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The Tragedy of the Anticommons:
The Effect of Uncertainty and Accountability

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Abstract

The social dilemma called tragedy of the anticommons represents the underuse of a resource due to exclusion rights such as patents. We study the anticommons dilemma and its relationship with uncertainty and accountability, by means of an anticommons lottery tickets buying and selling group task game (cf. Glöckner Tontrup, & Bechtold, 2015). More specifically, we examine uncertainty about how much a buyer is willing to pay for the anticommon good, and accountability to the other owners of the anticommon good on the amount of payment they are willing to accept. We hypothesize that more uncertainty will lead to more overpricing, and that accountability will lead to lower prices compared to no accountability. The results indicate that, under higher levels of uncertainty, people tend to act more out of self-interest, by asking higher prices for their part of the anticommon good. Study limitations and implications for further researches are discussed.

Introduction

In our current technical capitalist society where innovation and competition play an integral role, the patent is a very important tool. The patent represents an exclusion right, making a specific idea or invention inaccessible to others, i.e. an anticommon resource/good. When exclusion rights prevent the optimal use of a resource, it is referred to as the tragedy of the anticommons (Buchanan & Yoon, 2000; Heller, 1998). Consider for example the series of Apple vs. Samsung patent infringement lawsuits; or the "Pharma Bro" incident, where Martin Shkreli increased the price of the AIDS treatment medication Daraprim from US $13.5 to $750 after his company bought the drug's manufacturing license.

The tragedy of the anticommons is the reversed counterpart of the better-known tragedy of the commons (Hardin, 1968). This phenomenon is represented by resource depletion and occurs when a common resource is exhausted due to excessive and inappropriate use by the owners (de Kwaadsteniet, van Dijk, Wit, & de Cremer, 2006; Edney & Harper, 1978; Glöckner, Tontrup, & Bechtold, 2015; Hardin, 1968). The tragedy of the commons is better known, because in our overpopulated world threatened by global warming and poverty, resource depletion, such as deforestation and overfishing, is often the center of media attention.

Both the tragedy of the commons and the tragedy of the anticommons are categorized as social dilemmas. Social dilemmas represent social interactions where the short-term individual interest is in conflict with the long-term common interest (Balliet, Parks, & Joireman, 2009; Glöckner et al., 2015; Komorita & Parks, 1995; Van Lange, Joireman, Parks, & Van Dijk, 2013). Preference for the individual interest over the

common interest is called “defection”, while “cooperation” is when the common interest is prioritized over the individual interest (Dawes, 1980; de Kwaadsteniet et al., 2006). Social dilemmas are made up of two properties: 1) defection leads to the highest individual outcome, regardless of what others involved may do, and 2) cooperation leads to the best outcome for all individuals involved (Dawes, 1980; de Kwaadsteniet et al., 2006; Van Lange et al., 2013).

The tragedy of the anticommons

To illustrate and better understand the tragedy of the anticommons, it is useful to first understand the tragedy of the commons. Imagine a group of fishermen who fish in an area where a popular type of fish resides. Each fisherman wants to make money, which implies catching as much fish as possible. But if all the fishermen adopt this as-much-as-possible tactic, the amount of the popular fish type will decrease continuously until it is endangered or extinct in that area. The extinction of the fish type will be detrimental to all the fishermen because without the fish they will have no income. This will also be unfavorable for the consumers because they will not be able to purchase the fish they like so much. The maximization of profit by overusing the common resource will ultimately become unfavorable for everyone. This is what we refer to as the tragedy of the commons.

Now imagine that after witnessing these events, the government in another country decides to give exclusive rights to only 5 fishermen to fish in the residential area of the popular fish type. These exclusion rights can be seen as patents or tickets, which allow only these 5 people access to that popular fish type. By transforming the fishing

area from a common to a restricted fishing resource, the government intends to prevent overfishing and the occurrence of the tragedy of the commons. For the interested buyers, such as a local restaurant who credit a big percentage of its revenue to selling a specialty fish dish, this will mean that this popular fish type can be acquired from these 5 rights holders only. Based on their monopoly position in the market, the high demands for the popular fish type, and their desire to make as much money as possible, these 5 rights holders will be tempted to price the fish artificially high. As a consequence, the local small business restaurant will not be able to afford the fish and thus lose a big part of its income, which may even lead to bankruptcy. This will not only be unfavorable for the restaurant, but also for the 5 rights holders who will lose a big client, which means less money. Instead of overfishing, the exclusion rights, with as consequence high prices and decrease in demand, will then lead to underuse of the fishing resource in that country. This represents the tragedy of the anticommons.

