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Editorial process in scientific journals: analysis and modeling

O. Mryglod · Yu. Holovatch · I. Mryglod

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Abstract The editorial handling of articles in scientific journals as a human activity process is considered. Using recently proposed approaches of human dynamics theory we examine the probability distributions of random variables reflecting the temporal characteristics of studied processes. The first part of this article contains our results of analysis of the real data about articles published in scientific journals. The second part is devoted to modeling of time-series connected with editorial work. The purpose of our study is to present new object that can be studied in terms of human dynamics theory and to corroborate the scientometrical application of the results obtained.

Keywords Human dynamics · Time-series modeling · Editorial process analysis

Introduction

The main purpose of this article is to gain insight on the editorial process in scientific journals using tools and concepts of the human dynamics theory. The sequences of human actions (telephone calls, information queries or stock exchanges) are not new subject to study. But contrary to generally accepted opinion about human actions randomly distributed in time and thus well approximated by Poisson processes (interevent times are exponentially distributed), the comparatively recent results of human dynamics analysis show the presence of power laws which nature and origin are unexplained up till now (Barabási 2005, Oliveira and Barabási 2005, Zhou et al. 2007). This discovery attracts an interest and provokes analysis of new processes involving human actions in different fields of our life. The analysis of time statistics of human activity patterns can be useful for different optimization and control tasks in spheres of mass service, communication, information technologies, resource distribution, etc. Besides, this approach can give a new possibility to understand human behaviour and to get its additional quantitative measure.

O. Mryglod (✉) · Yu. Holovatch · I. Mryglod
Institute for Condensed Matter Physics of the National Academy of Sciences of Ukraine,
1 Svientsitskii Str., Lviv 79011, Ukraine
e-mail: olesya@icmp.lviv.ua

The continuous human behaviour can be considered as the set of consecutive actions in time. In this case it is convenient to examine two characteristic random variables: the time interval between two consecutive actions (called the interevent time t_{int}) and the time a task is waiting for an execution (the so-called waiting time t_{w}). The power-law nature of corresponding distributions

$$P(t_{int}) \sim t_{int}^{-\alpha}, \qquad P(t_w) \sim t_w^{-\beta}, \qquad \alpha, \beta > 0 \tag{1}$$

arises from the analysis of real processes that involve human actions such as browsing the Internet, data downloading, electronic and mail communication, initiating financial transactions etc. (Barabási 2005, Oliveira and Barabási 2005, Johansen 2004). On the other hand, the processes with execution of tasks in queue are the typical objects of study in the queueing theory which can be seen as the subfield of the so-called theory of mass service or, generally speaking, of applied probability theory (Vázquez et al. 2006, Cooper 1981). So, it is natural to use some general terminology to describe such kinds of processes. An empirical analysis results in a variety of values of the exponents governing (1) (Zhou et al. 2007, Vázquez et al. 2006), however an observed tendency when similar values of the exponents describe different processes gives rise to an analogy with the "universality classes" found in physics of critical phenomena (Vázquez et al. 2006). Different models have been proposed to gain insight about an origin of power laws (1) (Zhou et al. 2007). Some of the proposed models are based on the assumption about the key role of priority-based (decision-based) queuing process (Vázquez et al. 2006). The situation when an individual has to perform a list of tasks and chooses a task from this list using some internal priority is very natural. It is important, that power-law-like distributions (1) appear only in the so-called critical and supercritical regimes of service, when its traffic intensity ρ:

$$\rho = \lambda / \mu \tag{2}$$

is greater than 1. In (2) λ is the tasks arrival rate and μ is the execution rate, respectively (Vázquez et al. 2006). In other words, the probability distribution functions of human activity processes are close to power law only when the queue of tasks is not exhausted (Vázquez et al. 2006). This class of human activity can be described by the so-called "task-driven" models (Zhou et al. 2007). On the other hand, the "interest-driven" models explain the existence of power laws in human dynamics in a different way. There, the power laws may be observed also for the processes without any possibility to determine the queue of tasks, for example visiting of web-sites by different users (Zhou et al. 2007).

In this article we will consider the editorial handling of articles in scientific journals as a human dynamics. To this end, we will use the above described approaches of human dynamics theory to examine the probability distributions of random variables reflecting the temporal characteristics of editorial process. The set up of the article is the following. In the next section we show our empirical results obtained during the data analysis about distributions of waiting times of articles in several scientific journals. The simple simulation model of editorial processing of scientific manuscripts is presented in the remaining part of this article.

