Understanding the Fall of Enron as Social Dilemma Accumulation: *Automated Text Analysis, Cognitive Mapping and Game Theory.*

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Introduction

From the 1980s on Enron evolved from an old-style pipeline company to an innovative, 'hard-ball' energy trader and US-market leader. Despite its initial success Enron was forced to file for bankruptcy in December 2001. When the dust was gone Enron suddenly proved to be the opposite of pretty much all it ever claimed to be: towards stock-holders it pretended to be in great shape while many of its project where failing, its books where dramatically cooked, the vice-chairman Cliff Baxter committed suicide and executives has transferred tens-of-millions of dollars to their own bank accounts (McLean & Elkind, 2003). The fall of Enron became the exemplar of the 1990 USA 'stock marked systems failure' (Coffee J. C., 2004). Although many explanations for this have been given, this paper observes important uncovered ground in the available scientific accounts for this dramatic chain of events. It suggests that Enron was plagued by 'dilemma accumulation': the observation that Enron its 'low trust' culture might have been as such that social dilemmas were 'solved' in an lower rate than they were produced.. In addition: it explores the possibility of using automated text analysis and cognitive mapping techniques to gain further understanding of the internal conditions that – among others - let to Enron its breakdown.

In part one a short overview of 'what happened at Enron' will be provided. In the sideline scientific accounts provided thus far will be shortly touched upon. At the end of part one it will be shown that a plausible hypothesis – namely *'social dilemma accumulation'* - has been overlooked in these accounts. The second part will be used to broadly explore the methodological possibility of testing this hypothesis (and further scrutinizing what happened at Enron) with automated text analysis and cognitive mapping of game theoretical dilemma situations. A possible workflow for such a project is described and expected problems will be elaborated upon.

The rise and fall of Enron

Several high quality readings are available for those interested in a detailed description of what happened at Enron. A book by the McClean and Elkind named 'T*he Smartest Guys in the Room'* (McLean & Elkind, 2003) would be an excellent starting point. For a broader context I can highly recommend the papers from John C. Coffee on the subject (Coffee J. C., 2004; 2002).

With hindsight the time-line-like narrative of the rise and fall of the Enron empire can be outlined in three 'phases': the *setup phase* (in which the company was setup, a certain culture emerged and certain institutions where put into place (who as we will see later played an important role it it's breakdown), the *creative accounting phase* (in which the failure of huge projects forced to company to apply highly creative accounting techniques to 'keep the stock-holders happy') and finally the *break down phase* (in which crucial information became available to outsiders, there was a major breakdown in external trust and earlier arrogantly introduced 'trigger mechanisms' let to liquidity problems).

The setup phase

Enron was the product of a merger between two classical US-energy companies: the Texas based 'HNG' and the Houston based 'InterNorth'. Driving force behind their merger was (Ph. D in economics and strong 'believer' in the power of the free-market) Ken Lay. Right after the merger he overturned the new company into working towards one-single goal: GET BIG FAST. At first Enron only mildly succeeded. All this changed when the company found a new visionary in the person of Jeff Skilling. Lay and Jeff Skilling came in touch with each other while the later was working on a job for Enron at Mc Kinsey and Company. Lay later hired Skilling and together they transformed the gas marked into a 'full blown trading market'. In the upcoming 'Enron glory years' the company grew dramatically.

In compliance with the still present 'get big fast'-strategy and a strong belief n the power of free-markets Enron developed a very specific corporate culture in these years. Keywords that have been used to describe this culture are: darwinistic, competitive, arrogant, big-spending, idea-driven and 'stock-value-focused'. Two vicious circles: the constant hiring of more 'smart guy's' i.e. 'free market believers' and second socialization[1] effects seem to have had a strong homogenizing effect on the culture of the corperation.

A second relevant institution introduced into the Enron environment in these years was so called 'mark to market accounting'. Especially Jeff Skilling is said to have pushed hard for the company to apply this new 'power

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[1] A quote from a veteran Enron executive is illustrative in this sense: "You could see the green MBAs coming in, so happy-go-lucky and innocent [..] Within six months, they'd become assholes" (McLean & Elkind, 2003, p. 335)

of ideas driven' accounting paradigm[2] (McLean & Elkind, 2003, p. 39). Two important differences between regular accounting and mark to market accounting are important to mention here. Mark to market accounting allows booking 'life time profits' from a deal on the day the contract has been signed, while traditional accounting books revenues as they 'come through the door'. Related to this mark-to-market accounting forces you to 'update' your profit whenever 'the market changes'. This means that unexpected profits or losses from a deal – for example due to market changes – have to be booked whenever information informing one about these changes becomes available.

