**How game theory affects your everyday life**

[1] Should women be ***wearing makeup***? Do you need to find an ***internship*** for this summer? Should your country limit its CO2 ***emissions*** to ***fight global warming?*** If you can't see the ***link*** between these questions, don't worry, you soon will.

[1] Should women be ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m\_\_\_\_\_\_\_\_\_\_\_\_\_***? Do you need to find an ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** for this summer? Should your country limit its CO2 ***\_\_\_\_\_\_\_\_\_\_\_\_\_***to ***\_\_\_\_\_\_\_\_\_\_\_\_\_global \_\_\_\_\_\_\_\_\_\_\_\_\_?*** If you can't see the ***\_\_\_\_\_\_\_\_\_\_***between these questions, don't worry, you soon will.

[2] Game theory is everywhere, and you do not have to be an economist to understand its most ***insightful*** aspects. In the game theory, there's a fundamental concept — ***Nash equilibrium*** (named after the economist John Nash). What is it then? And how is it applied in the real world?

[2] Game theory is everywhere, and you do not have to be an economist to understand its most i***\_\_\_\_\_\_\_\_\_\_\_\_\_***aspects. In the game theory, there's a fundamental concept — ***Nash \_\_\_\_\_\_\_\_\_\_\_\_\_*** (named after the economist John Nash). What is it then? And how is it applied in the real world?

[3] ***The definition*** of Nash equilibrium is ***straightforward***: It is a situation in which all people are using a Nash strategy. What is a Nash strategy? Simply the aim of doing what is best for yourself, ***taking as a given*** what others around you are doing. In economic terms, you are "best responding" to other people's actions ***in a purely individual and self-interested way.*** For example, if there were two ***convenience stores*** right next to your house, your Nash strategy when buying milk in the morning would be to go to the cheaper store, given each store's price. And ***similarly***, the Nash strategy for the storekeeper would be to price their milk just below their ***competitor*** in order to attract you.

[3] ***The \_\_\_\_\_\_\_\_\_*** of Nash equilibrium is ***\_\_\_\_\_\_\_\_\_\_\_\_\_***: It is a situation in which all people are using a Nash strategy. What is a Nash strategy? Simply the aim of doing what is best for yourself, ***taking as a \_\_\_\_\_\_\_\_\_\_\_\_\_***what others around you are doing. In economic terms, you are "best responding" to other people's actions ***in a purely \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ way.*** For example, if there were two ***\_\_\_\_\_\_\_\_\_\_\_\_\_stores*** right next to your house, your Nash strategy when buying milk in the morning would be to go to the cheaper store, given each store's price. And s***\_\_\_\_\_\_\_\_\_\_\_\_***, the Nash strategy for the storekeeper would be to price their milk just below their ***\_\_\_\_\_\_\_\_\_\_\_\_\_***in order to attract you.

[4] ***So far so simple,*** but you may wonder how this leads to anything insightful. This is where the prisoner's dilemma ***comes in.*** In A Beautiful Mind, a movie inspired by John Nash's life story, Russell Crowe ***pronounces this memorable quote***: "Adam Smith was wrong!" What is meant by this? Well, in ***classical economic theory***, Adam Smith stated that individuals, by pursuing their own interests, were ***maximising the collective welfare*** of society as a whole, a ***notion*** that developed throughout t***he allegory of an "invisible hand***." The beauty of Nash equilibrium is precisely that it shows ***how acting rationally*** from an individual's point of view can lead to ***collectively undesirable (or even disastrous) outcomes.***

***so far so good 到现在为止，一直都还不错***

pronounce： ***to say or give sth formally, officially or publicly 正式宣布（或公布、授予等）***

to pronounce an opinion

The judge will pronounce sentence today.

She pronounced him the winner of the competition.

I now pronounce you man and wife (= in a marriage ceremony) .

She was pronounced dead on arrival at the hospital.

He pronounced the country to be in a state of war.

