

Conference Article

The Social Dynamics of the Peter Principle

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Abstract

In this paper the author presents a critique of the recent computational studies looking at efficient promotion strategies in hierarchical organisations [1, 2], and presents his own study, more applicable for socio-economic systems. While previous research based on the Peter Principle [3] is an interesting and fresh (though grounds have been laid by [4]) view on the problem of organisational efficiency, they do lack psychological and sociological basis so important in social sciences [5, 6]. Therefore the advice saying that it may be beneficial to promote worst employees or employees at random is not based on sound methodological grounds of social sciences [7]. In this paper two mechanisms are introduced to the model proposed by [1], which bring the computational study closer to real life organisations, rendering the analysis more enlightening for them and their strategies. The first introduces social dynamics allowing agents to conform to the perceived expectations of the organisation, and the latter frees the model from univariate analysis of the competence of an agent together with the crude mechanisms for its propagation between positions, exchanging it for multivariate analysis with mechanism based on the classic research by Henri Fayol [8]. The results of these simulations allow the author to conclude that despite the fact that Peter was right in principle; in real organisations the best way to promote employees is to choose the best employees, which is in agreement with the reality of most organisations [9]. The paper underlines the need to use the methodology of social science in econophysics.

Keywords: Peter Principle, Organisations Efficiency, Agent Based Models

1. Introduction

The efficiency of an organisation is a key concept in social sciences [10], particularly economics [11] [12] and more recently also game theory [13, 14]. In 2010 Italian team has published a paper [1] in which they simulated a hierarchical organisation with a mechanism named after Laurence J. Peter, who proposed a seemingly paradoxical principle: *'Every new member in a hierarchical organization climbs the hierarchy until he/she reaches his/her level of maximum incompetence'* [3], therefore making it the first computational study of this Principle, using econophysics as the framework since it has become largely accepted that models and simulations inspired by statistical physics are able to take into account collective behaviour of large groups of individuals, process started with papers such as [15]. This principle (similar ideas appeared before [3] as *theory of incompetence* in Russian literature) is not as unreasonable as it may seem at first glance and so the computational study was interesting and received some attention. The results were unexpectedly calling for promoting employees at random, and in the strong case for promoting the worst

performing employees, which must be puzzling for any experienced manager [9]. It appears to the author that the above-mentioned research has not taken into account the important social side of hierarchical organisations, thereby leaving their conclusions not even remotely applicable to the real world organisations, even if the researchers claim otherwise [2].

2. The Peter Principle and Organisational Efficiency

Even though the quoted researchers have refined their model since their first paper, notably employing a more realistic tree structure [2], these changes have not altered the results of the study significantly and therefore this study is based on their original model, to comply with Occam's razor [16]. In fact none of the basic structure has been changed for the first part of the present investigation, so as to provide a comparable environment. The simulation is then performed by means of an agent based simulation [17, 18]. Here the author will recall the model proposed in [1] and introduce the specific differences. The model takes a pyramidal organisation, made up of 160 positions distributed over six levels, with 81 members on lowest level and then respectively 41, 21, 11, 5 and 1. The original research showed that the numerical results for such an organisation

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are robust and show little dependence on the number of levels or agents per level.

Each agent is characterized only by an *age* and by a *degree of competence*. The degree of competence, which is designed to include all the features characterizing the average performance of an agent in a given position at a given level, is a real variable with values ranging from 1 to 10. This is changed in the second part of this study. The age is an integer variable included in the range 18-60 however, which increases by one year per each step in the simulation. Both the competence and the age of each agent are selected randomly inside two normal distributions with, respectively, means of 7 and 25 and standard deviations of 2 and 5.

At each simulation step all the agents with a competence under a fixed dismissal-threshold (set to 4) or with an age over a fixed retirement-threshold (set to 60) leave the organisation and their positions become empty. Any empty position at a given level is filled by promoting one member from the level immediately below. Empty positions at the bottom level are filled with the recruitment of new members with the same normal distributions of competences and age as described above.

Two possible mechanisms of transmission of competence of an agent from one level to the next are considered: the *common sense hypothesis*, where a member inherits his old competence in his new position with a small random variation δ (where δ can assume random values $\sim N(0,0.1)$), and the *Peter hypothesis*, where the new competence of every agent is independent of the old one and is assigned randomly. For each one of these two cases two promotion strategies are considered: the most competent agent is chosen, as suggested by common sense, or the least competent agent is chosen, in the Peter Principle. The strategy where an agent at random is promoted has been ignored as it is irrelevant to the hypothesis of this study, which argues with the advice not to promote best employees.