The anticommons dilemma occurs when a resource is not utilized to its optimal potential, due to exclusion rights owned by a limited group of people (Buchanan & Yoon, 2000; Glöckner et al., 2015; Heller, 1998; Heller & Eisenberg, 1998; Heller, 2013). The anticommons dilemma can lead to missed opportunities. Because of the exclusion of others, overpricing, or other restrictions, the available resource cannot be used, for example, to earn (more) money, make new developments or improvements.

The anticommons dilemma is less known and researched than the commons dilemma, but this fact does not equal irrelevance. Even though the anticommons dilemma is the opposite of the commons dilemma, both can lead to an unfavorable outcome for the

majority. When consulting the above-mentioned fishing example, the unfavorable outcome in the commons scenario is the extinction of the fish caused by overfishing, resulting in less income for the fishermen and the unavailability of the popular fish for consumers. In the anticommons scenario, the unfavorable outcome is artificially high prices, resulting in underfishing, less income for the restaurant as well as for the rights holders, and the unavailability of the popular specialty fish dish for the consumers.

The individual interest in the anticommons scenario was chosen over the common good. In other words, the minimum amount of money the rights holders were willing to accept (WTA) for their fish, was more than the minimum amount of money the buyer was willing/able to pay (WTP) for the fish. Owners of exclusion rights become strategic when it comes to allowing others to access their anticommon resources, often increasing their WTA (Glöckner et al., 2015). However, if the WTA of the owners/sellers is higher than the WTP of the interested buyer, the transaction will fall through, leaving both parties "empty-handed". In previous research on the tragedy of the anticommons, increased levels of environmental and resource uncertainty led to more self-interested behavior (De Kwaadsteniet et al., 2006; Depoorter & Vanneste, 2007; Suleiman & Rapoport, 1988; Wit & Wilke, 1998). This indicates that defection, such as increased WTA by the owners, is more likely to occur in cases of uncertainty or ambiguity.

Uncertainty

When examining decision making in social dilemmas, uncertainty can play an important role. When we interact with others, we learn and obtain information about norms (what is normal: how others behave and expect us to behave). We carry this

information with us and apply it in other social interactions. This information provides us with expectations for particular situations, and these expectations help guide our behavior (Friedkin, 2001).

When confronted with a social dilemma, expectations are of even greater importance. If you are certain that another person will respond in a specific way, it will make it easier to decide what actions to take yourself. However, the more uncertain you are about the behavior of the other person, the more difficult it becomes to make a decision. Uncertainty about the behavior of others undermines cooperation and enables self-interested behavior (De Kwaadsteniet et al., 2006; Depoorter & Vanneste, 2007; Sniezek, May, & Sawyer, 1990).

Uncertainty can present itself at different levels of an anticommons dilemma. For example, there can be uncertainty about the number of co-owners of the anticommon resource, or uncertainty about the profit the buyer may receive from purchasing the anticommon resource. Amid all the possible uncertainties that can be present when buying and selling an anticommon good, the most relevant to the rights holder is arguably the amount of payment he/she will receive for the anticommon good. Rightsholders are in possession of a valuable resource; for them to relinquish these rights, the payment would have to measure up to the value of the anticommon resource. Therefore, the amount the interested buyer is willing to pay for the anticommon good is of great importance to the rights holders. Uncertainty regarding the WTP of the buyer would thus be expected to have a great influence on the WTA of the owners. In this study, we will further explore the effects of uncertainty on cooperation during anticommons dilemmas, by focussing on uncertainty about the WTP of the buyer, i.e. how much the buyer is willing to pay for the

anticommon good. More specifically, a comparison will be made between the chosen WTA of the sellers in response to a buyer's WTP that is certain, low uncertain, and highly uncertain.