翻译：

他宣布全国进入战争状态。

发表意见

到达医院时她被宣告已经死亡。

现在正式宣布你们结为夫妻。

她宣布他是竞赛的优胜者。

法官将于今天宣判。

***造句：***

[4] ***So \_\_\_\_\_\_\_\_\_\_ so \_\_\_\_\_\_\_\_\_\_\_\_\_,*** but you may wonder how this leads to anything insightful. This is where the prisoner's dilemma ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** In A Beautiful Mind, a movie inspired by John Nash's life story, Russell Crowe ***\_\_\_\_\_\_\_\_\_\_\_\_\_ this \_\_\_\_\_\_\_\_\_\_\_\_\_ quote***: "Adam Smith was wrong!" What is meant by this? Well, in ***\_\_\_\_\_\_\_\_\_\_\_\_\_ economic theory***, Adam Smith stated that individuals, by pursuing their own interests, were ***\_\_\_\_\_\_\_\_\_\_\_\_\_the c\_\_\_\_\_\_\_\_\_\_\_\_\_\_w\_\_\_\_\_\_\_\_\_\_\_\_***of society as a whole, a n***\_\_\_\_\_\_\_\_\_\_\_\_*** that developed throughout t***he \_\_\_\_\_\_\_\_\_\_\_\_\_of an "\_\_\_\_\_\_\_\_\_\_\_\_\_hand***." The beauty of Nash equilibrium is precisely that it shows ***how acting \_\_\_\_\_\_\_\_\_\_\_*** from an individual's point of view can lead to ***\_\_\_\_\_\_\_\_\_\_\_\_\_ \_u \_\_\_\_\_\_\_\_\_\_\_\_ (or even disastrous) outcomes.***

[5] To ***illustrate*** this, we use the extremely famous example of the prisoner's dilemma. Imagine two ***burglars*** who are being accused of ***robbery*** by the police. The police have no evidence but decide to take both burglars to separate rooms and give them the chance to ***confess to their crime.*** They cannot communicate with each other in order to decide whether to confess or not. Each of the burglars knows the following: a) If both of them confess, they each get 5 years of prison; b) If none of them confesses, they each get 1 year of prison; c) If one of them confesses and the other does not, the confessor gets 0 year of prison (***collaboration*** is ***rewarded*** by the police) and the non-confessor gets 10 years of prison (he ***pays for*** the entire crime).

[5] To ***\_\_\_\_\_\_\_\_\_\_*** this, we use the extremely famous example of the prisoner's dilemma. Imagine two b***\_\_\_\_\_\_\_\_\_\_*** who are being a***\_\_\_\_\_\_\_\_\_\_\_\_*** of ***\_\_\_\_\_\_\_\_\_\_*** by the police. The police have no evidence but decide to take both burglars to separate rooms and give them the chance to ***\_\_\_\_\_\_\_\_\_\_\_ \_\_ their crime.*** They cannot communicate with each other in order to decide whether to confess or not. Each of the burglars knows the following: a) If both of them confess, they each get 5 years of prison; b) If none of them confesses, they each get 1 year of prison; c) If one of them confesses and the other does not, the confessor gets 0 year of prison (***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** is ***\_\_\_\_\_\_\_\_\_\_*** by the police) and the non-confessor gets 10 years of prison (he ***\_\_\_\_\_\_\_\_\_\_ for*** the entire crime).

[6] Clearly in this situation, ***the collectively optimal outcome*** for burglars is for nobody to confess, so that they each get only 1 year of prison. However, will this outcome be ***attained a***s predicted by classical theory? ***Put yourself in the burglars' position*** when they decide whether to confess or not: If the other burglar confessed, your ***self-interest*** is to do the same, to get 5 instead of 10 years of prison. If the other burglar did not confess, your self-interest is to do the opposite, to get 0 instead of 1 year of prison.

[6] Clearly in this situation, ***the c\_\_\_\_\_\_\_\_\_\_ o\_\_\_\_\_\_\_\_\_\_ o\_\_\_\_\_\_\_\_\_\_*** for burglars is for nobody to confess, so that they each get only 1 year of prison. However, will this outcome be ***a\_\_\_\_\_\_\_\_\_\_ a***s predicted by classical theory? Put \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ when they decide whether to confess or not: If the other burglar confessed, your ***s\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_***  is to do the same, to get 5 instead of 10 years of prison. If the other burglar did not confess, your self-interest is to do the ***\_\_\_\_\_\_\_\_*** , to get 0 instead of 1 year of prison.