In order to evaluate the global performance of the organisation, *global efficiency* parameter is introduced, which is calculated by summing the competences of the members level by level, multiplied by a level-dependent factor of responsibility (r_i , with $i=1,2,\dots,6$) ranging from 0 to 1 (showing that levels had differing importance, respectively: 1, 0.9, 0.8, 0.6, 0.4, and 0.2). Finally, the result is normalized to its maximum possible value ($Max(E)$) and to the total number of agents (N), so that the global efficiency (E) can be expressed as a percentage. Therefore, if C_i is the total competence of level i , the resulting expression for the efficiency is

$$E(\%) = \frac{\sum_{i=1}^6 C_i r_i}{Max(E) \cdot N} \cdot 100, \quad (1)$$

where $Max(E) = \sum_{i=1}^6 10 * n_i r_i / N$ (n_i being the number of agents of level i).

The researchers [1] did not account for the sociology or economics of these processes and only the mechanics in the crudest sense. Therefore in this paper a simple social mechanism is added in order to show whether the recommendation to promote the worst employees holds given a more realistic ground. The cited research does not take into account that when consistently promoting the worst employees may not only produce massive amounts of frustration (ergo reduced productivity), but also people who wishing to enhance their careers would try to become the worst employee to gain a promotion and its perks [19]. In other words the cited research assumes that the system is

chaotic, while economic systems are not chaotic systems but complex adaptive systems, therefore a different methodology is necessary in order to study them. Firstly a simple conformism mechanism is added, which after 150 promotions changes the degree of competence of every employee at every step, bringing it closer to the average degree of competence of the last 100 promoted employees by a normally distributed variable with mean equal to μ times the difference between the employee's degree of competence and the average described above, where μ is the conformism coefficient. The higher it is the more people are willing to change to become similar to the people who have been promoted in the past. Presumably μ close to 1 is unrealistic, but μ equal to 0 or lack of the mechanism also seem unrealistic or not well-founded within the current understanding of sociology and economics. The standard deviation of this random variable has been set to 0.1. The choice of 100 and 150 and 0.1 is largely irrelevant to the results. This should change the results, showing that the common sense is perhaps not failing us and it is advantageous to promote the best workers. The random strategy should also no longer seem as seductive as before.

Secondly the author changes the assumptions of the model proposed by [1]. They do assume two extreme, unrealistic, hypotheses: one stating that the degrees of competence between levels are almost fully correlated (the standard hypothesis) and one where these are completely unrelated (modelled by ii Normal distributions - the Peter hypothesis). The author believes that it may be interesting to introduce a more realistic assumption. In order to do this the skills described by [8] are used and his assessment of what the skills are needed for every of the 6 levels of a big manufacturing organisation a hundred years ago. This is an aged assessment, however for the purpose of the study which is not to be used in a concrete problem this is sufficient, and will show how the model behaves not in a priori hypothesis but with assumptions based on real organisations. Therefore the model is changed so that instead of one degree of competence each agent has an array of six specific degrees of competence (technical, commercial, financial, security, accounting, and administrative skills), which have the same characteristics as the original one, and their distributions are independent. The discussion of independence of their distributions is ignored as in the original study. Then a person is promoted if he's the best or worst (according to strategy) based on an assessment weighed by the importance from Fayol's table [8]. The author calls it *Peter-Fayol hypothesis*.

Using the same notation global efficiency in this case can be calculated as (if $C_{i,j}$ is the total competence of level i for skill j):

$$E(\%) = \frac{\sum_{i=1}^6 \sum_{j=1}^6 C_{i,j} r_i s_j}{Max(E) \cdot N} \cdot 100, \quad (2)$$

where $Max(E)$ stays the same as previously.

3. Simulation Results: Part One

The below results have been obtained with a simulation realized with C++, as opposed to [1], which used NetLogo. The evolution is calculated for 1000 time steps, a duration long enough to reach a stationary (on average) asymptotic value, and is further averaged over 50 different realizations.

Initial conditions are not the same for every realization, as opposed to the original study (the effects of this are negligible). At $t=0$ all the curves start from a point which differs from the average of 70%, as the initial random distribution of competences produces numerous empty positions which are immediately filled in the first few steps, producing a sudden small initial change in the global average efficiency, similar as in [1].

Observing the simulation results for the common sense hypothesis where workers retain their degree of competence after a promotion (with small variability) does not bring any surprise. With strategies where the best workers are being promoted the efficiency is higher than average after a short time, and is becoming higher with higher conformism coefficient, as seen in Fig. 1. For the strategy where the worst employee is being promoted the global efficiency always drops, and does so the more the higher the conformism coefficient is, as seen in Fig. 2. There is a small exception for full conformism (1) where the herd instinct drives employees over the edge of dismissal threshold, and high rotation slightly rises average efficiency.