Waiting times statistics: analysis of scientific journals

Let us consider the editorial process in scientific journals as an example of human activity processes (Mryglod and Holovatch 2007). Keeping in mind the classification mentioned above, we will consider the “task-driven” model. In this kind of mass service system the input flow consists of submitted articles forming the queue. A standard procedure after article submission can include the following steps: (i) peer-review process, (ii) revisions if necessary, (iii) acceptance by an Editorial Board, (iv) other intermediate processes. On each of the above stages the article may be rejected. However, typically the information concerning the rejected articles is not publicly available. Therefore, we consider the random variable t_w defined as a number of days between the dates of the article final acceptance t_a and the article receiving $t_r : t_w = t_a - t_r$.

All stages of the editorial processing of submitted manuscripts are considered together as the one process (Fig. 1). Though more than one actor takes part in it, we consider that every part of this study is controlled by an Editorial Board. Therefore, we can treat this process as one of the main characteristics of the Editorial Board activity.

During the real data analysis we met the problem of acceptance time t_a determining whereas the dates of article receiving t_r are usually fixed very accurately. Different dates reflecting stages of articles processing are available for different scientific journals: date of revision, date of final acceptance, date of availability on-line, etc. It is necessary to specify the meaning of t_a for every particular journal. Besides, it is also interesting to consider various sets of t_w choosing different meanings of t_a for the same journal and to compare the obtained results. In our analysis, the t_a was defined as the date of revised version if the final acceptance date was omitted and as the final acceptance date (if present). So, t_w were calculated as the time differences between the date of submission and the most distant of two possible dates: revision date or final acceptance date.

Our goal was to determine the functional form of probability distributions $P(t_w)$ based on the statistical data analysis performed for a few scientific journals. Another task was to find if possible a typical form of $P(t_w)$ for normally working Editorial Board.

Several journals with different Editorial Boards were chosen in our study: three of them belong to the international Elsevier Publishing House (“Physica A: Statistical Mechanics and its Applications”, “Physica B: Condensed Matter” and “Information Systems”) (Mryglod and Holovatch 2007). One more journal is rather new “Condensed Matter Physics” (published by the Institute for Condensed Matter Physics: http://www.icmp.lviv.ua). The publicly available data from the official web-sites were used for analysis. Also we tried to get the corresponding statistics of “Scientometrics”, although the data set is too small because the required dates for articles are available online only for several last years.

Some formal parameters of databases used in this part of our study are shown in Table 1. As we can see from the table, the typical number of records for each journal is of order of 10^3 which allows to make some quantitative conclusions. These general conclusions hold even for a more poor statistics (c.f. results for “Condensed Matter Physics” in Fig. 5). Zeros in the table mean that for some articles their submission date coincides with

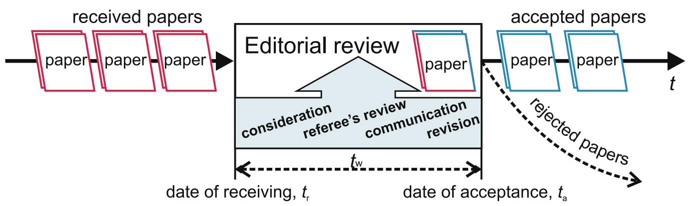

Fig. 1 Schematic picture of editorial processing of manuscripts in scholarly journals

Table 1 Characteristics of the data sets analysed: general number of records, maximal (t_w^{max}), minimal (t_w^{min}), typical (t_w^{typ}), mean (t_w^{mean}), and median (t_w^{med}) waiting times for the journals under consideration

	Physica A (1975–2010)	Physica B (1988–2010)	Information systems (1975–2010)
Number of records	4,576	4,944	814
t_w^{max}, days	1,629[a]	1,087[b]	2,260[c]
$t_w^{\min}$, days	0	0	0
t_w^{typ}, days	60	80	245
t_w^{mean}, days	124	122.2	331.7
t_w^{med}, days	95	90	275

[a] I.A. McLure, A.-M. Williamson, Physica A, 1996, **234**, Iss. 1–2, 206–224; ibid. 225–238

[b] V.G. Bar'yakhtar, V.A. Popov, Physica B, 1999, **269**, Iss. 2, 123–138

[c] M. Binbasioglu, D. Karagiannis, Information Systems, 2000, **25**, Iss. 6–7, 453–463

the final acceptance date. But what is even more interesting, in every journal one can find articles with very long waiting periods (for example, 2,260 days it is more that 6 years!). Of course, we can only speculate about the possible reasons for that. For example, it could be long discussion about the manuscript or banal misprint.

