
Sur duration, ratio		267.584, 0.23	
		fixation	gaze
number		2190	554, $\mathbf{k_{chain}}$ **4**
mean duration, std		0.528, 0.664	2.089, 3.341
min, 25, 50, 75, max		0.06, 0.16, 0.28, ***0.6***, 10.477	0.06, 0.4, 0.979, 2.500, 26.974
R $\mathbf{k_{vip}}$ **3.8**	number, ratio	1048, 47.9	251, 45.3, $\mathbf{k_{chain}}$ **4.2**
	mean, std	0.81, 0.845	3.382, 4.461
	min, 25, 50, *75*, max	0.06, 0.24, 0.48, *1.14*, 10.477	0.1, 0.91, 1.86, 3.72, 26.974
Sur	number, ratio	1014, 46.3	260, 46.9, $\mathbf{k_{chain}}$ **3.9**
	mean, std	0.14, 0.216	1.018, 1.164
	min, 25, 50, *75*, max	0.06, 0.14, 0.2, *0.3*, 2.22	0.06, 0.275, 0.56, 1.26, 6.517
First telling			
duration		235.472	
R duration, ratio		144.547, 0.62, $\mathbf{k_{aside}}$ **0.6**	
Sur duration, ratio		90.465, 0.38	
		fixation	gaze
number		536	166, $\mathbf{k_{chain}}$ **3.2**
mean duration, std		0.439, 0.547	1.419, 1.22
min, 25, 50, 75, max		0.06, 0.14, 0.22, ***0.46***, 3.56	0.06, 0.4, 1.16, 2.155, 5.78
R $\mathbf{k_{vip}}$ **5**	number, ratio	161, 0.3	80, 0.48, $\mathbf{k_{chain}}$ **2**
	mean, std	1.321, 0.795	1.807, 1.188
	min, 25, 50, *75*, max	0.06, 0.24, 0.64, *1.4*, 3.56	0.1, 0.93, 1.499, 2.555, 5.78
Sur	number, ratio	372, 0.69	83, 0.5, $\mathbf{k_{chain}}$ **4.5**
	mean, std	0.243, 0.17	1.091, 1.15
	min, 25, 50, *75*, max	0.06, 0.134, 0.2, *0.28*, 1.18	0.06, 0.31, 0.6, 1.49, 5.337
Retelling			
duration		332.55	
R duration, ratio		313.421, 0.94, $\mathbf{k_{aside}}$ **0.1**	
Sur duration, ratio		19.129, 0.06	
		fixation	gaze
number		497	74, $\mathbf{k_{chain}}$ **6.7**
mean duration, std		0.669, 0.894	4.494, 6.916
min, 25, 50, 75, max		0.06, 0.2, 0.32, ***0.76***, 10.477	0.077, 0.345, 0.81, 6.078, 26.974
R $\mathbf{k_{vip}}$ **3.2**	number, ratio	418, 0.84	36, 0.49, $\mathbf{k_{chain}}$ **11.6**
	mean, std	0.75, 0.949	8.706, 8.001
	min, 25, 50, *75*, max	0.08, 0.22, 0.4, *0.9*, 10.477	0.14, 1.639, 6.577, 14.247, 26.974
Sur	number, ratio	79, 0.16	38, 0.51, $\mathbf{k_{chain}}$ **2.1**
	mean, std	0.242, 0.211	0.503, 0.455
	min, 25, 50, *75*, max	0.06, 0.12, 0.2, *0.28*, 1.26	0.077, 0.239, 0.37, 0.575, 2.54

Table 1: Full Oculomotor Portrait for N 04 (durations shown in seconds)

(1) k_{aside} denotes how often N looks away compared to his R's fixations or gazes; = (Sur's duration) / (R's duration).
(2) k_{vip} denotes how much R is more important for N compared to Sur; = (mean R's duration) / (mean Sur's duration).
(3) k_{chain} denotes how many fixations are included in one N's gaze; = (number of fixations) / (number of gazes).