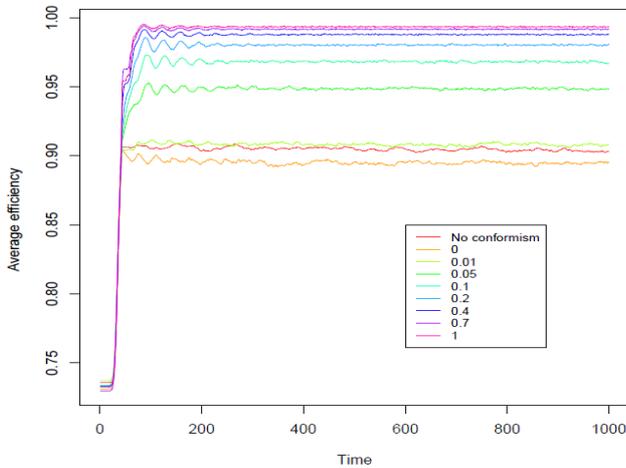


Fig. 1 E(%) under common sense hypothesis with standard promotion strategy

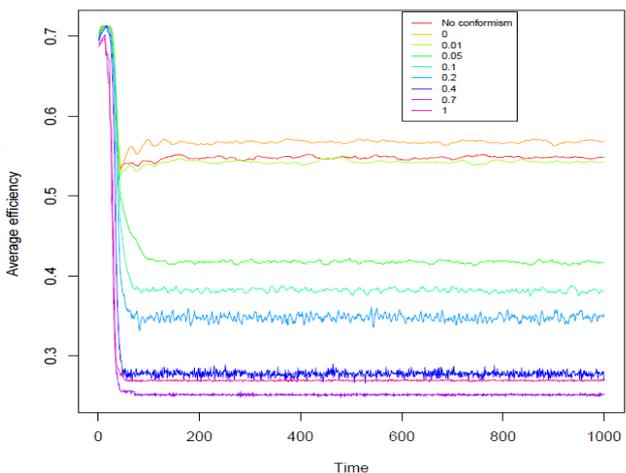


Fig. 2 E(%) under common sense hypothesis with reverse promotion strategy

The results are more interesting for the *Peter hypothesis*. There with the strategy promoting best employees the global efficiency drops where there is no conformism (no mechanism) or effectively no conformism (0 coefficient), but even for a very small conformism with the coefficient

equal to 1% the global efficiency is already higher than the starting point. The global efficiency quickly rises with the rising conformism coefficient, as seen in Fig. 3. Similarly when the worst employees are being promoted with no conformism or effectively no conformism the global efficiency is higher than the starting point, but any conformism leads it under this point, and quickly further away with rising conformism coefficient, as seen in Fig. 4.

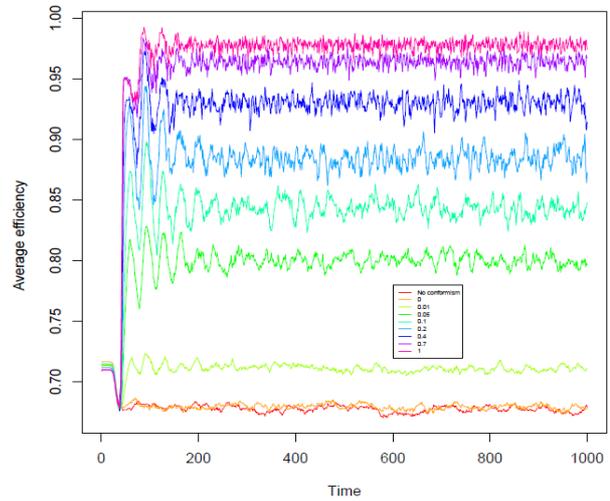


Fig. 3 E(%) under Peter hypothesis with standard promotion strategy

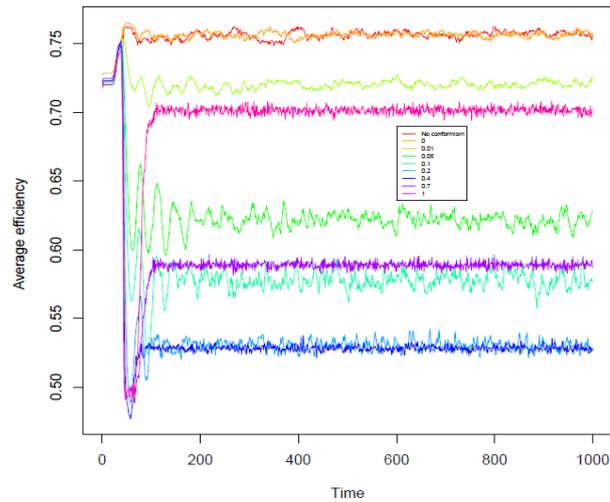


Fig. 4 E(%) under Peter hypothesis with reverse promotion strategy

Therefore the advice to use the strategy of promoting the worst employees [1] cannot be taken seriously, as employees are surely going to present at least a small degree of conformism in trying to become promotable. We know at least a few socio-economic mechanisms through which conformism may arise in this situation [19], and we only need a very small degree of this phenomenon in order for an opposite advice to be sensible.