At the first stage the probability histograms of waiting times $P(t_w)$ for selected journals were constructed (Mryglod and Holovatch 2007). All experimental values were distributed among discrete intervals (bins) of length equal to 5 days.

Our purpose was to verify the functional form of $P(t_w)$ and to refer it to the power-law-like class (non-Poisson processes) or, for example, to the exponential-like class (Poisson processes). The exponential distributions of random variables t_{int} and t_w are evidences of the random selection of tasks to execute (Zhou et al. 2007, Barabási et al. 2005). In Fig. 2 we see the $P(t_w)$ distribution for journal "Physica A". It has a form of a unimodal non-symmetrical distribution with a smooth decay. Since the distribution is skew, the mean value t_w^{mean} does not coincide with the typical value t_w^{typ}, at which maximum in $P(t_w)$ occurs. Both the mean, typical and median values of t_w are given in the Table 1. The log-log and log-linear plots of Fig. 2 demonstrate good possibilities for linear approximations of $P(t_w)$ in both scales and this situation is analogous for other journals analysed (Mryglod and Holovatch 2007).

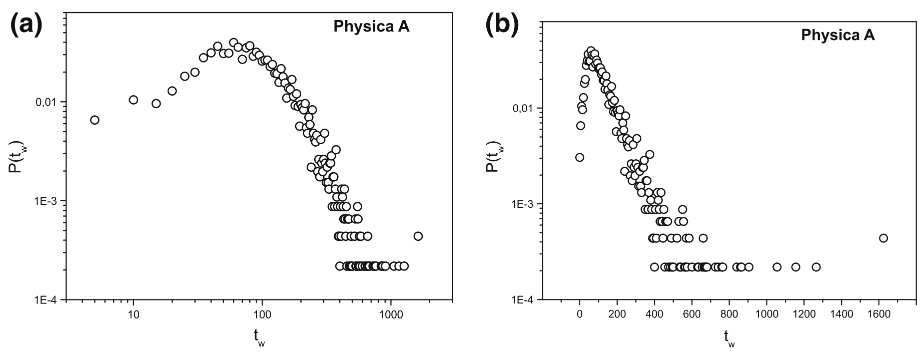

Fig. 2 **a** Log-log plot and **b** linear-log plot of the $P(t_w)$ distribution for journal "Physica A"

Further, we have verified two main hypotheses about the form of probability distributions which are used to describe human activity processes: (i) log-normal distribution (Stouffer et al. 2006):

$$P(t_w) = P_0 + \frac{A}{\sqrt{2\pi}\omega t_w} e^{-\frac{\left[\ln\left(\frac{t_w}{t_c}\right)\right]^2}{2\omega^2}}, \qquad t_c,\, \omega > 0, \tag{3}$$

where $\ln(t_c)$ and ω are the mean and standard deviations of the $\ln(t_w)$, P_0, A are fitting constants; and (ii) power-law distribution with exponential cutoff (Vázquez et al. 2006) for exponent values $\alpha = \{1;\, 3/2\}$:

$$P(t_w) = A t_w^{-\alpha} e^{-\frac{t_w}{t_0}}, \qquad t_0 > 0, \tag{4}$$

where t_0 is characteristic of waiting time which depends on traffic intensity, A is a constant. Using fitting procedure we found optimal parameters for both distributions (3) and (4). The results of fits obtained for journal "Physica A" are shown in Fig. 3 by smooth curves.

To compare the accuracy of approximations by different functions (log-normal (3) and power-law with exponential cutoff (4)) we exploited the criterium based on the value of the adjusted coefficient of determination $\bar{R}^2$ (Draper and Smith 1998). This coefficient is used to verify the closeness of experimental data to the non-linear theoretical curve and is a modification of statistical coefficient of determination R^2 which is the square of the sample correlation coefficient between the outcomes and their predicted values. A value of $\bar{R}^2$ close to 1 indicates that the fit is a good one. For example, for the journal "Physica A" we have found that both log-normal (3) ($\bar{R}^2 \approx 0.97$) and power-law function with exponential cutoff (4) and exponent $\alpha = 1$ ($\bar{R}^2 \approx 0,95$) can be the probable functions of distributions $P(t_\mathrm{w})$ The value of $\bar{R}^2$ for power-law approximation function with exponential cutoff (4) and exponent $\alpha = 3/2$ is slightly smaller ($\approx$ 0.92) for this journal.