Mark to market accounting has several major downsides which later proved to be important in Enron's breakdown. First, it is sometimes very hard to come-up with reasonable prospects (on for example the price of gas 10 years later). Because of this the value of a contract that is booked is subject to discussion (and manipulation, as we will see). Second, for the full profit from every contract is booked at the moment the contract is signed the company is forced to 'keep closing contracts' to be able to produce stable revenues (there is no stable flow of income).

Cultural explanations

Cultural accounts for the fall of Enron are widely spread. Cohan for example claims that Enron was rooted in a 'culture of intimidation' that made its employees reluctant to share crucial information that would have been needed to properly act towards accounting scandals (Cohan, 2002). The 'Powers report' (named after the chairman of the special committee on Enron's board that issued a report about the Raptors) mentions that Enron had a *"culture that appears to have encouraged pushing the limits"* (Powers, 2/1/2002, p. 28). Sayan Chatterjee states that early success *"contributed to arrogance that led to a simplistic formula for success"* (Chatterjee, 2003, p. 145). Coffee explains how markets have a tendency to become 'euphoric' and 'uncritical' in times of great prosperity (Coffee J. C., 2004) and how this helped Enron 'to get away' with a poor information distribution. Kulik sets out the show how the Enron's culture was 'rooted in agency theory', its executives had a strong 'homo economicus' inspired model of man, this helped them to legitimize and promote selfish behavior (Kulik, 2005) . Sims and Brinkman claim that while business ethic codes were in place as a 'status symbol' these codes did not prevented unethical behavior. They show how 'self-deception' and the accumulation of small steps in the long run lead to 'very unethical' behavior (Sims & Brinkmann, 2003). Langevoort makes similar claims when he describes Enron its 'hyper-competition-culture' that let to over-confident, egocentric behavior, how claims that Enron its promotion structures let to the selection of people with a high 'ethical plasticity' (Langevoort, 2002).

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[2] When the SEC (U.S. Securities and Exchange Commission) told Enron that it would not object their use of mark to market accounting 'Skilling was ecstatic' *"he quickly gathered his troops [..] [and] brought in champagne"* (McLean & Elkind, 2003, p. 39).

A third important institution were Enron's incentive structures[3]. The focus on the value of the stock and the importance of signing deals was reflected in these structures: Enron management was paid high above average salaries and received large amounts of delayed stock cashing options as bonuses. Enron personnel was highly stimulated to invest in (and partly compensated with) Enron stock options (for those who were still not convinced Skilling had stock counters installed in elevators, hallways and cantinas). As a result Enron employees had strong incentives to act as such that the stock would rise[4]. As, under the mark to market accounting paradigm, singing deals was of crucial importance. Enron bonuses where mostly paid after signing deals[5] (not after successful completion of projects).

Second, the creative accounting phase

After a couple of years Enron's first mover advantages (related to Skilling's brilliant idea of gas trading) started to wear off and it was urgently exploring similar structured markets[6] in search of 'its new Enchilada'. And although the outside world - including stock-holders - was completely oblivious about this, Enron was getting into trouble, despite loads of good ideas[7], Enron was having a very hard time in successfully completing most of the projects it initiated in

Culture, incentives and failing projects

There appear to have been several relations between the company's culture and incentive structures on the one hand and the failure of projects on the other. Considering the culture one might claim that the arrogant, idea driven and big-spender culture let Enron employees in a sort of 'all or nothing' morale considering their projects. It can indeed be observed that Enron excluded itself with high risk and high costs projects . Enron's motto was *"it doesn't matter what you cost, it matters what you make!"* (ex Enron employee in (McLean & Elkind, 2003)).

Considering the incentive structures it is important to note that the little returns from Enron projects might be related to the payment of bonuses when closing deals, not when successfully completing them.

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[3] Since Enron executives where 'educated' in agency theory (Kulik, 2005) these structures can be considered to be deliberately constructed.

[4] Note that there is a certain public good problem present here, 'what does my contribution really add to the value of the stock' this does indicated that there must have been some additional structures present to explain Enron personnel their 'focus on the stock-value'.