4. Simulation Results: Part Two

In this part the results of simulation of the Peter-Fayol hypothesis are presented, whereby the skills are not univariate. When the best workers are promoted the global efficiency is significantly higher than at the starting point. Additionally it becomes even higher when the effects of

conformism kick in, as seen in Fig. 5. Similarly when the worst employees are being selected for a promotion the global efficiency becomes lower than at the starting point, and even more so with the rising influence of the conformism mechanism, as seen in Fig. 6. This is not a mechanism applicable for all organisations, or any in particular one, but is based on values from real industry and has more relevance to the real world than the crude simulation performed by the Italian researchers. The change introduced in the second part of this study, similarly to the first part, voids the advice of [2] not to promote best employees.

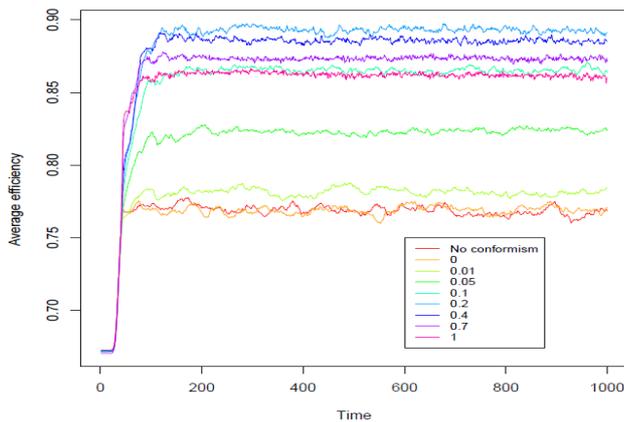


Fig. 5 E(%) under Peter-Fayol hypothesis with standard promotion strategy

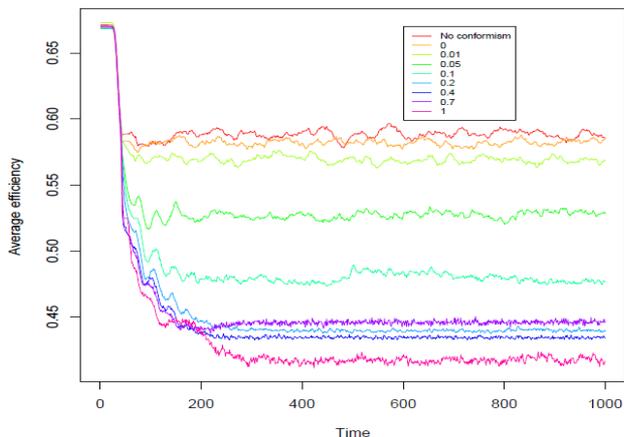


Fig. 6 E(%) under Peter-Fayol hypothesis with reverse promotion strategy

5. Conclusions

The study shows that the research presented in [1] and later refined in [2] despite having solid numerical grounds is lacking solid grounds in sociology and economics [7]. The assumptions of univariate degree of competence and its propagation across positions in an organisation either with complete preservation or full randomness seems to the author to be unnecessarily simplistic, therefore the 6-dimensional degree of competence is proposed together with a mechanism of propagation proposed first by [8], who took it from observations of real world organisations. Also the assumption of no social or psychological feedback from workers to the two extreme promotion strategies. In social sciences this approach is unacceptable, and treating the results as a guidance for real organisations, and not just a numeric check on the Peter hypothesis in principle is groundless. In other words treating economic systems as chaotic systems is not sound, and will lead in best case scenario to uncertain results and generally will lead to bad results, which has been presented in this paper. The author introduces a simple way of workers providing such backup, and shows that the conclusions presented in [1] are most likely incorrect, as it only takes a small, easy to defend, degree of conformism to invalidate those conclusions. Therefore it is concluded that managers can still promote the best employees without worrying about the efficiency, unless they are able to mitigate the social effects of promotion strategies. More importantly the study shows that research in econophysics should not be done independently of the methodology of social sciences, as is often the case due to the domination of physicists in the field. As shown, the results of such treatment may be severe.

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