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The Peter principle revisited: A computational study

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ABSTRACT

In the late sixties the Canadian psychologist Laurence J. Peter advanced an apparently paradoxical principle, named since then after him, which can be summarized as follows: *'Every new member in a hierarchical organization climbs the hierarchy until he/she reaches his/her level of maximum incompetence'*. Despite its apparent unreasonableness, such a principle would realistically act in any organization where the mechanism of promotion rewards the best members and where the competence at their new level in the hierarchical structure does not depend on the competence they had at the previous level, usually because the tasks of the levels are very different to each other. Here we show, by means of agent based simulations, that if the latter two features actually hold in a given model of an organization with a hierarchical structure, then not only is the Peter principle unavoidable, but also it yields in turn a significant reduction of the global efficiency of the organization. Within a game theory-like approach, we explore different promotion strategies and we find, counterintuitively, that in order to avoid such an effect the best ways for improving the efficiency of a given organization are either to promote each time an agent at random or to promote randomly the best and the worst members in terms of competence.

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1. Introduction: The Peter principle

The efficiency of an organization in terms of improving the ability to perform a job, minimizing the respective costs, is a key concept in several fields like economics [1] and game theory [2]. But it could also be very important in ecology to understand the behaviour of social insects [3], in computer science when you have to allocate different tasks to a cluster of computers having different performances [4] or in science policy concerning how individual tasks are distributed among the thousands of members of a big collaboration, like those working for example at a large collider. Common sense has always been widely used in any hierarchical organization to manage the system of promotions: it tells us that a member who is competent at a given level will be competent also at an higher level of the hierarchy, so it seems a good deal, as well as a meritorious action, to promote such a member to the next level in order to ensure the global efficiency of the system. The problem is that common sense, in many areas of our everyday life, often deceives us. In 1969 the Canadian psychologist Laurence J. Peter warned that the latter statement could be true also for the promotions management in a hierarchical organization [5].

Actually, the simple observation that a new position in the organization requires different work skills for effectively performing the new task (often completely different from the previous one) could suggest that the competence of a member at the new level could not be correlated to that at the old one. Peter speculated that we may consider this new degree of

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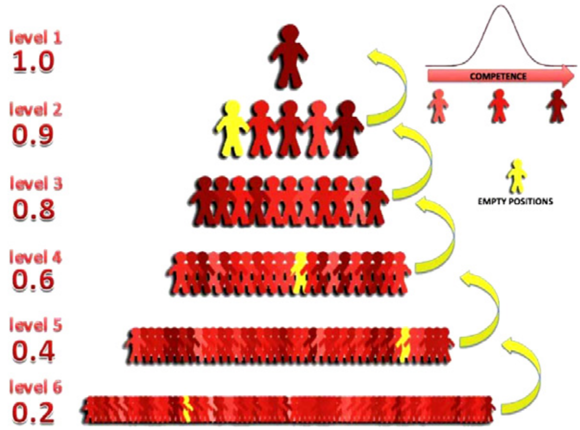

Fig. 1. Schematic view of a hierarchical pyramidal organization. We consider here an organization with 160 positions divided into six levels. Each level has a different number of members (which decreases, climbing the hierarchy) with a different responsibility, i.e. with a different weight on the global efficiency of the organization, reported on the left side. The member colour indicates the degree of competence, which at the beginning is normally distributed with average 0.7 and variance 0.2. Empty positions are in yellow (see the text). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

competence as a random variable, even taking into account any updating course the organization could require before the promotion: this is what we call the Peter hypothesis. If the Peter hypothesis holds, and if one promotes each time the most competent member at the level involved, it could turn out a paradoxical process for which competent members will climb up the hierarchical ladder indefinitely, until they reach a position where they will be no longer competent and therefore no longer promoted. This is the so called Peter principle, whose long term consequence seems to imply an unavoidable spreading of the incompetence over all of the organization and would be in danger of causing a collapse in its efficiency, as also confirmed already in 1970 by a mathematical analysis of Kane [6].

More recently several reflections on bureaucratic inefficiency have been carried out in the context of social science, politics and business management [7–12], some of which were directly inspired by the Peter principle and with the purpose of circumventing its adverse effects. However, as far as we know, we still lack a computational study that not only would reproduce the Peter principle dynamics, but also would allow, in particular, the exploration of alternative strategies in order to find the best way for improving the efficiency of a given organization [13].

In the last few years the help of hard sciences, like physics and mathematics, has been frequently advocated in order to get a more quantitative understanding of social sciences mechanisms [14–17]. It is now largely accepted that simple models and simulations inspired by statistical physics are able to take into account collective behaviour of large groups of individuals, discovering emergent features independent of their individual psychological attributes and very often counterintuitive and difficult to predict following common sense [18–20]. Along these lines, by means of an agent based simulation approach [21–23], here we study the Peter principle process within a general context where different promotions strategies compete with one another for maximizing the global efficiency of a given hierarchical system.

2. Dynamical rules of the model

In order to simplify the problem, we chose for our study a prototypical pyramidal organization (see Fig. 1), made up of a total of 160 positions distributed over six levels numbered from 6 (the bottom level) to 1 (the top one), with 81 members (agents) in level 6, 41 in level 5, 21 in level 4, 11 in level 3, 5 in level 2 and 1 in level 1. We verified that the numerical results that we found for such an organization are very robust and show only a little dependence on the number of levels or on the number of agents per level (as long as it decreases going from the bottom to the top). Each agent is characterized only by an *age* and by a *degree of competence*. The degree of competence, which includes all the features (efficiency, productivity, care, diligence, ability to acquire new skills) characterizing the average performance of an agent in a given position at a given level, etc., is a real variable with values ranging from 1 to 10 and is graphically represented with a colour scale with increasing intensity. The age, however, is an integer variable included in the range 18–60, which increases by one unit per time step.

The snapshot reported in Fig. 1 shows, as an example, a given realization of the initial conditions, where both the competence and the age of each agent have been selected randomly inside two appropriate normal distributions with, respectively, means 7.0 and 25 and standard deviations 2.0 and 5. At each time step all the agents with a competence under a fixed dismissal-threshold or with an age over a fixed retirement-threshold leave the organization and their positions become empty, while their colour becomes yellow (the dismissal-threshold is arbitrarily fixed to 4 and the retirement-threshold to an age of 60). Simultaneously, any empty position at a given level is filled by promoting one member from the level immediately below, going down progressively from the top of the hierarchy until the bottom level has been reached. Finally,

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