[5] The book of McLean and Elkind is filled with examples of enormous bonuses being paid to central figures in the organization for projects that failed miserably afterwards.

[6] Highly inefficient markets with 'pay or go' contracts, related with an infrastructure in which one could relatively easy get an information position and relatively homogeneous goods that would enable risk deduction by including small production facilities within the own control structure.

[7] Many of the markets that where explored / initiated by Enron in that time have proven to be major growth markets later on.

this search. Among others, the *Dabhol project* (huge power plant project in India that failed, costs to build: 2.9 bn), *Enron Broadband Services* (a failed attempt for broadband trading), *Enron Energy Services* (a project initiated to profit from liberalized energy markets by selling energy to directly to end-users) and Enron's *video on demand* projects where highly problematic.

What happened next is highly understandable but proved also proved to become highly problematic over time. Every time the 'end of the quarter' was closing in and Enron was having troubles 'making its numbers' (numbers that Jeff Skilling had promised to the stock-holders) a memo would go around and the company's would go into a sort of 'short-term money making frenzy'. Contracts were quickly signed and internal accountants where asked to 'have a look' at the project prospects with the implicit question of coming up with a way to book some extra profit from them.

Over time, and quarter by quarter, everybody became increasingly creative: revenues were booked from projects which were already known to be failing and additional losses where almost never booked[8].

Over time the problems grew and the company had to find new ways to make its numbers. The solution to this problem came

The failed monitoring explanation

Since Enron was capable of applying fraudulent practices for more than two years, one is forced to conclude that several monitoring devices and governance mechanisms (auditors, analysts, debt rating agencies, SEC) miserably failed. How can this be understood?

Coffee (2002; 2004) shows how the expected liability costs with gatekeeper participation in managerial misbehavior for each of these 'reputational intermediaries' went down while the expected benefits went up. Since auditing firms, under the 'Internal Revenue Act', were only allowed to receive a restricted cash compensation many of them diversified their services to include all kinds of consultancy like services. The existence of these 'other benefits' strongly influenced auditors their motivations . Enron was indeed a huge client for Arthur Anderson (Enron its auditor) (it accounted for roughly 27% of the fees of the Houston office (Healy & Palepu, 2003, p. 15))

And I was not only Arthur Anderson that failed, analysts (analyst act as specialized and knowledgeable investigators for stock-brokers, searching for clues, analyze trends and looking into financial statements to inform their customers which stock to '*buy*, *hold* or *sell*' advise) and dept rating agencies (whose job it is to focus on one thing: the ability of a company to pay back its dept) both 'should have seen red flags already years earlier ' (Cohan, 2002, p. 276) but didn't. More striking even might be, that even when Enron began its fall, both analyst and credit rating their positive classifications remained unchanged . Only when pretty much all hell broke loose their advices where changed (McLean & Elkind, 2003).

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[8]   The fact that Enron personnel all had Enron stock made this behavior not only profitable for the company but also for themselves. It is important to note here that the internal culture and 'group think' effects have seem too been as such that no one within the company was really perceiving this to be 'a bad thing' (Sims & Brinkmann, 2003).

in the person of Andy Fastow. Andy Fastow became the head of what was known as the 'Global Finance Group' in the spring of 1998. He was a hard worker, not perceived by everyone as being the smartest guy in the company, but he had one important expertise: setting up legal constructions to shift revenues and losses between different entities to 'smoothen out fluctuations in the market'. And though it was know at Wall Street that Enron was applying loads of creative accounting methods, under the hands of Fastow it soon turned uglier than anyone had ever expected.

Under the mark to market accounting paradigm Enron was expected to book correcting losses for failing projects, but since so many projects were failing and the company was already having a hard time making its numbers Fastow was looking for ways out. What began with an opportunistic delay – 'let's book this losses next quarter' – later turned into the use of constructions that *"defied the laws of accounting gravity"* (McLean & Elkind, 2003, p. 151). Fastow created 'off balance sheet vehicles' - internally know as the 'Raptors' - that could be used to make dept disappear by parking it at non Enron ventures. Since under US legislation at least 3% of these corporations had to be owned by 'non-Enron entities' (and it was very hard to find investors for these extremely high risk corporations) Fastow was allowed by the Enron board to invest his own money into these ventures (Powers, 2/1/2002). In addition he created a group called 'the friends of Enron' that would provide the needed 3% for his future constructions. When even the 'friends of Enron' pool ran dry, Fastow power-played (Enron was a huge player so banks had good reasons to stay 'friends with Enron') several banks into investing in the Raptors.