In fact, both log-normal and power-law functions predict the same leading behavior t^{-1}, differing only in the functional form of the exponential correction (Barabási et al. 2005). The advantage of hypothesis about log-normal functional form of $P(t_\mathrm{w})$ consist in the possibility to describe all the data span, not only the tail. The results of analogous approximations obtained for "Physica B" and "Information Systems" journals are presented in Fig. 4. For all journals analysed the conclusions are common: the both hypothesis about possible data approximations by log-normal (3) and by power-law with exponential

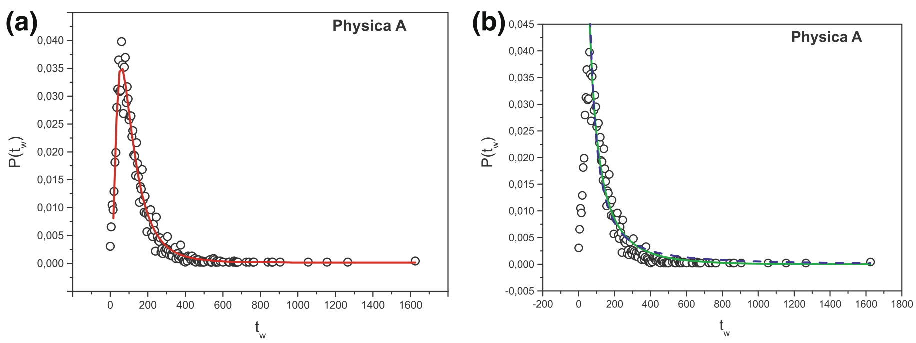

Fig. 3 The $P(t_\mathrm{w})$ distribution for journal "Physica A" with different approximation curves: **a** log-normal (3) (*solid line, red online*), **b** power-law with exponential cutoff (4) with $\alpha = 1$ (*light solid line, green online*) and $\alpha = 3/2$ (*dashed line*)

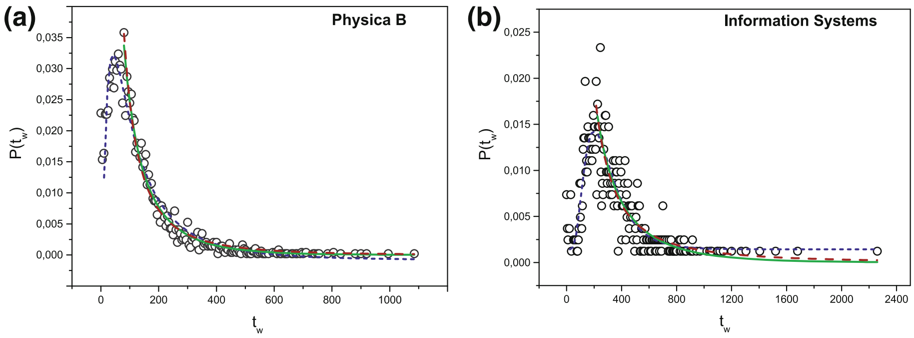

Fig. 4 The $P(t_w)$ distribution for **a** "Physica B" and **b** "Information Systems" journals. The *dotted dark* (*blue online*) *lines* are the approximations by log-normal (3), the *light solid* (*green online*) and *dark dashed* (*red online*) *lines*—by power-law with exponential cutoff (4) with $\alpha = 1$ and $\alpha = 3/2$, respectively

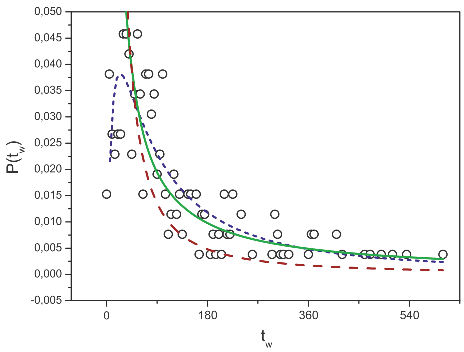

Fig. 5 The $P(t_w)$ distribution for "Condensed Matter Physics" journal. The *dotted dark lines* (*blue online*) are the approximations by log-normal (3), the *light solid* (*green online*) and *dark dashed* (*red online*) lines—by power-law with exponential cutoff (4) with $\alpha = 1$ and $\alpha = 3/2$, respectively

cutoff (4) and $\alpha = 1$ are almost equally good. Moreover, these conclusions are also right for the "Condensed Matter Physics" journal in spite of much smaller database with only 262 records (see Fig. 5). The observed data fluctuations can be explained by relatively small statistics but such situation is usual for the majority of scientific journals.

