# The destructive effect of human stupidty: a revision of Cipolla's Fundamental Laws

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#### Abstract

In this work we analyze an evolutionary game that incorporates the ideas presented by Cipolla in his work *The fundamental laws of human stupidity*. The game considers four strategies, three of them are inherent to the player behavior and can evolve via an imitation dynamics, while the fourth one is associated to an eventual behavior that can be adopted by any player at any time with certain probability. This fourth strategy corresponds to what Cipolla calls a stupid person. The probability of behaving stupidly acts as a parameter that induces a phase transition in the steady the distribution of strategies among the population.

## 1. Introduction

In 1988 Cipolla wrote an essay entitled The fundamental laws of human stupidity [1]. The structure of this essay consisted in several chapters with some of them intended for the introduction and discussion of each of the five fundamental laws that according to Cipolla rule the human stupidity.

As the concept of stupidity can be ambiguous it is important to properly frame the meaning we embrace here. A stupid person is someone given to unintelligent decisions or acts but here we consider those acts within a social context. Stupidity should not be understood as the opposite of intelligence. In fact, according to some of the ideas of Cipolla, none of us gets rid of or will never get rid of a brief moment of stupidity.

The association of stupidity to a source of collective troubles and nuisance and to the origin of social scourges has been manifested through history in several nowadays popular quotes. Among them it is worth citing a phrase credited to A. Dumas: "One thing that humbles me deeply is to see that human genius has its limits while human stupidity does not" [2]. B. Russell, in his essay *The triumph of stupidity* wrote: "The fundamental cause of the trouble is

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that in the modern world the stupid are cocksure while the intelligent are full of doubt" [3].

Cipolla starts by preventing us about the silent danger of stupidity in the first law. There he affirms that detecting a stupid person is a hard task. This law states that always and inevitably everyone underestimates the number of stupid individuals in circulation.

While it could be tempting to associate stupidity with lack of education or training, Cipolla affirms that the probability that a certain person be stupid is independent of any other characteristic of that person. This is the content of the second law. This somehow suggests that there is a natural stupidity, which resists any academic training.

But again, we are here interested in an operational definition of stupidity, the one that is dangerous for others, an idea that can be summarized by a quote taken from one of M. Atwood novels, [4]: "Stupidity is the same as evil if you judge by the results."

This idea is expressed in Cipolla's third law: A stupid person is a person who causes losses to another person or to a group of persons while himself deriving no gain and even possibly incurring losses.

This law also suggest the definition of three other phenotypes that complement the stupid group (S). These three groups, according to Cipolla, are the intelligent people (I), whose actions benefit both themselves and others, the bandits (B), who benefits themselves at the expense of others, and finally the helpless or unaware people (U), whose actions enrich others at their own expense.

Stupid people are dangerous and damaging because their behavior is hard to understand and predict from a rational point of view. The bandit's actions, while producing some damage, obey a predictable pattern of rationality. The possibility to foresee the behavior of a bandit can help an individual to build up defenses against it. On the contrary, when facing a stupid person this is impossible. So, while most of the time the evil has a clear face and is easily identifiable, stupidity is not. This biased evaluation is what is considered in the forth law: Non-stupid people always underestimate the damaging power of stupid individuals. In particular non-stupid people constantly forget that at all times and places and under any circumstances to deal and/or associate with stupid people always turns out to be a costly mistake.

The effect of stupidity and the difficulty to recognize it is what leads us to the fifth law: A stupid person is the most dangerous type of person.

Cipolla characterized the four groups in terms of two parameters; the own gains or losses p, and the gains or losses that an individual inflicts on others, q. The payoff resulting from the interaction between two persons can be defined in terms of these quantities associated to the identification of the participants with one of the four defined groups. These four groups can then be characterized by the range of values adopted by p and q as follows:

 $S: p_s \le 0 \ y \ q_s < 0$ 

 $U : p_u \le 0 y q_u \ge 0$ 

I :  $p_i > 0$  y  $q_e \ge 0$ 

B:  $p_b > 0 \text{ y } q_b < 0$ 

In [5] we presented a four strategy game based on this four groups. The payoff of the strategies was defined by the values of p and q as presented in Table 1, that indicates which is the payoff of the strategy at the file when competing with the strategy at the column

	$\mathbf{S}$	$\mathbf{U}$	I	В
$\mathbf{S}$	$p_s + q_s$	$p_s + q_u$	$p_s + q_i$	$p_s + q_b$
U	$p_u + q_s$	$p_u + q_u$	$p_u + q_i$	$p_u + q_b$
Ι	$p_i + q_s$	$p_i + q_u$	$p_i + q_i$	$p_i + q_b$
В	$p_b + q_s$	$p_b + q_u$	$p_b + q_i$	$p_b + q_b$