Investors were compensated for the efforts with Enron stock options. But due to the high risk involved with the Raptor investments banks and other 'outside investors' negotiated a additional paragraph into the investment contracts: since the Enron stock options would not be worth anything when the Enron stock would fall they wanted to receive their stock-options in cash whenever the Enron stock or the Enron credit rating would fall below a certain level. Although this would prove to be fatal later on, Fastow agreed (McLean & Elkind, 2003).

The breakdown

For a good two years the applied strategies (including its semi-fraudulent structures) 'worked'. The fact that Enron 'made its numbers' every quarter, together with a very well functioning public relation apparatus, had a very positive influence on the value of the Enron stock (it boomed from around $20 in spring 1998 to $80plus in the winter of 2000 (Healy & Palepu, 2003)).

This of course could not go on forever; and in didn't. In the winter of 2000, just after Jeff Skilling succeeded Ken Lay as CEO, the company was getting into even more serious troubles: the Dabhol project produced its last

puffs, Arthur Anderson (Enron's auditing firm) increased its pressure on the Enron board to keep an eye on the 'Fastow constructions' and hedge funds investigators started doing research on Enron.

The first hints towards cracks in the Enron foundation became visible when Fortune magazine ran a story, on 21 February 2001, called 'IS ENRON OVERPRICED'. Fortune was asking questions about the transparency of Enron's financial statements. On this day something that did not happen for a long time began to happen: in the 7 days after 21 February 2001 the Enron stock sank from $82 to $68.50 (Healy & Palepu, 2003).

This first decline in Enron stock had severe consequences: it affected Enron's trustworthy reputation and led to serious problems with the Raptors. Enron, normally always successful in presenting itself as a very trustworthy 'no need to ask questions' investment, all of a sudden was forced to answer all sorts of troublesome questions. Not all questions were easy to answers and some (for example about the success of several projects and the company's financial transparency) were plain-out too painful to answer honestly. Enron's unwillingness to answer certain questions, together with the answers that were given led to a further decrease in the value of the Enron stock (Coffee J. C., 2004).

> ## The information flow explanation
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> Several scholars, including Cohan, Coffee and McLean and Elking also pointed towards an alternative (and sometimes complementary) explanation: the existence of problematically bad information flows in the Enron cooperation itself .
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> Cohan (Cohan, 2002) discusses several internal dynamics of Enron firm that contributed to the failure of knowledge conditions. He claims that the Enron board had strong difficulties monitoring the operational level due to narrow information flows and a 'culture of intimidation' that kept people form openly expressing doubt or skepticism. He relates this to the 'law of diminishing control' and shows how deliberate manipulation of information and pursuing 'sub goals' by lower level employees led to very problematic knowledge conditions. All this led to *"belief perseverance, confirmatory bias, entity effect, motivated reasoning, group cohesion or "groupthink." the false*

All of the above was severe, but still happened in relative ease. The first major blow came when Jeff Skilling, without any warning, suddenly decided to resign as CEO. Whatever his reasons; on August 14 – the day that his reassignment was made public - the Enron stock plunged to about $40 a share (McLean & Elkind, 2003). In the upcoming months Enron was struggling to solve its problems, it was under enormous pressure to 'clean out its booth' and was trying to get rid of some of its most troublesome constructions. After the Washington post ran a story about the Raptor construction Andy Fastow was fired (and the Enron stock took another blow). As McLean and Elkind state *"in the post-Skilling are, Enron's new mantra was: "We'll be honest""* (McLean & Elkind, 2003, p. 363).

And although they really tried, Enron was not capable of solving its problems. This, combined with overall drops in the value of stocks in the aftermath of the 9/11 World Trade Center attacks, led Enron into another of its self-digged pitfalls. A pit filled with Raptors! Though the Raptors were already sputtering earlier, the final blow for Enron 's liquidity came when the decline in the value of the Enron stock activated the 'triggers' in the Raptor constructions (remember the negotiated capsule about cash payments in the Raptor investment contracts?). Enron was forced to do huge cash payments to the Raptor investors.