We could resume that it is hard to discriminate between the power-law or exponential nature of the tail of the $P(t_w)$ distributions. But as is easy to see from obtained results the functional form of these distributions is the same: one explicit maximum and the long tail with several large values of t_w. The tail of the distributions built for several journals could be well approximated by functions with an exponential cut-off and leading power-law behavior t^{-1}. Thus, we could consider the obtained form of probability distributions $P(t_w)$ as the typical one that can be used for scientometrical analysis of given journals.

Editorial process modeling

We came to conclusion about the typical form of waiting time distributions $P(t_w)$ for scientific journals with normally working Editorial Boards based on the results described above. The origin of such functional form of $P(t_w)$ distributions is unknown. We can suppose that the contribution of human dynamics could be the reason of observed affinity of $P(t_w)$ to power-laws. The peer-reviewing stage (including the work of authors and the communication process) is the human activity probably most similar to "natural" in comparison with the rest stages of editorial process. The other phases consist of different periodical tasks (Editorial Board meetings, uploads to web-site, etc.) or work with manuscripts in order of receiving (i.e., language and technical editing).

To verify the hypothesis about the key role of peer-reviewing in the waiting times distributions $P(t_w)$ shaping we built the simple simulation model of editorial work in scientific journal omitting the peer-reviewing (Mryglod and Mryglod 2008). Below we show the (expected) crucial difference of the waiting time distributions in such a model from the real data set analysed in the previous section. In the frame of this model, we consider the input flow of the submitted articles. Decision about manuscript acceptance is taken during regular meetings of the Editorial Board. All articles submitted before the meeting are considered (i.e. accepted or rejected) during this meeting (see Fig. 6). Generally, the Editorial Board meetings are held periodically and at least once before publishing of each issue. Let us define the typical journal period T as a time interval (in days) between two consecutive journal issues. For example, since 1988 the journal "Physica A" has 24 issues per year and in this case $T = 15$ days. For "Condensed Matter Physics" journal (Fig. 5) $T = 90$ days since 1997 year. So, in our model the period between two consecutive meetings equals to some typical journal period T. Now the values of waiting time t_w for each published article could be calculated as the number of days between the moment of its receiving and the closest Editorial Board meeting.

In the absence of peer-review all the received manuscripts are supposed to be considered by the Editorial Board. In this case the presence of some constrains is important (for example, the limited size of the issue). For simplicity all the articles in our model have an equal number of pages, so the maximal size of a single issue could be limited by number of articles[1]. The value of parameter called the traffic intensity ρ (2) allows us to distinguish three regimes of work (Vázquez et al. 2006):

- the input flow of manuscripts is too slow—all the articles are accepted for publication but the issue is incomplete (subcritical regime, $\rho < 1$);
- the number of received manuscripts is equal to the size of issue—all the articles are accepted for publication and the issue is complete (critical regime, $\rho = 1$);
- the number of received manuscripts is larger than maximum number of papers in one issue—a part of articles is accepted and the other are waiting in the queue for the next issue (supercritical regime, $\rho > 1$).

Obviously, the first regime of editorial work is not effective due to the incompleteness of issues. The third regime is also not realistic due to the endless queue of articles and therefore increasingly large values of waiting time. The second regime could be considered as a perfect one since the issues are complete and the article publishing without delays. But this regime is not stable and it could not be reached in practice because it is impossible to control the number of input manuscripts from different authors. It is more probable to provide the critical regime with $\lambda \approx \mu$, when the queue of articles periodically appears but it does not grow infinitely. So, the existence of limited queue is necessary to provide the completeness of issues being some kind of reserve.

We start modeling with the simplest case when the number of input manuscripts is determined and equals to the size of issue (determined input flow). Besides, we set also the minimal possible size of printed issues. All the issues which are smaller than 80% from standard issue size are considered as incomplete. As manuscript submission times are

[1] We specify the issue size equals 10 articles in our models.

