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Modeling public attention to political events

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The paper applies the model of decrease of public attention to a one-time political event to more empirical cases, namely the Presidential election in France in 2017 and the inauguration of Emmanuel Macron as the President of France. The number of search requests about a political event is taken as a measure of public attention to it. The theoretical model stems from a neurological scheme of decision-making. Individuals are supposed to be differentially pre-disposed to making web search requests about a certain political event such as referendum, election or coup d'etat. This attitude of making such requests reflects their general interest towards political matters and/or towards a given country etc. Media coverage during the event and the run-up to it enhances public attention to the event. This add-on is called a dynamical component of attention. The basic hypothesis is that an individual makes a web search request about a political event, if the sum of their attitude and dynamical component exceeds a certain threshold value. Over time, the dynamical component decreases and so does the daily number of requests. Empirical data have been obtained using Google Trends online service. It is shown that the model matches empirical data and public attention to a past one-time event decreases as a double-exponential function of time.

Keywords: Google Trends, political events, search requests, mathematical model.

Introduction. The analysis of search requests is an increasingly salient part of communication science (see [1] for review). Practical implications of this topic are close to those of studying online social networks [2-6].

In this paper, we use search requests in order to study public attention to past political events. In this research area, the focus is usually on «eternal» issues such as unemployment, immigration, education, environment etc. The proportion of such a topic in public agenda may increase or decrease over time, which reflects the long-run dynamics of their saliency [7, 8]. However, the dynamics is very different with one-time political events such as elections, referendums and *coups d'etat*. Public attention to them generally decreases sharply over time.

The public attention to a political event can be measured by the number of search requests about it. Fig. 1 presents the dynamics of the number of search requests from Russian users containing the word «Macron». It can be seen that the Presidential election drew significant attention, as the

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number of requests soared on the election day (07 May 2017) and even higher on the day of announcement of results (08 May). Then the attention sharply decreased until the day of another political event, directly associated with Emmanuel Macron, namely his inauguration. Again, public attention sharply decreased after the event.

Below, we apply the model of decrease of public attention [9] to several events.

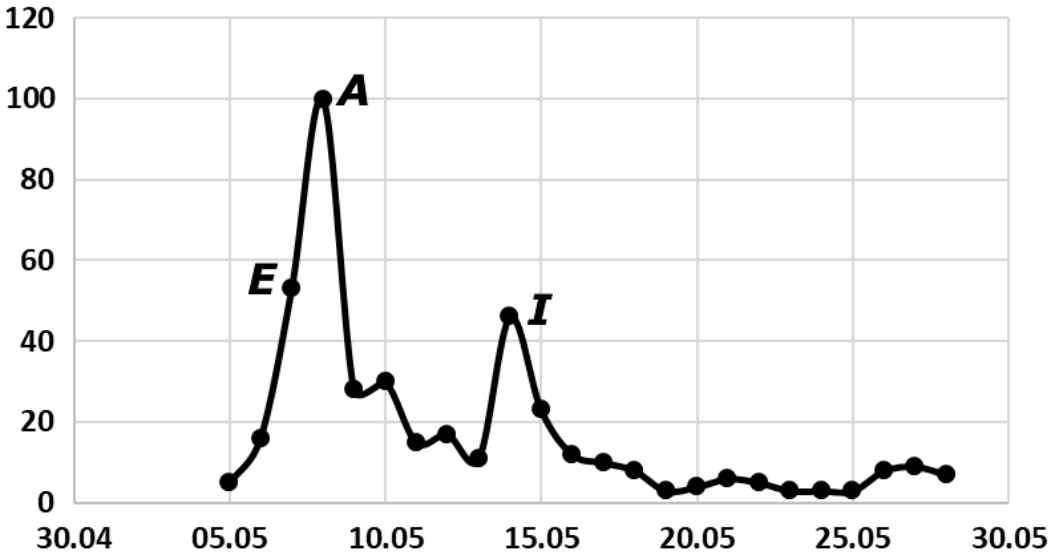


Fig. 1. The number of requests with the word "Macron" (05-28 May, 2017), normalized by 100. E – election day (07.05), A – announcement of results (08.05), I – inauguration day (14.05).