At the end of October Enron was realizing that the unbelievable had happened: they had ran out of cash. Although some last attempts were made to save the company (mergers, lending money) the enormous uncertainty about the company's actual value and the corporate culture had their final revenge. As Watson (a Dynegy CEO involved with a possible saving merger) later remembered *"The banks weren't stepping up the way Enron needed, thus making the repayment of all the debt impossible. It just wasn't going to work. And I also had a bellyful of Enron. I didn't trust any of its numbers, and I didn't want anything to do with its culture. At the end, you couldn't give it to me"* (McLean & Elkind, 2003, p. 403).

After four final days in the land of the living dead, Enron filed for bankruptcy on December 2, 2001.

Social dilemma accumulation

The world was shocked! What had happened? How could 'we' make sure that nothing like this would ever happen again? During the yearlong aftermath it has been generally concluded that the fall of Enron would not have happened '*if only'*: Enron's culture would have been different, the monitoring mechanisms would not have failed, the executive compensation would have been different and if the Enron information flow would have been better. Although not denying the importance of these explanations (the all important Sarbanes-Oxley act, which entirely transformed US accounting regulation was largely based on it (Coffee J. C., 2004)) it is important to note that all these accounts primarily explain how Enron's 'fraud' might have been forestalled not the more fundamental problem of its project failure. Since the project failure was the main reason that Enron started to apply fraudulent accounting practices it is important to study this process. In this direction, Sayan Chatterjee has given a top down explanation of how 'strategic mistakes' that Enron executives made let to the failure of many of its projects (Chatterjee, 2003). I would like to extend this analysis with a sociological reflection of 'bottom-up' process that seem to have contributed to this.

We have seen that the accumulation of several severe problems led to the failure of the majority of Enron's business projects. Enron thus seems to have been troubled by very limited problem solving capacities. This

brings us to a central question that has not been answered in the available literature thus far: why was problem solving so hard for Enron[9]?

In highly complex business environments like Enron's, loads of problems emerge every day. Some of these problems can be solved easily, in the sense that certain courses of action can be formulated and implemented after which the problems are solved. As commonly recognized in organizational sociology the complexity of problems strongly increases when agents start to become dependent on the actions of others for achieving their goals (Peterson, 1993; Williamson, 1981), i.e. when there is strategic interdependence between agents.

One could distinguish three types of interdependence relations that are relevant in this context: 'cooperative', 'mixed-motive' and 'competitive' interdependence (Liebrand & Lange, 1989 in Steur & Wittek, forthcoming). These interdependence relations give rise to related cooperation problems, that in their turn can be distinguished into five types (Steur & Wittek, forthcoming): *coordination problems* (where different parties strive for the same goal but need each other to attain it), *bargaining problems* (where resources have to be divided between different party's but there is a common-interest to avoid conflict because both parties will be better off in case of successful cooperation), *social dilemmas* (where there is a mutual dependence relation between the actors and a conflict between the individual interests and the common interest), *trust games* (where agents play a multiple-stage game where each individual has to choose between trusting / not trusting and the expected utilities are a such that there is a one-side prisoners dilemma situation (Buskens & Raub, 2002)) and finally *pure competition* (where there is a zero-sum situation: the interest of both parties are completely opposed, utility can only be gained on the expense of the other party). These five 'game types' have been widely studied and differ in their complexity and the ease with which they can be solved (Steur & Wittek, forthcoming).

Though every organization has to deal with solving cooperation problems there are several reasons that point towards Enron being specifically vulnerable to these types of problems. As James Coleman, and several scholars following in his footsteps, have recursively argued: trust is crucial for cooperative outcomes from these kind of game theoretical dilemmas (Coleman, 1994, pp. 97-99, 309). The available descriptions of Enron's culture (Langevoort, 2002; McLean & Elkind, 2003; Sims & Brinkmann, 2003) seem to suggest that its culture was not as such that it facilitated 'solutions' to cooperation problems[10].

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[9] Not denying that there already some hints in the descriptions of Enron as 'a culture of intimidation'.

[10] Specifically the influence of Jeff Skilling and his 'Darwinian' management views might be interesting here. As one of his early hires remembers *"Jeff could care less whether people got along with each other [..] in many cases, he felt it was better*

The study done by Steur and Wittek suggests that reorganizations have a tendency to 'produce' these kinds of dilemmas and they show the severity of the problems (at least: when cooperate managers do their work) tends to decline over time (Steur & Wittek, forthcoming). Related to their observations it might be important to note that the dynamic culture of Enron (many reorganizations, setting up new departments in matters of months (McLean & Elkind, 2003)) was such that one would indeed expect a relatively emergence of social dilemma situations.

