Physica A 390 (2011) 3496–3511

Contents lists available at ScienceDirect

Physica A

journal homepage: www.elsevier.com/locate/physa

Efficient promotion strategies in hierarchical organizations

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ARTICLE INFO

Article history:
Received 14 February 2011
Received in revised form 6 May 2011
Available online 1 June 2011

Keywords:
Peter principle
Organization efficiency
Promotion strategies
Game theory
Agent-based models

ABSTRACT

The Peter principle has recently been investigated by means of an agent-based simulation, and its validity has been numerically corroborated. It has been confirmed that, within certain conditions, it can really influence in a negative way the efficiency of a pyramidal organization adopting meritocratic promotions. It was also found that, in order to bypass these effects, alternative promotion strategies should be adopted, as for example a random selection choice. In this paper, within the same line of research, we study promotion strategies in a more realistic hierarchical and modular organization, and we show the robustness of our previous results, extending their validity to a more general context. We also discuss why the adoption of these strategies could be useful for real organizations.
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1. Introduction

Promotion strategies are fundamental for a hierarchical organization, this being a scientific group, a company, a public administration, a cluster of computers, or a group of animals. They are important for one to understand the dynamics of a pyramidal system and eventually provide ways to improve its efficiency. It is not strange that physicists are also working in this direction. In fact, in recent years, physicists have started to collaborate with economists and social scientists in order to get a more quantitative understanding of social science mechanisms [1–6]. Actually, it is by now largely accepted that, even in social sciences, simple schematic models and computer simulations inspired by statistical physics are able to take into account unexpected collective behaviors of large groups of individuals, discovering emergent features that are independent of their individual psychological attributes, which are very often counterintuitive and difficult to predict simply by following common sense. Along these lines, by means of an agent-based simulation approach [7–11], we study here the effects of the Peter principle [12] within a very general context in which different promotion strategies are investigated in order to maximize the global efficiency in a given hierarchical system. In a previously published paper [13], we have already studied this phenomenon within a pyramidal organization, showing its validity under certain conditions, and we have tested several strategies in order to bypass its negative effects. In this paper, we investigate in deeper detail a more complex modular organization, also endowed of new realistic features, in order to test these different promotion strategies under the Peter hypothesis and their influence in maximizing the global efficiency of the system, considering also the individual expectations of its members in terms of career progressions. In particular, we study the gain in efficiency due to both the organization topology (modular or pyramidal) and the introduction of a variable percentage of random promotions after a meritocratic transient. The paper is organized as follows. In Section 2, after a brief summary of our previous results, we present the details of the more realistic new model adopted in the present paper, and we compare the old pyramidal topology with the new modular one. In Section 3, we describe the new simulation results. Then a general discussion is addressed in Section 4, where the real applicability of these strategies is also presented, and finally some conclusions are drawn in Section 5.

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doi:10.1016/j.physa.2011.05.021

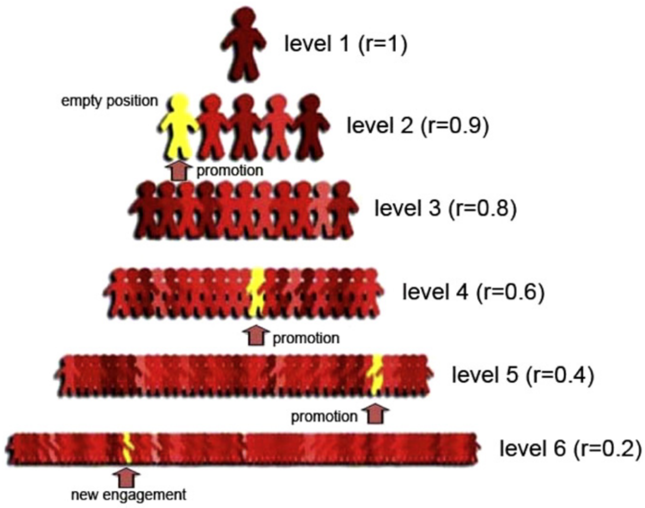

Fig. 1. Schematic view of the simple pyramidal model studied in our previous paper [13]. Beside each level, the corresponding value of responsibility (increasing linearly from the bottom to the top) is also reported. We show in yellow the empty positions for which promotions are required. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

2. The extended hierarchical organization model

We present in this section the details of the new hierarchical organization model adopted in this paper, in order to test in more realistic situations the effects of the Peter principle and the possible strategies to contrast it. However, before illustrating the new model, we summarize the results obtained in our previous paper [13].

2.1. Previous results about the pyramidal model

In our previous paper, we studied the schematic pyramidal model shown in Fig. 1. The main features of this model are summarized below.

(1) We considered a hierarchical pyramidal organization with 160 positions divided into six levels. Each level has a different number of members (which decreases, climbing the hierarchy) with a different responsibility, i.e., with a different weight on the global efficiency (see below) of the organization. The members of the organization have only two features: an age (ranging from 18 to 60 years) and a degree of competence (ranging from 1 to 10, and indicated by a color with intensity proportional to the competence). As initial conditions we selected ages and competences following normal distributions with, respectively, average 25 (with standard deviation 5) and average 7 (with standard deviation 2).

(2) At each time step, members with an age over the retirement threshold (fixed at 60 years) or with a competence lower than the dismissal threshold (fixed at 4) leave the organization (their color becomes yellow), and someone from the level immediately below (or from outside for level 6) will be chosen for promotion; see Fig. 1.

(3) Four different competing strategies of promotion have been proposed. The first strategy consists in promoting the best worker, the second in promoting the worst, the third considers the promotion of a random worker, and the fourth alternates the promotion of the best and the worst.

(4) For each promotion at the upper level, two different mechanisms of competence transmission have been considered. (1) Common Sense (CS): if the features required from one level to the upper are sufficiently stable, the new competence at the upper level is correlated with the previous one and the agent maintains his/her competence with a small error. (2) Peter hypothesis (PH): if the features required from one level to a higher one can change considerably, the new competence at the higher level is NOT correlated with the previous one, so the new competence is again randomly assigned from a normal distribution, as happens in a new engagement.

(5) A parameter, called the global efficiency, E, is calculated by summing the competences of the members level by level, multiplied by the level-dependent factor of responsibility, ranging from 0 to 1 and linearly increasing on climbing the hierarchy. 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 global efficiency is

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

with $Max(E) = \sum_{i=1}^{6}(10 \cdot n_i) \cdot r_i/N$, where n_i is the number of agents at level i.

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