Accountability

In addition to uncertainty, this study on the anticommons dilemma will also take accountability into account. More specifically, we will test whether accountability will counter the (negative) effects of uncertainty on cooperation. Accountability is the justification of one's actions, decisions, convictions, or feelings to others (Lerner & Tetlock, 1999). Accountability, like uncertainty, is a crucial factor when assessing social interactions. According to Frink and Klimoski (2004), accountability represents the glue that binds social systems together, because without accountability people are not required to answer for their actions when in violation of social norms. In our society, we are expected to behave according to certain social norms, such as the norm of cooperation and the norm of nonviolence. Violations of these norms can lead to unfavorable reactions by others, e.g. rejection, while satisfactory explanations can lead to favorable outcomes, such as social praise and acceptance (Lerner & Tetlock, 1999). Due to our need to belong (Baumeister & Leary, 1995), people are strongly inclined to avoid any type of transgression, especially when they are easily identifiable and thus accountable for their actions and decisions.

Imagine for example if the group of fishermen mentioned above in the anticommons scenario would be required to report their business to the government who gave them exclusion rights. The likelihood of them artificially increasing the price would

then become less probable, because they would be identified and confronted with behaving according to their self-interest.

When it comes to social interactions, the norm of cooperation prescribes that people should be selfless and put the common good above their own. This is considered to be moral behavior and increases our chances of being liked. So, as co-owners of exclusion rights to an anticommon resource, the expectation would be to ask a reasonable WTA in order to increase the likelihood of the deal going well. A successful deal is beneficial to all parties involved.

However, during most research on social dilemmas, the participants are anonymous and do not have to explain their actions to anyone. Thus, they cannot be held accountable for their decisions. Anonymity can be considered the opposite of accountability; it is the inability of others to identify an individual (Christopherson, 2007; Zimmerman & Ybarra, 2016). Various research on anonymity reported negative effects on social interactions, such as increased aggression and group polarization (Christopherson, 2007; Zimmerman & Ybarra, 2016).

Accountability can also present itself at different levels in an anticommons dilemma. For example, people can be held accountable to the buyer interested in the anticommon good, or a third party (e.g. researcher or reporter). In this study, we focus on accountability to the fellow owners of the anticommon good. While unfavorable for all parties, if a transaction falls through because one person got too greedy, this can be considered most unfair to the other owners who were motivated to sell and did ask a reasonable price for their part of the anticommon good. Therefore, the owners, who are dependent on each other, will feel more pressure to cooperate in order to not jeopardize

the deal and disappoint the rest of the group. Based on the above-mentioned information, we expect that when people are accountable for their chosen WTA to their group members, they will be less likely to defect and more likely to set a lower WTA.

Current study

The current study aims to build upon the increasing amount of research on the tragedy of the anticommons, by studying the effect of uncertainty and accountability on this dilemma. The experiment will be conducted by means of an anticommons game based on the paradigm developed by Glöckner et al. (2015), using a lottery ticket buying and selling group task. The lottery tickets represent the anticommon good, which can be sold in bundles of three to a buyer. Uncertainty about the buyer's WTP will be manipulated in three rounds: certainty (200 coins), low uncertainty (150-250 coins), and high uncertainty (100-300 coins). To measure the influence of accountability, half of the participants will be instructed to explain their chosen WTA to the other two sellers. Cooperation will be assessed by the number of coins asked for the tickets, i.e. the height of the WTAs set by the sellers; with higher WTAs indicating less cooperation. This is because if the WTAs set by the three sellers combined exceed the WTP set by the buyer, the deal will not go through, which is detrimental to the group. By evaluating the difference in height of the WTAs set by the sellers for each of the three uncertain rounds and between the two accountability conditions, the effects of uncertainty and accountability on cooperation can be assessed. With this assessment, the following research question can be answered: "what is the effect of different levels of uncertainty about a buyer's WTP and the effect of accountability on the seller's WTA in an

anticommons dilemma?" Based on previous research, the current study aims to test the following hypotheses:

Hypothesis 1: Uncertainty has a positive relationship with WTAs: more uncertainty about a buyer's WTP will lead to higher WTAs by the sellers. This hypothesis is based on the results of studies where uncertainty led to more self-interested behavior (De Kwaadsteniet et al., 2006; Depoorter & Vanneste, 2007; Sniezek et al., 1990; Suleiman & Rapoport, 1988; Wit & Wilke, 1998).