Model. In layman's terms, the basic idea is as follows. Individuals are differentially predisposed to search or seek information about a certain event, as for instance the Brexit referendum. This predisposition is measured by their attitude φ, which is an individual-specific number. Let, for instance, attitudes of Anna, Ben, Carl, and Daniel be $\varphi_A = 0.7$, $\varphi_B = 0.8$, $\varphi_C = 1.1$, $\varphi_D = 1.7$, respectively. This may mean that Daniel is deeply interested in politics, especially in British politics, whereas Anna is weakly concerned with such matters. Extensive and intriguing media coverage during the run-up to Brexit added to the public fascination with and attention to the event. Suppose this add-on to be $\psi(0) = 2$ on the day of the announcement of results, which then decreases by 20% every day as the impression (and the shock, as it was in the case of Brexit) fades away. This means $\psi(1) = 1.6$, $\psi(2) = 1.28$, $\psi(3) = 1.024$, $\psi(4) = 0.8192$ and so on. Postulate that an individual i makes the search request about Brexit on day t if (and only if) $\varphi_i + \psi(t) > h$ and, for the sake of definiteness of this toy example, put $h = 2.5$.

This being so, for the zeroth day, we have

$$\varphi_A + \psi(0) = 2.7 > h, \quad \varphi_B + \psi(0) = 2.8 > h,$$

$$\varphi_C + \psi(0) = 3.1 > h, \quad \varphi_D + \psi(0) = 3.7 > h.$$

Therefore, we would see four requests made by this group of individuals on day $t = 0$. On the next day, we have inequalities

$\varphi_A + \psi(1) = 2.3 < h$, $\varphi_B + \psi(1) = 2.4 < h$,

$\varphi_C + \psi(1) = 2.7 > h$, $\varphi_D + \psi(1) = 3.3 > h$.

Therefore, only two individuals, namely Carl and Daniel, make requests on day $t = 1$. On day $t = 2$, only Daniel makes his request because

$\varphi_C + \psi(2) = 2.38 < h$, $\varphi_D + \psi(2) = 2.98 > h$.

Calculating further, we get

$\varphi_D + \psi(3) = 2.724 > h$, $\varphi_D + \psi(4) = 2.5192 > h$,

and obviously, $\varphi_D + \psi(5) < h$. Therefore, on days $t = 3$, $t = 4$ there is only one request, and there are no requests starting from $t = 5$.

To sum up, an observer studying the daily dynamics of requests made by this group of individuals would see the following time series:

$k(0) = 4,\ k(1) = 2,\ k(2) = 1,\ k(3) = 1,\ k(4) = 1,\ k(5) = 0$.

In studying real processes, these time series are observables, whereas the other parameters are to be determined analytically.

More concretely, we collect empirical time series using Google Trends service and hypothesize the exponential form of the distribution of attitudes among individuals; that is, we posit that there are relatively a few individuals only, deeply interested in political issues (and, therefore, deeply pre-disposed to ask Google about politics) so that the distribution of individuals over attitudes is a decreasing exponential function: $N(\varphi) = N_0 \lambda e^{-\lambda\varphi}$, $\varphi \geq 0$. Here N_0 is the total number of individuals who can (being in some degree of excitation, that is having a certain add-on) make a search request about the event, that is $\int_0^\infty N(\varphi)\, d\varphi = N_0$. Both constants N_0, λ are event-specific.