Compare now the "Core Oculomotor Portraits" of our seven Narrators, including k_{aside}, k_{vip}, k_{chain}, and dur_{75}, i.e. mean durations of fixation for 75% quantiles, separately for the *"First Telling"* (Table 2) and the *"Retelling"* (Table 3) stages.

k / Ns	4	6	16	21	22	23	24
k_{aside}	0.6	1.2	0.8	0.3	3.8	0.4	0.2
k_{vip}	5	3.5	5.5	5.8	2	1.5	5.4
k_{chain}	3.2	2.9	3.9	2.7	6.5	5.7	3.4
dur_{75}	0.46	0.69	0.36	0.62	0.72	0.58	0.5

Table 2: Comparison of Core Oculomotor Portraits, the "*First Telling*" stage

k / Ns	4	6	16	21	22	23	24
k_{aside}	0.1	0.1	0.1	0.1	0	0.2	0
k_{vip}	3.2	2.8	3	4.1	3.6	1.6	6.5
k_{chain}	6.7	5.6	8.5	3	14.6	6.2	11.9
dur_{75}	0.76	0.7	0.74	1.22	1.45	0.64	1.61

Table 3: Comparison of Core Oculomotor Portraits, the "*Retelling*" stage

(1) k_{aside}
At the *"First Telling"* stage, we observe a classical continuum from 0.2 to 1.2. N22 (k_{aside}=3.8) distinguished herself from the others. At the *"Retelling"* stage, the coefficient is almost the same for all Ns.
(2) k_{vip}
As can be seen from the tables, R is always more important, the question is how much. Ns 04, 06, 16 and 21 have higher coefficients for the *"First Telling"* stage, while Ns 22 and 24, on the contrary, for the *"Retelling"* stage. N23 distinguished herself from the others by both the similarity of the coefficient k_{vip} for the *"First Telling"* and the *"Retelling"* stages and a small difference between R's and Sur's durations.
(3) k_{chain}
The values of the coefficient are distributed between 2.7 and 14.6. All Ns have higher coefficients for the *"Retelling"* stage, but for Ns 21 and 23 the difference is minimal. At the same time Ns 22 and 24 distinguished from the others by high values of k_{chain}.
(4) dur_{75}
All Ns have higher coefficients for the *"Retelling"* stage, but for N6 the difference is minimal. N 21 (dur_{75}=1.22), N 22 (dur_{75}=1.45), and N 24 (dur_{75}=1.61) have the duration for the *"Retelling"* stage more than 1 second.

What can we say about the differences between Ns based on the Core Oculomotor Portraits? We can assume that N 04 and N 16 behave the same way in terms of Core Oculomotor Portrait, for both the *"First Telling"* and the *"Retelling"* stages. N 6 is similar to this pair, but she has k_{aside} more than 1. Four other Ns are unique, each in his own way; N 22 is particularly unique.

4 Conclusion

When exploring almost any scientific phenomenon, one addresses two opposite issues: individual differences, on the one hand, and general patterns, on the other. In this paper we've focusing on the individual differences and proposed a "portrait" approach to bimodal communication. We are faced with a difficult task to find a good metric for analyzing oculomotor behavior of people in everyday communication. In previous papers, starting from [14], the authors were looking for oculomotor patterns, but their results depend critically on the metric used. In this paper, we compared the most common metrics and showed that individual differences have a much more serious weight than general patterns. We then identified four main coefficients that determine these individual differences: k_{aside}, k_{vip}, k_{chain}, and dur_{75}. By comparing these Core Oculomotor Portraits, we were able to make these individual differences more clear. However, a fact is a fact: there are far more individual differences than general patterns between

our Ns behavior. The proposed coefficients, in our opinion, clearly show (and even explain and predict) the observed individual differences.

Acknowledgements

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Appendix. Full Oculomotor Portraits