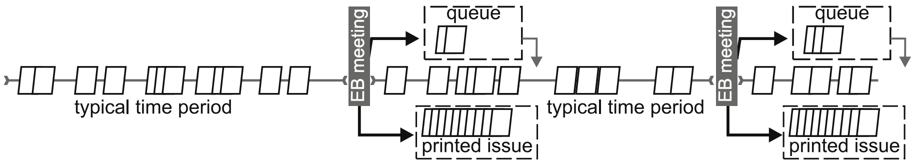

Fig. 6 The schematic representation of modeled editorial work in scientific journals

uniformly distributed and all of them are accepted for publication, the resulting $P(t_w)$ distribution is uniform too.

In practice the number of received manuscripts could not be always equal to the number of published articles. Traditionally, the input flow of tasks from an independent sources is modeled as the Poisson flow:

$$P_k(t) = \frac{(\lambda t)^k}{k!}\exp(-\lambda t), \qquad k \geq 0, \qquad t \geq 0, \tag{5}$$

here, k is the number of input tasks during time interval t, λ is the input flow intensity or the number of tasks which were received during the time unit. Poisson flow is also characterized by the exponentially distributed time intervals between two consecutive tasks. So, the modeling of Poisson flow mostly means generation of series of exponentially distributed random variables (for example, see (Vázquez et al. 2006)). This approach is convenient for the cases when the execution law is also specified by the Poisson law. Then it is possible to study different work regimes of the system controlling the values of intensities of input and execution laws.

In the case of our model (omitting the peer-reviewing) we don't need to specify the execution law since all the articles could be accepted at one moment at the Editorial Board meeting. So, the execution rate μ could be expressed by the number of published articles while the number of received manuscripts could naturally define the arrival rate. Consequently, we need to simulate the input flow in a way allowing to control the input intensity by the number of received manuscripts.

We generate the random value distributed by Poisson law (5) with some value of λ (input intensity). In this case different number of manuscripts (which may be larger or smaller than λ) could be received during the typical journal period T. Further, having the number of received articles we distribute them randomly over the T. If the number of manuscripts exceeds issue size, than a part of them goes to the queue or could be rejected. There are two ways of manuscript choosing from the queue (and also from the input flow) in our model: "FIFO" (first-in-first-out) and "RANDOM". We can suppose that the second way could be the simplest method to reflect the situation with the numerous continuous priorities.

At first we modeled the case with non-determined input flow of articles and without any limitations of queue length. Modeling the input flow using (5) we can control its intensity changing the value of λ. The modeling results are shown in Figs. 7 and 8. Here one can see the change of $P(t_w)$ distribution form according to an increase of λ. If λ is small then queue doesn't exist and waiting times are distributed more or less uniformly or forming the following "steps". In this case the majority of published issues is incomplete (i.e., above 98% incomplete issues in the case of $\lambda = 3$ and $\mu = 10$). In these figures and further each point means the probability for the published article to have waiting time in the interval

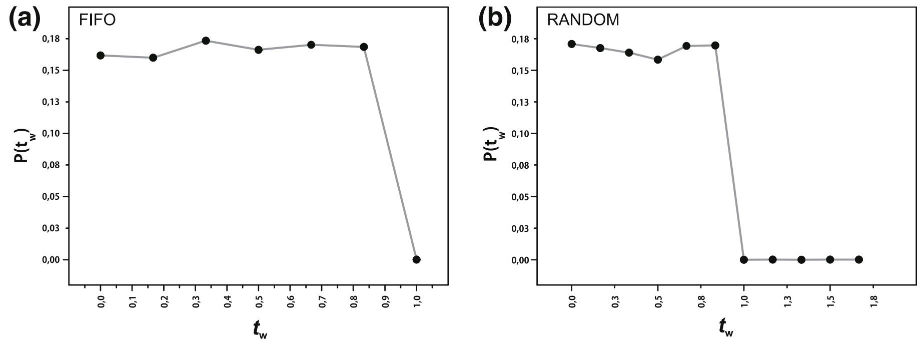

Fig. 7 The $P(t_\mathrm{w})$ distribution for the modeled periodical where input rate is comparably small: $\lambda = 3$, $\mu = 10$. Two scenarios of manuscript choosing from queue are used: **a** FIFO and **b** RANDOM