An individual makes a request on day t if $\varphi + \psi(t) > h$, therefore the number of requests is

$$k(t) = \int_{h-\psi(t)}^{\infty} N(\varphi) d\varphi = N_0 \lambda \int_{h-\psi(t)}^{\infty} e^{-\lambda\varphi} d\varphi = N_0 \exp\left[-\lambda\left(h - \psi(t)\right)\right].$$

Supposing that the dynamical component exponentially decreases over time: $\psi(t) = \psi_0 \exp(-\gamma t)$, we obtain

$$k(t) = \exp\left[\ln N_0 - \lambda\left(h - \psi_0 \exp(-\gamma t)\right)\right].$$

Denoting $\alpha = \ln N_0 - \lambda h;\ \beta = \lambda\psi_0$, we finally get

$$k(t) = \exp\left[\alpha + \beta \exp(-\gamma t)\right]. \quad (1)$$

Parameters α, β, γ are event-specific and determined from empirical time series for $k(t)$.

Empirical Data. As mentioned earlier, we measure public attention to a political event by the number of search requests about it (made by users from a given area-from Russia in our case).

The raw data have been obtained using Google Trends online service, which provides the data about a given query. These raw data have the form of time-series scores normalized to 100 (the day with the maximum number or requests over the given range). These scores are integer numbers, thus inaccuracies are unacceptably high for low scores. In order to reduce these inaccuracies, we use a multi-stage procedure as described in [10]. For each event, we get daily scores as shown in Table 2 (see Appendix).

Five political events have been considered:

1) Brexit referendum (UK, 23 June 2016),
2) US Presidential election (08 November 2016),
3) Attempted *coup d'etat* in Turkey (15-16 July 2016),
4) French Presidential election (07 May 2017),
5) Inauguration of Emmanuel Macron as the President of France (14 May 2017).

It is worth visually comparing the dynamics of public attention to these events with that for the case of the rebellion in Venezuela in 2019. On 23 January 2019, Juan Guaido, supported by the National Parliament, declared himself to be the acting President of Venezuela. That was not the end of the story, however, because President Maduro retained control over police and the army. Day after day, as the situation continued to be unresolved, each successive piece of news from Venezuela helped to maintain the interest and expectations for the next day. Due to this, the decrease of number of requests was significantly less sharp than in cases of the one-time events listed above (Fig. 2).