I would like to label this hypothesized process 'social dilemma accumulation': an increasing prevalence of (social) dilemmas within organizations over time due to lack of problem solving capabilities of the organization (which in the case of Enron presumably was related to its low-trust culture). Having set the stage, the rest of this paper will be spent describing a possible methodology that could be used to scrutinize this hypothesized process of social dilemma accumulation.

Part 2: Method

Specifically, if a dilemma-accumulation-like process indeed took place at Enron the primary pattern that one would expect is an increasing prevalence of social dilemmas over time (since dilemmas then would emerge faster than that they could be 'solved'). Complementary understanding would be gained by looking more into detail at a possible relative increase in 'severe' game theoretical situations (like pure competition and prisoner's dilemma like problems) over less severe ones (like coordination and bargaining problems). In addition it would be fruitful to explore if this prevalence was particularly high in the specific 'failing departments' (The Dabhol project, Enron Broadband Services, Enron Energy Services and the failed video on demand project). Since there is still a lot of internal Enron text data available, (semi)automated text-analysis and so called 'cognitive mapping' techniques might be suitable methods for detecting these patterns. More generally, a semi-automated detection of game theoretical in available Enron text-data could be used to gain further insight on the strategic dynamics underlying / verifying / falsifying parts of the narrative as described in part one.

Data

One big advantage for those setting out to investigate what happened at Enron, is that there is a lot of Enron data available. What is of specific interest here is that (as collateral of the legal investigations after the

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if they didn't get along, since it created a level of tension that he believed was good for helping people come up with new ideas" (McLean & Elkind, 2003).

bankruptcy of Enron) a lot of text-data became available in the public domain: Enron staff e-mails (92% coverage, including headers etc), between October 17, 2001 and December 7, 2002. (This makes for a total of 1.368.775 emails). And over 85.000 records (150.000 scanned pages, (timeframe fall 1966 until June, 2002) of scanned pages of documents provided to FERC during the Enron investigation. Considering the expected occurrence of the phenomena in which we are interested (roughly 1996 until 2001) specifically the document data would seem to be most suited for our analysis. It has to be noted here that the representativeness of these documents can be expected to be questionable; the e-mail data seems more suited in that sense but unfortunately does not cover the periods of theoretical interest.

Dataflow and to be expected problems

The final goal of a specific analysis one could do with the here described methods would be graphs in which the prevalence of detected social dilemmas over time in a specific context is visualized. The input of this analysis is text-data that has been produced within these contexts. As a time stamp for the dilemmas one could use the time stamps of the document in which the conflict is detected[11].

I addition a (semi-automated) detection of social dilemma situations text data is needed. The proposed method is inspired by Steur and Wittek (Steur & Wittek, forthcoming) who use 'cognitive mapping' techniques (inspired by Anthony et al (Anthony, 1994)) to code social dilemmas in interviews (with bank directors of a middle-sized bank in the Netherlands) with the goal of gaining further understanding in the occurrence of social dilemmas during transitions processes in organizations. The proposed method elaborates on their method but is aimed at developing a further automated version of it.

To be able to classify the prevalence of a specific social dilemma in a text is it necessary to qualify concepts in the text into specific 'entity classes'. Entity classes are labels that will be assigned to concepts in a text that can be used for automatic processing of these texts.

The following entity classes have to be codified to be able to detect social dilemmas in text: *actors*, *general events* (including 'competition nodes'), *concession events*, *disagreement events*, *defection events* and *public good emergence events).* In addition also causal utility relations (if event 'x' happens this will have a positive/negative influence on actor 'y') have to be specified *between* these entities. Thus to be able to detect the 'game structure', utilities ('y' will profit / suffer losses', from event 'x') have to be appended to the event /

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[11] For this operationalization to be suitable one needs to expect that conflicts will be 'reflected upon' as long as they are present. When an conflict would be present but 'not discussed' it will not be counted in the suggested method.

actor ties. For clarity one specific case is shown in Figure 2 (the structure of different game types and the related entity classes are included in Appendix 1).

After the relevant text is detected (and connected to a time-frame in a specific social locus) the first step is to assign relevant entity classes to parts of the text. As an example we will use the following text (which has been copy/pasted from the BBC-news service website):

Figure 2.