Overall			
duration		1041.781	
R duration, ratio		696.375, 0.67, $\mathbf{k_{aside}}$ **0.3**	
Sur duration, ratio		219.956, 0.21	
		fixation	gaze
number		1656	402, $\mathbf{k_{chain}}$ **4.1**
mean duration, std		0.629, 1.198	2.592, 6.098
min, 25, 50, 75, max		0.06, 0.18, 0.3, ***0.6***, 22.493	0.06, 0.505, 1.05, 2.215, 95.298
R $\mathbf{k_{vip}}$ **3**	number, ratio	655, 39.6	171, 0.43, $\mathbf{k_{chain}}$ **3.8**
	mean, std	1.063, 1.734	4.072, 8.837
	min, 25, 50, *75*, max	0.06, 0.26, 0.5, *1.14*, 22.493	0.2, 0.7, 1.36, 3.29, 95.298
Sur	number, ratio	665, 40.2	183, 0.46, $\mathbf{k_{chain}}$ **3.6**
	mean, std	0.33, 0.447	1.202, 1.323
	min, 25, 50, *75*, max	0.06, 0.16, 0.24, *0.38*, 9.197	0.6, 0.37, 0.78, 1.629, 9.377
First telling			
duration		104.554	
R duration, ratio		47.908, 0.46, $\mathbf{k_{aside}}$ **1.2**	
Sur duration, ratio		56.646, 0.54	
		fixation	gaze
number		184	64, $\mathbf{k_{chain}}$ **2.9**
mean duration, std		0.568, 0.623	1.634, 1.51
min, 25, 50, 75, max		0.08, 0.2, 0.37, ***0.685***, 4.380	0.08, 0.695, 1.2, 2.09, 9.157
R $\mathbf{k_{vip}}$ **3.5**	number, ratio	40, 0.22	32, 0.5, $\mathbf{k_{chain}}$ **1.3**
	mean, std	1.198, 0.917	1.497, 1.21
	min, 25, 50, *75*, max	0.16, 0.555, 0.839, *1.655*, 4.380	0.2, 0.695, 1.249, 1.895, 5.277
Sur	number, ratio	144, 0.78	32, 0.5, $\mathbf{k_{chain}}$ **4.5**
	mean, std	0.393, 0.354	1.77, 1.769
	min, 25, 50, *75*, max	0.08, 0.16, 0.28, *0.48*, 1.937	0.08, 0.675, 1.159, 2.335, 9.157
Retelling			
duration		430.138	
R duration, ratio		382.512, 0.89, $\mathbf{k_{aside}}$ **0.1**	
Sur duration, ratio		47.626, 0.11	
		fixation	gaze
number		550	98, $\mathbf{k_{chain}}$ **5.6**
mean duration, std		0.782, 1.39	4.389, 11.055
min, 25, 50, 75, max		0.06, 0.22, 0.329, ***0.7***, 18.593	0.06, 0.469, 1.03, 1.97, 95.298
R $\mathbf{k_{vip}}$ **2.8**	number, ratio	388, 0.71	43, 0.44, $\mathbf{k_{chain}}$ **9**
	mean, std	0.986, 1.605	8.896, 15.633
	min, 25, 50, *75*, max	0.08, 0.26, 0.43, *0.94*, 18.593	0.24, 1.13, 1.98, 12.317, 95.298
Sur	number, ratio	162, 0.29	55, 0.56, $\mathbf{k_{chain}}$ **3**
	mean, std	0.289, 0.234	0.866, 0.791
	min, 25, 50, *75*, max	0.06, 0.14, 0.22, *0.34*, 1.68	0.06, 0.36, 0.6, 1.17, 4.12

Table 4: Full Oculomotor Portrait for N 06 (durations shown in seconds)