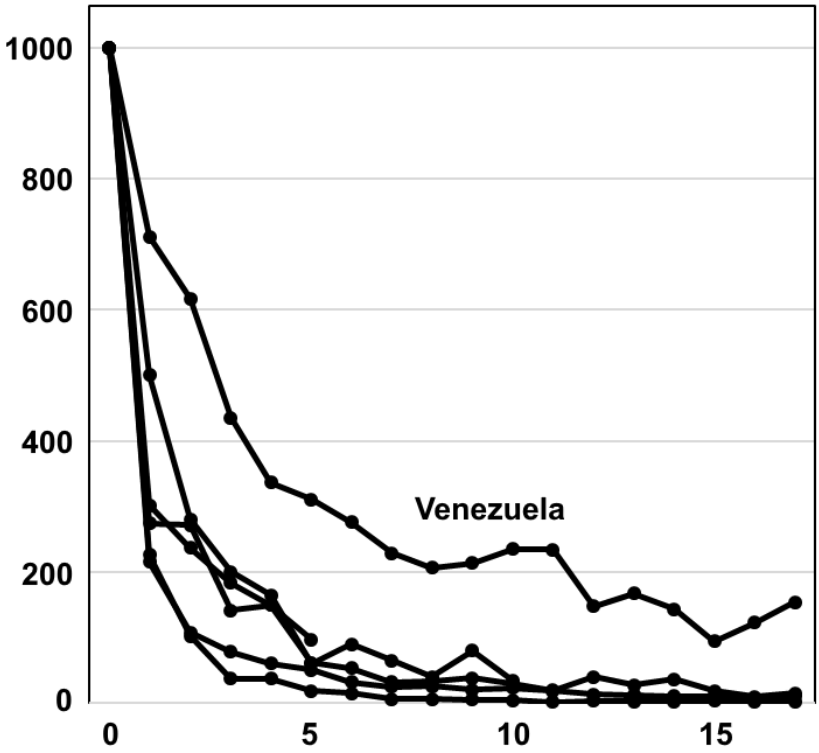
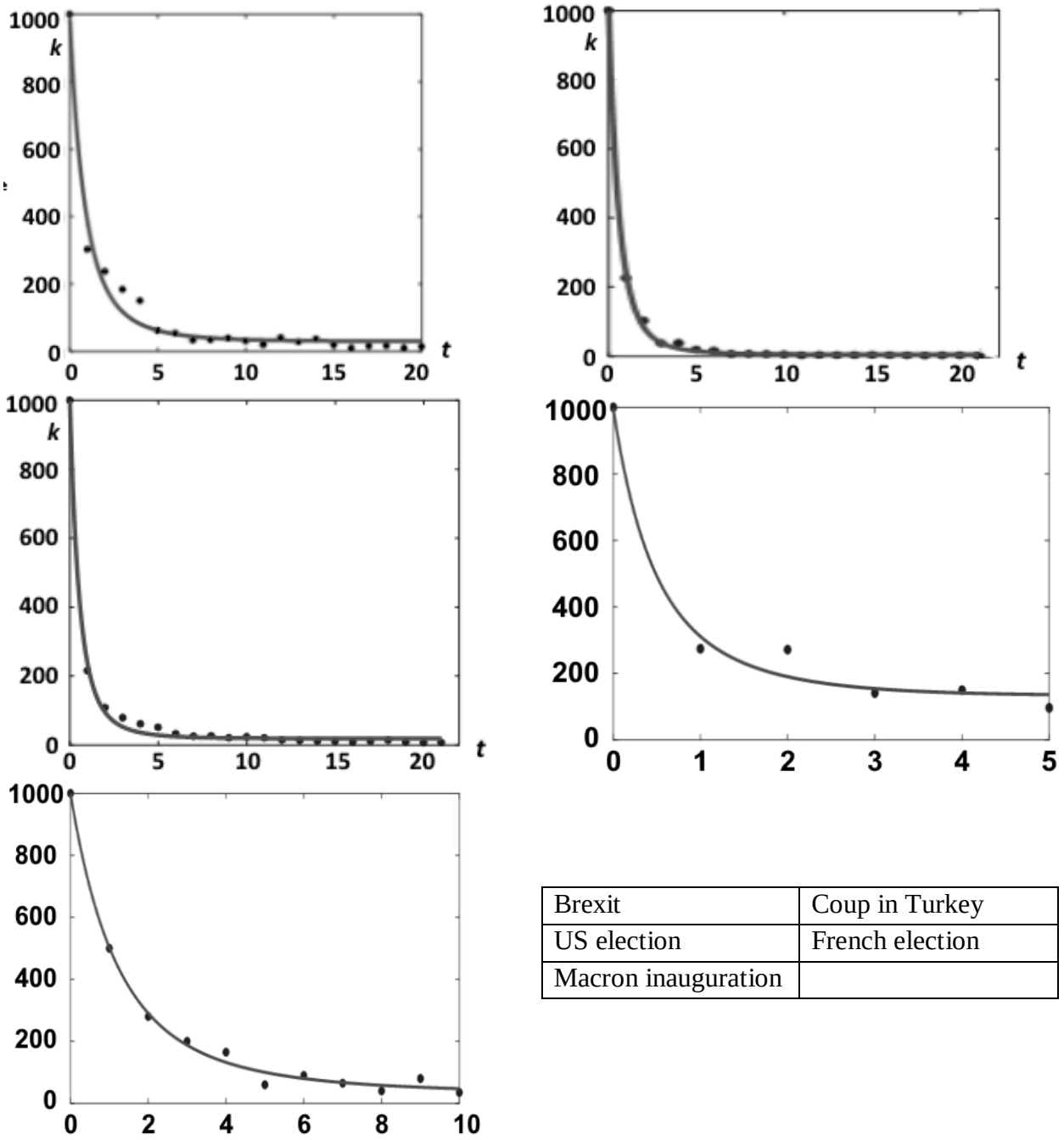


Fig. 2. The daily dynamics of number of requests for the case of Venezuela and five listed events, normalized by 1000.