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*UN envoy **ordered to** leave Sudan*

The UN's envoy to Sudan*, Jan Pronk, has been recalled to New York for consultations* *following Khartoum's demand that he leave within three days*

The following step is to apply entity class labels to the text. This has been done in the text above by labeling agents blue and events green.

What follows is defining the influences relations and applying utilities to them as will be shown in Table 1.

Agent	Events	Relations / utilities
A Jan Pronk, UN envoy	**C** been recalled to New York for consultations	C is neutral for A
B Khartoum's	**D** leave within three days	C is neutral for B
	E NOT leave within three days	D is bad for A
	F demand	D is good for B
		E is good for A
		E is good for A

Table 1.

In the final step the utility relations between the actor nodes, event nodes can be classified as being specific game theoretical events:
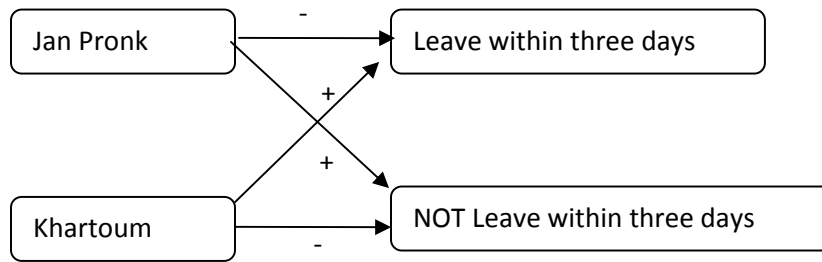
Figure 3.

Looking at the structures as defined by (Anthony, 1994)(see appendix 1) this is a pure competition game.

Following step 1 to 4 we systematically derived the presence of a 'zero-sum game' from the available text. What is important to note is that the events and related utilities under consideration here are perceived utilities, not 'actual' utilities.

The label the specific entity classes it might be possible to use the certain 'Conditional Random Field' algorithms developed by Jana Diesner at Carnegie Mellon University (Diesner & Carley, 2008). Although computationally challenging, after a certain learning period on already tagged data (supervised learning) these algorithms have proved to relatively successful (around 60% correct assessments) in labeling certain entity classes (agents, knowledge, resources, events, organizations, locations). This method seems to be especially successful because it uses the sequential character of human language in its learning algorithms. It has to be seen if this method is going to be successful in classifying the above described entity classes. Compared to the entity classes in Diesner's study the desired classes here are relatively specific (for example 'disagreement events', 'concession events'). Even if this indeed proves to be a problem a semi-automated method, where texts are automatically pre-coded and later checked by hand, seems do-able.

As the example showed the next step is to code casual utility relations between the actor nodes and the event notes. As far as I know this is very hard to do automatically, thus human intervention will be necessary in this step. Some steps have been taken in finding causal relationships between concepts in texts using casual 'statement formation rules' based on explicit statement concepts like 'is a' 'is part of' etc. These sort of techniques, combined with 'world knowledge' databases that contain information on possible causality between concept (' if A then B ' is 'allowed' when A is decision and B is outcome, but not when A is daffodil and B is crocodile) might again make a semi-automated method possible.

Applying utilities to this links seems to be very hard to automate. Although there might be some possibility in using connectionist models to look for hints towards positive or negative 'framing' of events by actors defining event related utilities for specific actors probably remains to be done by hand. An advantage here is that no cardinal utility is needed, ordinal classifications (based on a claim like: I would prefer A (not) to happen) already contain enough information.

I would like to remark that, without any extra checks, the proposed research project is strongly vulnerable to critique related to its imperfect coverage of the total overall occurrence of the specific social dilemma types we are interested in. The train of thought runs something like this: far from all social dilemmas that occurred have been documented, and far from all Enron documents (e-mails / memo's / minutes) containing references to these social dilemmas have been released during the Enron investigation – or where still existing for that matter. For those dilemmas that were documented and released the suggested automated analysis will then be an additional hurdle: even if the proposed algorithms are 'successful' only 60% of the entity classes will be tagged. Even if we presume the specific entity classes to be equally 'detectable', this will mean than just 13% (0.6^4, since 4 entity classes need to be detected for a successful identification of the specific social dilemmas of the present dilemmas be successfully identified. Even an 'optimistic' calculation will then look something like this:

From	To	Related proportion	Related 'error'
Occurrence	Documentation	0.5 *	?
documentation	released during Enron investigation	0.028 **	?
released	automated detection	0.13	?
Result		**0.00182**	

* optimistic guess
** very rough → 5000 employees, 140 available mailboxes = 5000 / 140 = 0.028

On basis of this very rough calculation we would expect only 0.2% of the 'actual' dilemmas to be successfully detected using the proposed method!