Overall			
duration		1389.722	
R duration, ratio		988.166, 0.71, **k_{aside} 0.3**	
Sur duration, ratio		285.072, 0.21	
		fixation	gaze
number		2817	684, **k_{chain} 4.1**
mean duration, std		0.493, 0.703	2.031, 5.435
min, 25, 50, 75, max		0.06, 0.12, 0.22, ***0.52***, 10.496	0.06, 0.34, 0.86, 1.865, 72.628
R **k_{vip} 5**	number, ratio	1150, 0.41	282, 0.41, **k_{chain} 4.1**
	mean, std	0.859, 0.946	3.502, 8.1
	min, 25, 50, *75*, max	0.06, 0.205, 0.55, *1.2*, 10.496	0.08, 0.72, 1.49, 2.855, 72.628
Sur	number, ratio	1351, 0.48	329, 0.48, **k_{chain} 4.1**
	mean, std	0.211, 0.175	0.859, 1.003
	min, 25, 50, *75*, max	0.06, 0.1, 0.16, *0.24*, 2.16	0.06, 0.24, 0.56, 1.06, 7.4
First telling			
duration		223.446	
R duration, ratio		126.713, 0.57, **k_{aside} 0.8**	
Sur duration, ratio		96.733, 0.43	
		fixation	gaze
number		609	157, **k_{chain} 3.9**
mean duration, std		0.367, 0.459	1.423, 1.236
min, 25, 50, 75, max		0.06, 0.12, 0.2, ***0.36***, 3.62	0.08, 0.56, 1.1, 1.96, 6.217
R **k_{vip} 5.5**	number, ratio	127, 0.21	77, 0.49, **k_{chain} 1.7**
	mean, std	1.278, 0.654	1.646, 1.16
	min, 25, 50, *75*, max	0.06, 0.47, 0.96, *1.32*, 3.62	0.14, 0.88, 1.26, 2.34, 6.217
Sur	number, ratio	482, 0.79	80, 0.51, **k_{chain} 6**
	mean, std	0.201, 0.147	1.209, 1.276
	min, 25, 50, *75*, max	0.06, 0.1, 0.16, *0.24*, 1.66	0.08, 0.295, 0.73, 1.585, 6.1
Retelling			
duration		318.993	
R duration, ratio		303.122, 0.95, **k_{aside} 0.1**	
Sur duration, ratio		15.871, 0.05	
		fixation	gaze
number		501	59, **k_{chain} 8.5**
mean duration, std		0.637, 0.889	5.407, 13.186
min, 25, 50, 75, max		0.06, 0.14, 0.28, ***0.74***, 9.44	0.06, 0.21, 0.52, 1.81, 72.628
R **k_{vip} 3**	number, ratio	436, 0.87	27, 0.46, **k_{chain} 16.1**
	mean, std	0.695, 0.936	11.227, 17.956
	min, 25, 50, *75*, max	0.06, 0.14, 0.34, *0.838*, 9.44	0.1, 0.52, 1.88, 12.03, 72.628
Sur	number, ratio	65, 0.13	32, 0.54, **k_{chain} 2**
	mean, std	0.244, 0.211	0.496, 0.713
	min, 25, 50, *75*, max	0.06, 0.08, 0.18, *0.28*, 0.957	0.06, 0.16, 0.29, 0.67, 4.037

Table 5: Full Oculomotor Portrait for N 16 (durations shown in seconds)

Overall			
duration		913.07	
R duration, ratio		738.513, 0.81, $\mathbf{k_{aside}}$ **0.2**	
Sur duration, ratio		131.265, 0.14	
		fixation	gaze
number		1344	406, $\mathbf{k_{chain}}$ **3.3**
mean duration, std		0.679, 0.984	2.254, 4.042
min, 25, 50, 75, max		0.06, 0.16, 0.28, ***0.74***, 10.2	0.08, 0.36, 0.94, 2.34, 39.411
R $\mathbf{k_{vip}}$ **5.6**	number, ratio	654, 0.49	193, 0.48, $\mathbf{k_{chain}}$ **3.4**
	mean, std	1.129, 1.246	3.826, 5.297
	min, 25, 50, *75*, max	0.06, 0.26, 0.72, *1.559*, 10.2	0.12, 1.04, 2.017, 4.337, 39.411
Sur	number, ratio	530, 0.39	192, 0.47, $\mathbf{k_{chain}}$ **2.8**
	mean, std	0.248, 0.174	0.682, 0.847
	min, 25, 50, *75*, max	0.06, 0.14, 0.2, *0.28*, 1.46	0.08, 0.22, 0.397, 0.805, 6.3
First telling			
duration		275.979	
R duration, ratio		207.695, 0.75, $\mathbf{k_{aside}}$ **0.3**	
Sur duration, ratio		68.284, 0.25	
		fixation	gaze
number		507	187, $\mathbf{k_{chain}}$ **2.7**
mean duration, std		0.544, 0.672	1.476, 1.63
min, 25, 50, 75, max		0.06, 0.16, 0.28, ***0.62***, 5.458	0.08, 0.37, 0.9, 1.779, 11.617
R $\mathbf{k_{vip}}$ **5.8**	number, ratio	226, 0.45	94, 0.5, $\mathbf{k_{chain}}$ **2.4**
	mean, std	0.919, 0.856	2.21, 1.848
	min, 25, 50, *75*, max	0.06, 0.285, 0.66, *1.24*, 5.458	0.16, 0.91, 1.58, 3.053, 11.617
Sur	number, ratio	281, 0.55	93, 0.5, $\mathbf{k_{chain}}$ **3**
	mean, std	0.243, 0.155	0.734, 0.903
	min, 25, 50, *75*, max	0.1, 0.13, 0.19, *0.215*, 0.8	0.08, 0.22, 0.48, 0.88, 6.3
Retelling			
duration		231.025	
R duration, ratio		217.405, 0.94, $\mathbf{k_{aside}}$ **0.1**	
Sur duration, ratio		13.02, 0.06	
		fixation	gaze
number		239	80, $\mathbf{k_{chain}}$ **3**
mean duration, std		0.967, 1.235	2.889, 4.514
min, 25, 50, 75, max		0.08, 0.2, 0.44, ***1.22***, 6.979	0.08, 0.295, 0.59, 4.295, 22.894
R $\mathbf{k_{vip}}$ **4.1**	number, ratio	192, 0.8	39, 0.49, $\mathbf{k_{chain}}$ **4.9**
	mean, std	1.132, 1.324	5.574, 5.281
	min, 25, 50, *75*, max	0.08, 0.22, 0.597, *1.48*, 6.979	0.56, 1.39, 4.82, 6.839, 22.894
Sur	number, ratio	46, 0.19	40, 0.5, $\mathbf{k_{chain}}$ **1.2**
	mean, std	0.283, 0.142	0.329, 0.18
	min, 25, 50, *75*, max	0.08, 0.2, 0.26, *0.36*, 0.78	0.08, 0.22, 0.29, 0.385, 1.12