Hypothesis 2: Accountability has a negative effect on WTAs: the sellers will set higher WTAs in the non-accountable conditions, compared to the accountable conditions. This hypothesis is based on studies where no accountability/anonymity resulted in negative social behavior, while accountability impaired the likelihood of defection and enabled selfless behavior (Christopherson, 2007; Zimmerman & Ybarra, 2016).

Method

Participants and design

The study was conducted with the help of 142 participants (35 males and 107 females, *M* age = 21.56 years). Participants were recruited via the online cloud-based participant management software SONA, flyers, posters, and personal connections and approaches. The selection criteria for participating in the study consisted of being at least 18 years of age, and with a sufficient understanding of written and spoken English. As compensation for their participation, participants received a standard payment of €2 plus an additional pay-out based on the results of their performance in the anticommons game (on average €1.50 to €2.50 per participant).

The study was conducted in the form of a lab experiment with a 2 (accountability: yes vs. no) × 3 (uncertainty: no vs. low vs. high) experimental design, with WTA (amount of coins asked by the sellers) as the dependent variable. The variable accountability was manipulated between subjects, while uncertainty was manipulated as a within-subjects variable. Allocation of participants to the two different accountability (yes vs. no) conditions was done at random, with 23 groups of 3 participants per condition. The study received approval from the Psychology Research Ethics Committee.

Procedure

Participants were asked to participate in a study on social decision making at the Level lab of Leiden University in a group task, where they could earn extra money. Each participant was assigned to a cubicle with a computer and was asked to first sign the informed consent before the commencement of the experiment. After being informed about the game, participants answered a short questionnaire to assess their understanding of the game. If the information was not clear, a lab instructor was present to answer any questions until everything was understood.

The anticommons game

The experiment was conducted by means of an anticommons game based on the paradigm developed by Glöckner et al. (2015), programmed using the software platform for experiments Otree. During the game, participants were informed that they, alongside two other players, each start with three lottery tickets that they can sell for coins to a buyer in three rounds. One coin was worth €0.01 and was given as a monetary reward on

top of the standard €2 fee at the end of the experiment. Each participant in a three-person group had to indicate per round the minimum amount of coins they were willing to accept (WTA) from the buyer for their lottery ticket. The buyer on the other hand also indicated how much he/she is willing to pay (WTP) for the three lottery tickets together in each round. If the combined total coins of the three WTAs set by the participants was equal or lower than the WTP set by the buyer, each participant received the number of coins they asked for their lottery ticket. However, if the combined total of the three WTAs together surpassed the WTP set by the buyer, the transaction would not go through and each participant kept their lottery ticket. These lottery tickets were valuable because participants were able to participate in a lottery at the end of the game with the chance to win €20. Each lottery ticket provided an expected profit of 1/36 × €20 = €0.55 and with each ticket there was a 2.8% chance of winning.

Uncertainty

The game consisted of three rounds, where the three sellers had to choose a WTA between 0 and 300 coins after receiving the WTP of the buyer. Each round consisted of a different level of uncertainty (no, low, high). The WTP and the level of uncertainty were randomly determined per round by the computer. In the *no uncertainty* condition, the three sellers were informed of the exact amount the buyer was willing to pay for the three tickets combined, namely 200 coins (€2). During the *low uncertainty* condition, the buyer's WTP was set at 150 to 250 coins (€1.50 to €2.50), and WTP for the *high uncertainty* condition was between 100 to 300 coins (€1 to €3). So, the (un)certainty

about the number of coins the buyer was willing to pay for the three tickets was different for each round.

Accountability

After receiving the standard instructions of the game, half of the participants (69 people) received additional information about accountability. These participants were informed at the beginning of the game that at the end of the three rounds, they had to explain their chosen WTAs for each round to the other two sellers in a group chat. Meaning that every player had to give a reason for choosing the specific amount of coins they asked for their ticket in each round.