Table 1: Payoff Table

The results shown in [5] supported the validity of the law enunciated by Cipolla that contained some appreciations about the dangerousness of the presence of stupid people. In this work, the evaluation of the effect of the actions of this group was done by calculating the total wealth of the population in the steady state of the strategy profile resulting from an evolutionary game and an imitation dynamics. The presence of stupid people not only undermined the total wealth but also promoted the inhibition of cooperative behaviors represented by intelligent and unaware people. In that work we could not find a critical value for the fraction of stupids that could divide the behavior of the system into two different regimes. According to the the first law it is not possible to know the number of stupid individuals in a population, so it might be interesting to find different regimes for different fraction of stupid people.

In the present work we have adopted a different approach, interpreting Cipolla's idea in a different way. We will consider a three strategy game, where the participating strategies will be (I), (B) and (U) and we will let any individual to occasionally behave as a stupid person with a given probability. This probability is the parameter that will govern the amount of stupid people at each time.

This means that being stupid will not be a permanent state by an occasional state accounting for the possibility that at any time any individual can behave stupidly. In the following sections we present a more thorough description of the model and the numerical results.

#### 2. The model

As mentioned before, we are going to consider an evolutionary game, with four strategies though one of them, the (S), differs from the others in the sense that it is not durable and it can not be imitated. Any individual can be stupid at any time and during one time step with probability  $\rho_s$ .

While stupidity will not be a permanent condition on this version of the game, we still need to define the payoff of each of the three strategies when playing between them and when ocassionally confronting with a stupid person. We also need to define the payoff that an eventual stupid player may receive. We introduce then a 4x4 payoff matrix

$$A = \begin{pmatrix} p_s + q_s & p_s + q_u & p_s + q_i & p_s + q_b \\ p_u + q_s & p_u + q_u & p_u + q_i & p_u + q_b \\ p_i + q_s & p_i + q_u & p_i + q_i & p_i + q_b \\ p_b + q_s & p_b + q_u & p_b + q_i & p_b + q_b \end{pmatrix}$$

To compare the effects of this new model with those obtained in [5], we will adopt the values in Table 2.

Ī	$x_i$	$x_b$	$x_d$	$x_e$	$y_i$	$y_b$	$y_d$	$y_e$
ĺ	1	[1.1,2]	[-2,-1]	[-2,-1]	1	-1	1	-1

Table 2: Chosen values for the payoff matrix

The only Nash equilibrium of this game is strategy (B). As shown in [5], considering the chosen values for the payoffs, the sub game in which only the strategies (I) and (B) participate constitutes a Prisoner's Dilemma (PD) or a Donation Game [6].

Despite that there is only one Nash equilibrium and thus an evolutionary game ruled by the replicator mean field equations will have only one steady state, when considering a spatially extended game with players located on top a network, the steady state can show a different steady configuration [7, 8, 9, 10].

In order to compare the results obtained here with those previously shown in [5] we locate the players on top of the networks used in that work. We consider a particular family of regular networks, i.e. with all the node having the same degree, but with a tunable degree of disorder. These networks described in [12] present a topology that varies according to a disorder parameter  $\pi_d$ . This parameter is responsible for the change in the value of the clustering coefficient C of the network. This dependence is shown if Fig. (1)

We will adopt a simple evolutionary dynamics for the strategies considering a deterministic imitation. In each round a selected player plays with all its neighbors. In turn, these neighbors do the same with their own. After that selected player analyses its performance or earnings and compares them with that of its neighbors. Then, it adopts the strategy of the player with the highest gain, that eventually can be its own one. In case of tie the choice is decided at random. This update dynamics is the simplest one, representing a deterministic imitation and closely linked to the replicator dynamics [11].

Players will play according to their chosen strategy, that can be (I), (B) or (U) but at any time, any player can adopt the strategy (S) with probability  $\rho_s$ . This election will not be permanent, will last only one time step (there is always a probability  $\rho_s^n$  of adopting the (S) strategy during n consecutive steps) and after that, the player will adopt the original behavior or change it to imitate

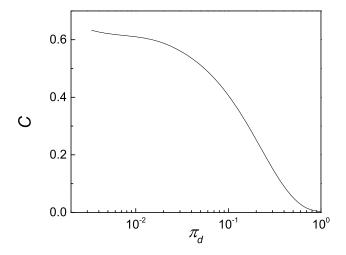


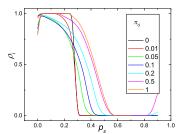
Figure 1: Mean clustering coefficient of the used networks as a function of the degree of disorder

the neighbor with the highest payoff. We recall that the (S) strategy can not be imitated, but this is not an issue as under any circumstance a player adopting the (S) strategy will obtain the higher payoff. The fact that there is probability  $\rho_s$  of adopting strategy (S) means that at each time step there is a mean effective population of  $\rho_s N$  stupids, where N is the total population size.