Table 6: Full Oculomotor Portrait for N 21 (durations shown in seconds)

Overall			
duration		898.282	
R duration, ratio		472.258, 0.53, $\mathbf{k_{aside}}$ **0.4**	
Sur duration, ratio		180.083, 0.2	
		fixation	gaze
number		1149	185, $\mathbf{k_{chain}}$ **6.2**
mean duration, std		0.782, 0.922	4.89, 11.241
min, 25, 50, 75, max		0.06, 0.2, 0.42, ***0.98***, 7.1	0.1, 0.79, 1.84, 4.355, 118.712
R $\mathbf{k_{vip}}$ **2.9**	number, ratio	422, 0.37	70, 0.38, $\mathbf{k_{chain}}$ **6**
	mean, std	1.119, 1.11	6.776, 16.604
	min, 25, 50, *75*, max	0.08, 0.32, 0.72, *1.5*, 7.1	0.24, 1.039, 2.499, 5.218, 118.712
Sur	number, ratio	418, 0.36	74, 0.4, $\mathbf{k_{chain}}$ **5.7**
	mean, std	0.431, 0.455	2.428, 4.176
	min, 25, 50, *75*, max	0.06, 0.16, 0.26, *0.52*, 3.38	0.1, 0.46, 1.17, 2.315, 21.514
First telling			
duration		164.723	
R duration, ratio		34.088, 0.21, $\mathbf{k_{aside}}$ **3.8**	
Sur duration, ratio		130.635, 0.79	
		fixation	gaze
number		301	46, $\mathbf{k_{chain}}$ **6.5**
mean duration, std		0.547, 0.573	3.581, 4.978
min, 25, 50, 75, max		0.06, 0.18, 0.34, ***0.72***, 3.38	0.14, 0.825, 2.1, 3.405, 21.514
R $\mathbf{k_{vip}}$ **2**	number, ratio	35, 0.12	23, 0.5, $\mathbf{k_{chain}}$ **1.5**
	mean, std	0.974, 0.768	1.482, 1.228
	min, 25, 50, *75*, max	0.12, 0.369, 0.8, *1.25*, 2.94	0.24, 0.66, 0.96, 2.067, 5.277
Sur	number, ratio	266, 0.88	23, 0.5, $\mathbf{k_{chain}}$ **11.6**
	mean, std	0.491, 0.518	5.68, 6.321
	min, 25, 50, *75*, max	0.06, 0.16, 0.32, *0.635*, 3.38	0.14, 2.1, 2.5, 6.088, 21.514
Retelling			
duration		297.55	
R duration, ratio		293.15, 0.99, $\mathbf{k_{aside}}$ **0**	
Sur duration, ratio		4.08, 0.01	
		fixation	gaze
number		278	19, $\mathbf{k_{chain}}$ **14.6**
mean duration, std		1.07, 1.142	15.633, 30.355
min, 25, 50, 75, max		0.08, 0.28, 0.6, ***1.454***, 7.1	0.1, 0.33, 0.66, 16.157, 118.712
R $\mathbf{k_{vip}}$ **3.6**	number, ratio	262, 0.94	9, 0.47, $\mathbf{k_{chain}}$ **29.1**
	mean, std	1.119, 1.158	32.572, 38.207
	min, 25, 50, *75*, max	0.1, 0.3, 0.66, *1.495*, 7.1	0.66, 11.779, 18.757, 29.811, 118.712
Sur	number, ratio	14, 0.05	9, 0.47, $\mathbf{k_{chain}}$ **1.6**
	mean, std	0.291, 0.172	0.396, 0.376
	min, 25, 50, *75*, max	0.1, 0.15, 0.21, *0.415*, 0.62	01, 0.18, 0.34, 0.4, 1.34