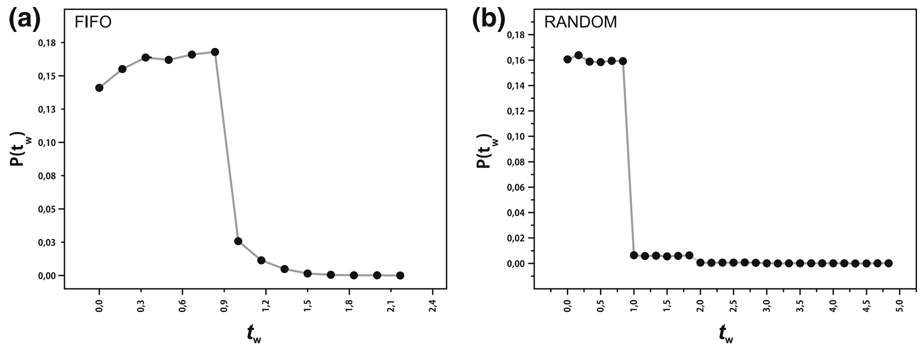

Fig. 8 The $P(t_\mathrm{w})$ distribution for the modeled periodical where input rate is approximately equal to the value of execution rate: $\lambda = 7$, $\mu = 10$. Two scenarios of manuscript choosing from queue are used: **a** FIFO and **b** RANDOM

$t_w \in [t_w^i..t_w^{i+1})$; the value of t_w is measured in number of typical journal periods T. The results were obtained from the time-series simulations each of length 900 T.

The queue appears when λ is of the order of magnitude of μ. In this (critical) regime the queue length fluctuates around some value: the "excess" manuscripts from previous periods can fill the deficiency of articles for next periods. The $P(t_\mathrm{w})$ distribution in this case has two distinct "steps" (Fig. 8) presenting two categories of articles: which are printed in the first following issue and which are reserved for next periods in the queue. In our model such critical regime was reached at $\lambda = 7$ and $\mu = 10$. Then the number of incomplete issues descends down to 56%.

To minimize part of incomplete issues it is enough to increase λ still more. Our modeling results at $\lambda = 10$ and $\mu = 10$ are presented in Fig. 9. This case corresponds to the unsteady state of the system. Despite the fact that number of incomplete issues is close to zero, such work regime is not efficient due to increasing queue length (one can see the queue length growing on the corresponding insets in Fig. 9).

We can conclude that it is impossible to reach the optimal work regime for Editorial Board in scientific journal without any artificial constrains. So, the next steps in description of this process may involve additional constrains into the model. We limit the queue length

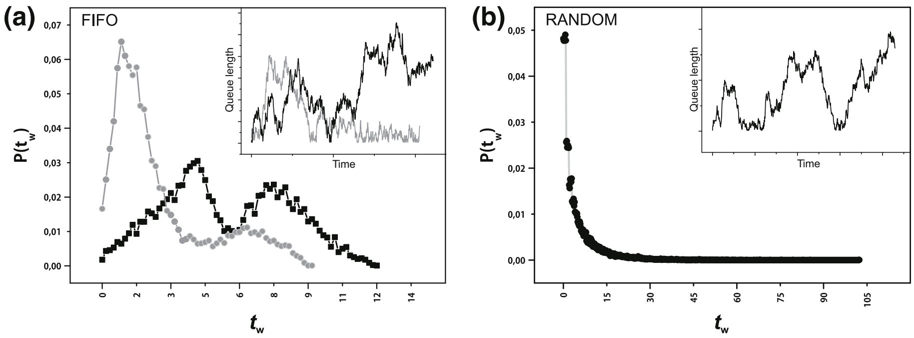

Fig. 9 The $P(t_w)$ distribution for the modeled periodical with $\lambda = 10$ and $\mu = 10$. Two scenarios of manuscript choosing from queue are used: **a** FIFO (two cases) and **b** RANDOM. The queue length growing is shown on the corresponding *insets*

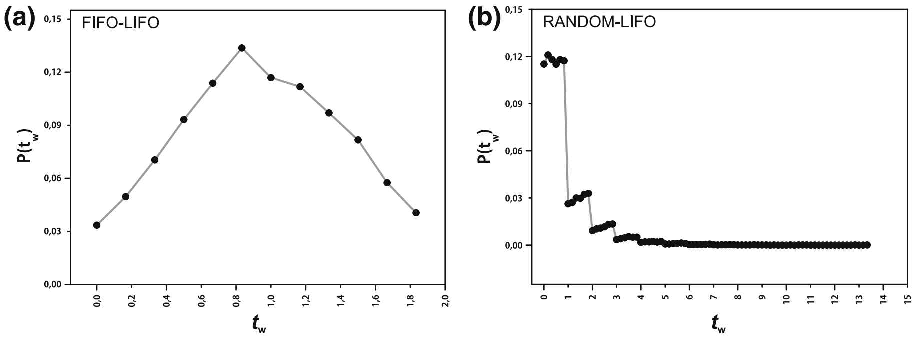

Fig. 10 The $P(t_w)$ distribution for the modeled periodical with $\lambda = 10$ and $\mu = 10$ using **a** FIFO and **b** RANDOM manuscripts selection rules. LIFO scenario of excess papers rejection is used