Dependent variable: Willingness To Accept (WTA)

In both accountability conditions (yes, no) and for all three uncertainty conditions (no, low, high), participants were asked the same question: how much coins are you minimally willing to accept for your ticket? Based on this standard question throughout the three rounds of the game, we were able to assess the effects of uncertainty and accountability on cooperation.

Succeeding the completion of the three rounds, the participants in the accountability condition had to explain their WTAs to the other sellers in a group chat. Afterward, all players were informed about the results of each round, i.e. how many of the three tickets were sold. The number of tickets sold was the same for each of the three sellers in a group, seeing that the offer of the buyer was for all three tickets combined. If not all three tickets are sold, a lottery drawing followed where the participants were

informed if they had won €20 or not. The duration of the game was approximately 15 to 20 minutes, and after completion participants were debriefed and paid the standard €2 plus the amount of money they earned and/or won during the game.

Results

With exception of the manipulation check of accountability, a Repeated Measures ANOVA was conducted to analyze the data, with uncertainty (no, low, high) as the within-subjects variable, accountability (no, yes) as the between-subjects variable, and WTA as the dependent variable.

Manipulation Check

To assess whether the manipulation of uncertainty about the buyer's WTP in the three conditions successfully influenced their experience of uncertainty, participants were asked to indicate on a 7-point scale how uncertain they felt about the buyer's WTP, with 1 = not at all uncertain, and 7 = completely uncertain. A repeated measures ANOVA was conducted with uncertainty (no, low, high) as the within-subjects variable, and accountability and uncertainty check as the dependent variables. The analysis resulted in a significant effect of uncertainty check, with $F_{(7,\ 123)} = 2.35$, $p = .03$, $\eta^2 = .12$. Participants' reported feelings of uncertainty increased along with the level of uncertainty about the buyer's WTP ($M_{no} = 98.47$, $M_{low} = 121.73$, $M_{high} = 118.02$). This indicates the successful manipulation of participants' feelings of uncertainty.

The effect of Accountability ($M_{no} = 116.32$, $M_{yes} = 109.17$) on the manipulation of uncertainty was non-significant, with $F_{(1,\ 123)} = .33$, $p = .57$, $\eta^2 = .00$.

Uncertainty

The main effect of Uncertainty was significant, with $F_{(1.97,\ 267.56)} = 13.68$, $p < .001$, $\eta^2 = .09$, indicating that the different levels of uncertainty resulted in a difference with regards to the WTAs set by the sellers. The WTAs set by participants increased along with the level of uncertainty; with the condition no uncertainty resulting in the lowest WTAs ($M = 91.47$, SEM = 4.55), followed by low uncertainty ($M = 110.25$, SEM = 5.89), and high uncertainty with the highest WTAs ($M = 115.27$, SEM = 6.46). These findings are in accordance with Hypothesis 1, showing that uncertainty does have a positive relationship with WTAs: more uncertainty about a buyer's WTP led to higher WTAs by the sellers. Table 1 shows the mean of the three uncertainty levels for each of the accountability conditions.

Table 1.
Mean (SEM) WTAs for the accountability and uncertainty conditions.

	No Uncertainty	Low uncertainty	High Uncertainty
Accountability No	88.72 (6.98)	114.90 (9.03)	115.88 (9.89)
Accountability Yes	94.21 (5.85)	105.61 (7.57)	114.67 (8.30)

Accountability

The analysis did not result in a significant effect of accountability, $F_{(1.97,\ 267.56)} = 1.19$, $p = .31$, $\eta^2 = .01$ (Huynh-Feldt correction of *df*s). Even though the mean WTAs set by participants were higher in the no accountability compared to the accountability condition as expected (Table 2), the difference was non-significant. This disproves Hypothesis 2, since the WTAs set by the sellers are not (significantly) higher in the non-accountable conditions, compared to the accountable conditions.

Table 2.

Mean (SEM) WTAs for accountability (no, yes).