Table 7: Full Oculomotor Portrait for N 22 (durations shown in seconds)

Overall			
duration		721.661	
R duration, ratio		384.117, 0.53, $\mathbf{k_{aside}}$ **0.4**	
Sur duration, ratio		157.436, 0.22	
		fixation	gaze
number		1721	259, $\mathbf{k_{chain}}$ **6.6**
mean duration, std		0.419, 0.644	2.763, 4.629
min, 25, 50, 75, max		0.06, 0.12, 0.24, ***0.46***, 11.977	0.08, 0.5, 1.18, 2.789, 46.231
R $\mathbf{k_{vip}}$ **1.7**	number, ratio	643, 0.37	96, 0.37, $\mathbf{k_{chain}}$ **6.7**
	mean, std	0.597, 0.879	3.939, 6.034
	min, 25, 50, *75*, max	0.06, 0.149, 0.34, *0.66*, 11.977	0.08, 0.935, 2.049, 5.432, 46.231
Sur	number, ratio	446, 0.26	117, 0.45, $\mathbf{k_{chain}}$ **3.8**
	mean, std	0.353, 0.531	1.346, 1.795
	min, 25, 50, *75*, max	0.06, 012, 0.22, *0.4*, 7.097	0.08, 0.34, 0.72, 1.48, 9.637
First telling			
duration		166.881	
R duration, ratio		119.693, 0.72, $\mathbf{k_{aside}}$ **0.4**	
Sur duration, ratio		46.768, 0.28	
		fixation	gaze
number		370	65, $\mathbf{k_{chain}}$ **5.7**
mean duration, std		0.451, 0.426	2.567, 2.885
min, 25, 50, 75, max		0.06, 0.16, 0.32, ***0.579***, 2.9	0.08, 0.74, 1.68, 3.379, 18.557
R $\mathbf{k_{vip}}$ **1.5**	number, ratio	244, 0.66	31, 0.48, $\mathbf{k_{chain}}$ **7.9**
	mean, std	0.491, 0.461	3.861, 3.399
	min, 25, 50, *75*, max	0.06, 0.18, 0.35, *0.66*, 2.9	0.94, 1.74, 2.64, 5.477, 18.557
Sur	number, ratio	123, 0.33	32, 0.49, $\mathbf{k_{chain}}$ **3.8**
	mean, std	0.38, 0.342	1.462, 1.646
	min, 25, 50, *75*, max	0.06, 0.15, 0.3, *0.44*, 2.317	0.12, 0.5, 0.84, 1.755, 7.817
Retelling			
duration		239.37	
R duration, ratio		198.605, 0.83, $\mathbf{k_{aside}}$ **0.2**	
Sur duration, ratio		40.685, 0.17	
		fixation	gaze
number		363	59, $\mathbf{k_{chain}}$ **6.2**
mean duration, std		0.659, 1.124	4.066, 7.317
min, 25, 50, 75, max		0.06, 0.14, 0.28, ***0.64***, 11.977	0.08, 0.41, 0.98, 5.817, 46.231
R $\mathbf{k_{vip}}$ **1.6**	number, ratio	286, 0.79	30, 0.51, $\mathbf{k_{chain}}$, **9.5**
	mean, std	0.694, 1.131	6.638, 9.407
	min, 25, 50, *75*, max	0.06, 0.14, 0.32, *0.715*, 11.977	0.08, 0.675, 4.2, 7.799, 46.231
Sur	number, ratio	76, 0.21	28, 0.47, $\mathbf{k_{chain}}$ **2.7**
	mean, std	0.535, 1.102	1.453, 2.22
	min, 25, 50, *75*, max	0.06, 0.1, 0.2, *0.445*, 7.097	0.08, 0.335, 0.69, 1.185, 9.637