### 3. Results

In our simulations we considered networks of  $N=10^5$  nodes and the system evolved untill reaching a steady state. The degree of disorder  $\pi_d$  and the probability of adopting the (S) strategy at each time step  $\rho_s$  were chosen as parameters. The results are shown in Fig. (2)

We observe that the topology of the network has a minor effect on the evolution of the strategy profile of the population. On the contrary the probability of adopting the (S) strategy plays a crucial role. The system shows the existence of a critical value of  $\rho_s$  separating the evolution of the system towards two differently regimes. For low values of  $\rho_s$  the dominating strategy is (I) while for higher values, (B) dominates. This is clearly reflected in the left panel of Fig (2) showing the fraction of (I) in the steady state and also in the right panel showing the mean gain of the population. Clearly, the prevalence of (B) attempts against the wealth of the population, and this prevalence is promoted by the sporadic appearance of the (S) behavior. The interesting additional feature observe in this work is the existence of two well defined ranges, and a critical  $\rho_s$  values more defined when the network is more ordered.



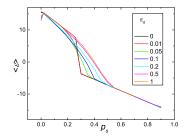


Figure 2: This plots shows the fraction of (I) individuals  $\rho_i$  (left) and the main gain of the population in one round  $<\epsilon>$  (right) as a function of  $\rho_s$ . All the curves correspond to a the steady state

The presence of a sharp transition between a cooperative to a defective steady state was not observed in [5]. To understand the relevance of this result we refer to previous results involving evolutionary games. There are several examples of the effect of locating the players on networks with different topologies [7, 8, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22]. These works show that the evolutionary behaviour of the strategies might be affected by the underlying topology of links between players, sometime promoting cooperative states even when the Nash equilibrium is the defective strategy. In these examples, the topology of the network is the factor responsible for different regimes. Here we show that while the topology of the networks plays a non negligible role, the most important parameter is the probability of a player to adopt the (S) strategy.

The results show that as  $\rho_i$  increases there is a transition from a scenario where (I) is prevalent to another one where most of the population behaves as (B). The transition is sharper for highly ordered network and turns smoother as  $\pi_d$  increases. Also, the critical value at which this transition occurs moves to right with increasing  $\pi_d$ . This fact is shown in Fig. (3)

# 4. Conclusions

As we stated in the introduction, the work by Cipolla should be understood in a cartoonish way. Nevertheless, it implies certain facts that deserve to be taken into consideration. It is in this spirit that we analyzed the work by Cipolla and the results that can be obtained by translating these ideas into a mathematical model. Lets start by the first law. It affirms that we always underestimate the number of stupid individuals in circulation. Inspired by this statement we wander whether despite the density of stupids is impossible to calculate there is a critical density separating two different scenarios or not. We mean by this to evaluate the possibility that only by reaching a threshold density, the group of stupid people can inflict a considerable harm to the entire population. For that we proposed a model in which any individual is susceptible of behaving stupidly at any time and with a certain probability. Our results

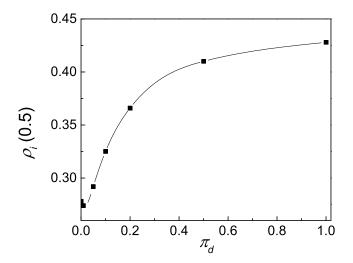


Figure 3: This plot shows the value of  $\rho_s$  at which  $\rho_i = 0.5$  as a function of  $\pi_d$ . The curve is a spline for helping visualization.

show the existence of a critical probability  $\rho_s \approx 0.35$ . The transition from the cooperative regime to the defective one is only sharp for slightly disordered networks, turning smoother as the disorder increases. Also, the increasing disorder produces a displacement of  $\rho_s$  to higher values. The curves show that while for low values of  $\rho_s$  the disorder attempts against (I), the situation is reversed for higher degrees of disorder. These results agree with those obtained in [5] for the case when the fraction of (I) individuals remains constant along the whole simulation. Another interesting feature is the increase in the fraction of (I) for higher values of  $\rho_s$ . This phenomenon can be attributed to a screening effect played by the (S) population. The (I) players can not be affected and tempted by the presence of (B) ones and then they survive. This effect has been also found in [5].

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