Accountability	Mean	Mean Difference	Sig.
No	106.50 (7.61)	1.67*	.87
Yes	104.83 (6.39)	-1.67**	.87

*Mean no – Mean yes
**Mean yes – Mean no

Discussion

In this study, we researched the tragedy of the anticommons and its relationship with uncertainty and accountability. More specifically, uncertainty about the buyer's WTP (how much the buyer is willing to pay for the anticommon good), and accountability to the other owners/sellers of the anticommon good. The study showed that increasing amounts of uncertainty (from no, low, to high) about the buyer's WTP, resulted in increasing WTAs set by the participants. In other words, the more uncertain participants were about the price the buyer was willing to pay, the higher they set their price for their part of the anticommon good. This shows that uncertainty about the behavior of others undermines cooperation and enables defection and self-interested behavior (Sniezek et al., 1990), in this case in the form of higher WTAs in order to receive more money. The results of this study are in accordance with previous studies on the tragedy of the anticommons, which showed that whether it being environmental, social, or resource uncertainty, people are more likely to defect under higher levels of uncertainty (De Kwaadsteniet et a1.,2006; Suleiman & Rapoport, 1988; Wit & Wilke, 1998).

The results, however, did not yield evidence for the expected negative effect of accountability on WTAs. Based on previous research on the negative effects of anonymity, and the cooperation enabling effects of accountability in social interactions

(Baumeister & Leary, 1995; Christopherson, 2007; Klimoski, 2004; Zimmerman & Ybarra, 2016), we hypothesized that participants would set lower WTAs in the accountable conditions compared to the non-accountable conditions. The study showed that this was indeed the case, but this difference was not significantly large to prove our theory.

A possible explanation for this occurrence can be due to a limitation of the study, where participants could easily lie about their chosen WTAs to the other sellers. The owners/sellers didn't receive any other information about the other owners' chosen WTAs, other than what is said during the chat. This means that there was no way of knowing whether the explanations given by the others were correct or not. The results of the three transaction rounds were given at the end, after the accountability chat. It was then too late to know which person was lying and to hold him/her accountable. The potential of lying reduces pressure, thus countering the positive effects of accountability on cooperation. Based on this, it can also be argued that the means by which participants had to give account to the others could have limited the effects of accountability. Participants were in separate cubicles behind the safety of a computer screen. The pressure to cooperate is then less compared to a more personal form of account giving, for example, a face-to-face confrontation. Thus, online chatting might not be a strong enough medium to enable the positive effects of accountability on cooperation.

Another point of improvement is that when informed about the anticommon good they owned and its value, we did not assess whether the participants were motivated to sell, or if they wanted to keep the lottery ticket and take a chance at winning the prize.

Selling all three tickets had an average pay outcome between €3.50 to €4.50 while keeping all three lottery tickets provided the participants with $2.8\%^3 = 22\%$ chance of winning €20. Some participants might have rather taken this chance. However, since the buyer only bought the tickets in groups of three, this may have led some participants to purposefully set higher WTAs, thus jeopardizing the transaction, in order to keep their tickets. Participants' motivation to sell their valuable anticommon good is thus also a factor that should be taken into account.

Furthermore, it is important to consider that the participants' feelings of uncertainty, measured by the uncertainty check, may have also been influenced by the uncertainty about the other sellers' WTAs. During the game, participants were explicitly asked to indicate on a 7-point scale how uncertain they felt about the buyer's WTP. However, some participants may have generalized or misattributed their feelings of uncertainty, resulting in higher scores on the scale. This implies that even though the WTAs increased along with the level of uncertainty, this may not have been due to increased feelings of uncertainty about the buyer's WTP exclusively. Because the game contains both uncertainty about the other owners' WTAs as well as uncertainty about the buyer's WTP, the manipulation of the latter (no, low, high WTP uncertainty) may have been affected by feelings of uncertainty for the former.

To summarize, this study contributes to the further understanding of the tragedy of the anticommons, by showing that uncertainty about the amount a buyer is willing to pay for an anticommon good or resource, can lead the owners of the anticommon good to

set a higher minimum price for them to accept the buyer's offer. Uncertainty thus reduces cooperation and increases people's tendency to defect during an anticommons dilemma. Accountability may have the potential to counter this effect. However, the potential to avoid accountability, in this case the potential to get away with lying, and the medium by which accountability is given, should be taken into account.

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