Brexit	Coup in Turkey
US election	French election
Macron inauguration	

Fig. 3. Empirical scores (dots) and trends estimated using the model (solid curve)

For each of these five events, we calculated the values of parameters α, β, γ and 95% confidence intervals (Table 1). The estimation procedure was performed in MatLab by applying the ordinary least squares method and nonlinear model (1). The graphs comparing theoretical curves to empirical data are presented in Fig. 3.

It can be seen that the curves calculated from the model fit the empirical data in all the five cases. This confirms the findings obtained earlier on parts of this empirical material. One of them is that public attention to a past one-time event decreases as a double-exponential function of time, which has implications for the dynamics of public agenda and information warfare.

Table 1. Estimated model parameters and 95% confidence intervals.

	Event	α	β	γ
1	Brexit	3.94 (3.59, 4.30)	291 (2.55, 3.26)	0.19 (0.14, 0.23)
2	Coup in Turkey	1.54 (1.03, 2.05)	5.37 (4.86, 5.88)	0.31(0.27, 0.35)
3	US election	3.16 (2.86, 3.46)	3.73 (3.44, 4.03)	0.23 (0.20, 0.26)
4	France election	4.89 (3.92, 5.85)	2.02 (1.04, 3.00)	0.86 (-0.19, 1.92)
5	Macron inauguration	3.50 (2.65, 4.36)	3.40 (2.56, 4.25)	0.23 (0.14, 0.31)

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APPENDIX

Table 2. Scores for the events.

Day	US election	Coup in Turkey	Brexit	France election	Macron inauguration
0	1000	1000	1000	1000	1000
1	215.2	225.9	301.7	274.5	500
2	107.7	102.3	236.6	271.6	280
3	78.5	36.9	183.0	141.2	200
4	60.4	37.3	149.2	149.9	165
5	50.5	18.2	60.9	96.7	60
6	32.0	15.2	53.3		90
7	24.7	6.0	31.9		65
8	25.9	6.1	33.7		40
9	20.1	5.5	38.2		80
10	22.9	4.5	29.9		35
11	19.9	1.9	18.3		
12	13.5	3.2	40.1		
13	12.2	2.5	27.7		
14	10.7	2.8	36.1		
15	10.3	3.2	18.3		
16	7.8	2.5	9.3		
17	10.3	2.1	14.7		
18	13.3	1.3	16.0		
19	8.0	1.8	9.3		

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Моделирование общественного внимания к политическим событиям

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Разработанная ранее модель спада общественного внимания к разовым политическим событиям применяется к новым эмпирическим случаям, а именно к президентским выборам во Франции в 2017 году и инаугурации Эммануила Макрона на пост президента Франции. В качестве меры общественного внимания к политическому событию принимается количество поисковых запросов о нем. Теоретическая модель основана на нейрологической схеме принятия решений. Предполагается, что индивиды в различной степени предрасположены делать поисковые запросы о конкретном политическом событии такому как референдум, выборы или государственный переворот. Эта предрасположенность отражает их общий интерес к политике и / или к данной стране и т. д. Освещение самого события или подготовки средствах массовой информации увеличивает общественное внимание. Эта дополнение называется динамической компонентой. Основная гипотеза состоит в том, что индивид делает поисковый запрос о политическом событии, если сумма его предрасположенности и динамической компоненты превышает определенное пороговое значение. С течением времени динамический компонент уменьшается; соответствующим образом уменьшается количество запросов за день. Эмпирические данные были получены с помощью онлайн-сервиса Google Trends. Показано, что модель сопоставляет эмпирические данные, и внимание общественности к прошедшему одноразовому событию уменьшается как двойная экспоненциальная функция времени.

Ключевые слова: Google Trends, политические события, поисковые запросы, математическая модель.

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