Table 8: Full Oculomotor Portrait for N 23 (durations shown in seconds)

Overall			
duration		1241.489	
R duration, ratio		991.884, 0.8, **k_{aside} 0.1**	
Sur duration, ratio		114.308, 0.09	
		fixation	gaze
number		2326	388, **k_{chain} 6**
mean duration, std		0.534, 0.803	3.209, 9.97
min, 25, 50, 75, max		0.06, 0.14, 0.24, ***0.56***, 8.597	0.06, 0.36, 0.88, 2.478, 112.653
R **k_{vip} 2.9**	number, ratio	1506, 0.65	158, 0.41, **k_{chain} 9.5**
	mean, std	0.659, 0.94	6.278, 15.033
	min, 25, 50, *75*, max	0.06, 0.14, 0.3, *0.74*, 8.597	0.08, 0.8, 2.009, 4.899, 112.653
Sur	number, ratio	515, 0.22	164, 0.42, **k_{chain} 3.1**
	mean, std	0.222, 0.154	0.719, 0.851
	min, 25, 50, *75*, max	0.06, 0.14, 0.18, *0.26*, 1.84	0.06, 0.2, 0.38, 0.77, 4.917
First telling			
duration		182.361	
R duration, ratio		146.57, 0.8, **k_{aside} 0.2**	
Sur duration, ratio		35.371, 0.19	
		fixation	gaze
number		333	99, **k_{chain} 3.4**
mean duration, std		0.548, 0.77	1.887, 2.416
min, 25, 50, 75, max		0.06, 0.159, 0.22, ***0.5***, 4.997	0.1, 0.34, 1.1, 2.31, 15.857
R **k_{vip} 5.4**	number, ratio	167, 0.5	49, 0.49, **k_{chain} 3.4**
	mean, std	0.878, 0.975	3.083, 2.892
	min, 25, 50, *75*, max	0.06, 0.18, 0.46, *1.39*, 4.997	0.22, 1.24, 2.08, 4.38, 15.857
Sur	number, ratio	163, 0.49	49, 0.49, **k_{chain} 3.3**
	mean, std	0.217, 0.121	0.722, 0.813
	min, 25, 50, *75*, max	0.6, 0.14, 0.18, *0.26*, 0.9	0.1, 0.2, 0.34, 1.077, 3.977
Retelling			
duration		238.287	
R duration, ratio		235.527, 0.99, **k_{aside} 0**	
Sur duration, ratio		2.76, 0.01	
		fixation	gaze
number		203	17, **k_{chain} 11.9**
mean duration, std		1.174, 1.525	14.017, 32.909
min, 25, 50, 75, max		0.06, 0.19, 0.48, ***1.61***, 8.597	0.18, 0.3, 0.62, 2.86, 112.653
R **k_{vip} 6.5**	number, ratio	191, 0.94	9, 0.53, **k_{chain} 21.2**
	mean, std	1.233, 1.553	26.17, 42.578
	min, 25, 50, *75*, max	0.06, 0.2, 0.58, *1.76*, 8.597	0.36, 0.76, 2.86, 25.434, 112.653
Sur	number, ratio	12, 0.6	8, 0.47, **k_{chain} 1.5**
	mean, std	0.23, 0.113	0.345, 0.21
	min, 25, 50, *75*, max	0.08, 0.18, 0.21, *0.27*, 0.44	0.18, 0.195, 0.26, 0.41, 0.72

Table 9: Full Oculomotor Portrait for N 24 (durations shown in seconds)