to the issue size specified before. In our case normal issue volume equals 10, so the queue length is limited to 10 also. Thus, such work regime could be called "the issue in reserve". According to our rules the excess articles should be rejected using one of the scenarios: "LIFO" (last-in-first-out) and "RANDOM".

As we can see from Fig. 10, the obtained functional form of $P(t_w)$ distribution considerably differs from the experimental one. When the "FIFO" scenario is applied to select the manuscript from a queue the waiting time distribution is symmetric with one distinct maximum (Fig. 10 a). In the case of "RANDOM" selection rule the waiting time distribution has decreasing form but also several "steps" corresponding to each time period could be observed (Fig. 10 b). The shape of distributions obtained for "RANDOM" scenario of rejection is the same as for the case of "LIFO" scenario (Fig. 10). Besides, the rate of decreasing observed is larger (with value of exponent close to 3) and more close to the exponential function.

To summarize this section several aspects should be mentioned. First of all, it is important to note, that it is impossible to any real scientific journal to publish all the manuscripts received. So, every Editorial Board should choose the way or rule to eliminate the part of them: examining the adherence to some obligatory technical requirements, applying peer-review mechanism, or following other own internal criteria. The second important remark is that one can suppose that for different scenario it is possible to notice different picture of waiting time distribution for the published manuscripts. In this section we made the attempt to simulate most simple case of manuscripts arrangement in scientific journal, i.e. without any external peer review but using just simple rules. The obtained functional form of papers waiting time distributions for this scenario differs from the analogous results obtained for the real journals with peer-review mechanism. Of course, it is also interesting to simulate the work with peer-reviewing but the way of natural human activity simulation is the subject of the discussions yet (Zhou et al. 2007).

Conclusions

We have found that both log-normal and power-law function with exponential cutoff and exponent $\alpha = 1$ can be the probable functions of waiting time distributions $P(t_{\mathrm{w}})$ for manuscripts in scientific journals. In fact, both log-normal and power-law functions predict exactly the same leading power behavior t^{-1}, differing only in the functional form of the exponential correction (Barabási et al. 2005). In this sense, process considered here is governed by similar probability distributions as other examples of human activities (Barabási 2005, Oliveira and Barabási 2005, Zhou et al. 2007, Johansen 2004, Vázquez et al. 2006, Stouffer et al. 2006). The observed data fluctuations can be explained by relatively small statistics but such situation is usual for the majority of real-world data bases. Thus, we consider the obtained form of probability distributions $P(t_w)$ as the typical one that can be used for scientometrical analysis of editions. The length of waiting times is an important characteristic of Editorial Board's activity. The publication delay effects journal rankings according to the impact factor (Yu et al. 2006) as well as personal citation rating of authors.

The simple model of Editorial Board work was created to verify the hypothesis about the important role of peer-reviewing in the waiting times distributions shaping. In general, the obtained results can be considered as the support of our previous conclusions.

In conclusion it is worth to mention some peculiarities of scientific editorial process that were not taken into consideration in our study. Here the main idea is connected with emphasizing of the meaning of natural human activity within the complex processes taking place in the Editorial Boards working. But these natural human activity patterns could be also affected by different situations or rules. For example, journal policy could be very different concerning the strictness of time deadlines for peer-reviewing or concerning the manuscripts with one "positive" and one "negative" referee reports. In addition to peer review we can mention other processes as the examples of natural human activity: technical work with raw manuscripts, communication between the editors and other participants of the editorial processes, etc. Moreover, one can distinguish several human activity sub-processes within peer reviewing such as pure referee work with manuscript, communication processes between referee, editorial office and authors, and, eventually, the manuscript revision by authors according to the referee remarks. It is very complex problem to account all these aspects in one model. So, it could be the worth challenge for the future analysis.

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