If one wants to be able to base any claims on these small numbers the representativeness / randomness of this 'sample' has to be made plausible. Relating to the occurrence / documentation step there 'is not much one could do', a possible suggestion though might be to crosscheck the results in specific context with available written accounts (some 'Enron memoires (for example Lynn Brewer her 'confessions of an Enron executive') are

available). On the documentation / release step more information gathering is crucial: what documents have exactly been released (one would expect strong overrepresentation of financial documents for example?). When this knowledge is available more specific claims on the representativeness of the available documents can be made. The last step (although far from trivial) is the easiest in the sense that a sample of the available data could be hand coded on social dilemma occurrence and the results can be compared (amount of false positives / false negatives) with the results of the algorithms, this will also help to detect possible under and/or over - representation of specific social dilemma types.

Working from the beginning to the end, what can we say about the do-ability of this research project? The outcome of the above representativeness analysis will probably lead to a go / no go decision for the rest of the project. The following step, getting the data into a format (.txt files with time stamps) that they can be analyzed is certainly doable. The third step: auto-coding relevant entity classes might be successfully automated using random conditional field algorithms, the specific success on labeling the desired entity classes is unknown but can be checked. The fourth step: defining casual links between the nodes and utilities to the nodes probably will need to be done by hand but computer assisted coding might prove fruitful here. Step five, the final automated classification of these entity classes, links and utilities into game theoretical labels again seems doable.

Conclusion / discussion

We have seen how a long chain of events eventually led to the bankruptcy of Enron. Most of the seeds that later grew out to be major hurdles, and unpleasant surprises, where already planted in earlier years in the form of Enron' culture, its incentive structures and its information flows. Work from scholars on the 'how and why' of Enron has provided plausible explanations of how Enron might have been stopped from its fraud, but not on why Enron did not succeed in producing successful projects (the major motivator for applying its fraudulent practices). It has been claimed that the accumulation of social dilemmas due to Enron its low-trust culture might have played an important role here.

Automated text-analysis using cognitive mapping techniques (that might be partly automated by using random conditional field algorithms) and other artificial intelligence techniques can be used to further scrutinizes the internal Enron processes.

The representativeness of the available text data might turn out to be too big of a problem to actually make the research project worth pursuing. In addition a lot of testing on the suggested methodology will need to be done before any credible results can be produced. Before the concept of social dilemma accumulation (and the

described methodological paradigm) could gain more general theoretical value its validity and explanatory it will have to be tested in other – non-Enron – cases.

Not denying this difficulties I hope to have shown how 'the story of Enron' has missing links and how 'the data of Enron' (and other longitudinal text-data for that matter) could be used to fix this link (and to gain understanding in the occurrence of social dilemmas over time and the relations between these dilemmas and organizational performance in general).

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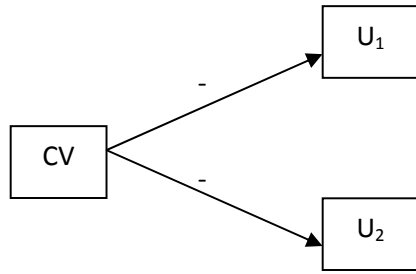
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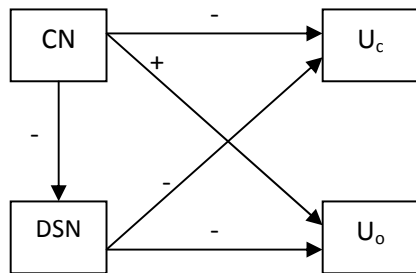
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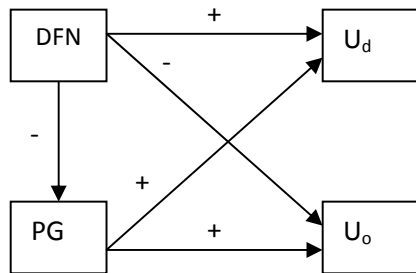
(a) coordination game

Legend:

- CV = Concept Variable

- U_1 = Utility of actor 1

- U_2 = Utility of actor 2

- CN = Concession Node

- DSN = Disagreement Node

- U_c = Utility of Concession maker

(b) bargaining game

(c) social dilemma