[7] We conclude that no matter what the other burglar does, your ***best response i***s to confess. Since both burglars ***reason in the same way***, they will both ***end up confessing***, which leads to the Nash equilibrium: Both burglars confess no matter what the other burglar does, and they both end up getting 5 years of prison, even though this is not the collectively optimal outcome for them. Both of them would in fact be ***better off*** if they agreed not to confess, but their ***personal temptations make this agreement infeasible***.

[7] We conclude that no matter what the other burglar does, your ***\_\_\_\_\_\_\_\_\_\_ r\_\_\_\_\_\_\_\_\_\_ i***s to confess. Since both burglars ***r\_\_\_\_\_\_\_\_\_\_ in the \_\_\_\_\_\_\_\_way***, they will both ***\_\_\_\_\_\_\_\_\_\_ up confessing***, which leads to the Nash ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***: Both burglars confess no matter what the other burglar does, and they both end up getting 5 years of prison, even though this is not the collectively optimal outcome for them. Both of them would in fact ***\_b\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_*** if they agreed not to confess, but their ***personal \_\_\_\_\_\_\_\_\_\_ make this agreement \_\_\_\_\_\_\_\_\_\_***.

[8] The reason why this example is so famous is that it relates to many ***real-life phenomena*** in which ***individualistic behaviors*** lead to negative outcomes for society. In sports, all professional athletes would be ***better off*** if no one used ***performance-enhancing drugs***. The problem is that when no one uses these drugs, an individual athlete might be ***tempted*** to use them in order to perform better than everyone else (the ***equivalent*** of confessing when the other burglar does not in the prisoner's dilemma). This then leads many other athletes to consume performance-enhancing drugs, and any athlete who decides not to consume these drugs would ***suffer from a major comparative disadvantage.***

[8] The reason why this example is so famous is that it relates to many ***\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ phenomena*** in which ***\_\_\_\_\_\_\_\_\_\_ behaviors*** lead to negative outcomes for society. In sports, all professional athletes would be ***\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_***  if no one used ***p\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ drugs***. The problem is that when no one uses these drugs, an individual athlete might be ***\_\_\_\_\_\_\_\_\_\_*** to use them in order to perform better than everyone else (the ***e\_\_\_\_\_\_\_\_\_\_***  of confessing when the other burglar does not in the prisoner's dilemma). This then leads many other athletes to consume performance-enhancing drugs, and any athlete who decides not to consume these drugs would ***suffer from a \_m\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_c\_\_\_\_\_\_\_ d\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.***

[9] This also applies to environmental policies regarding CO2 emissions. The world as a whole needs to stop climate change, but each country ***individually*** has an economic interest in emitting CO2 for their industrial production, which leads to ***global inaction***. You can think by yourself about the other examples I introduced: women having to ***put on makeup*** because everyone else does, students looking for ***internships*** because everyone else will have one to show on their ***CV***. Examples are ***everywhere***, and sometimes they ***entail inefficiencies*** that are extremely frustrating to economists.

[9] This also applies to environmental policies regarding CO2 emissions. The world as a whole needs to stop climate change, but each country ***i\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** has an economic interest in emitting CO2 for their industrial production, which leads to ***g\_\_\_\_\_ i\_\_\_\_\_\_\_\_\_\_***. You can think by yourself about the other examples I introduced: women having to p***\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** on m***\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** because everyone else does, students looking for internships because everyone else will have one to show on their ***\_\_\_\_\_\_\_\_\_\_***. Examples are ***\_\_\_\_\_\_\_\_\_\_***, and sometimes they ***e\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ i\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** that are extremely ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** to economists.

[10] The concept of Nash equilibrium allows us to understand why some society issues require particular forms of intervention if we want to reach ***desirable*** outcomes. ***Legally binding agreements*** and communication are generally the way to overcome the problem caused by ***personal incentives*** in situations such as global warming. Of course, ***this is much easier said than done*** in a ***global context of economic competition*** where no country wants to go first in depriving themselves of polluting for production.

[10] The concept of Nash equilibrium allows us to understand why some society issues require particular forms of i***\_\_\_\_\_\_\_\_\_\_\_\_\_*** if we want to reach ***d\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** outcomes. ***L\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ agreements*** and communication are generally the way to overcome the problem caused by ***personal i\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** in situations such as global warming. Of course, ***this is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** in a ***g\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_of economic c\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*** where no country wants to go first in depriving themselves of polluting for production.