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From quasars to bus stops and numbers
– how a time-network is used and organised within accounting practice

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Abstract: This paper starts out with a study of accounting practices in a Public Transport Organisation. A performative perspective has generated some interesting findings and leads on to some points that can be made.

I have followed how activities in the organization have been translated and distributed with the help of actors and technologies. I can show that accounting practices are intertwined with the construction of time and place. The construction of time seems to be quite central, more so than a first glance reveals. It is a process that not only has importance for this organization, but also for many other parts of the world where human beings conduct activities.

Accounting practices are intertwined with the construction of time. Time construction is an essential process that creates its own network, which not only supports accounting practice but also re-creates itself. Accounting practice, in turn, rides on the time construction network, gliding into every part of our lives. Mostly, this takes place with little or no reflection.

This paper shows how non-innocent this taken-for-granted time construction is. In order to make it visible, it is necessary to go outside the organisation – and to take a plunge into the network, as it were.

Keywords: time, construction of time, accounting practices, network, technology.

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Introduction:

It is not obvious that a bus should take me, in time, to a place where I want to go, or that I have to pay money for this trip. What is needed is an organization that circulates (Latour, 1998). Public Transport Organization (PTO) is an organization that can bring this kind of circulation about. I have investigated activities there in order to make observations of how accounting practices come into being. I have also inquired into how these accounting practices are connected to other processes within the organisation. My studies are based on ideas from Latour (1998), expressed here as: following translations from "here and now" to numbers – and then back. The issue of accounting practice has been explored by many authors as an important point of departure for understanding accounting as a social practice (see e.g. (Hopwood, 1987), (Preston et al., 1992), (Boland, 1993) and (Chua, 1995)).

Inspired by the ideas of Latour (1998) and ANT, particularly the chapter "Circulating reference – sampling the soil in the Amazon forest" I have travelled to places, asked questions, looked at documents and made observations. These expeditions have led me to some interesting findings of which the construction of time was one. It turned out to be a network with much relevance. Latour (1998) points out that to make something durable and diffused, it has to be materialised and simple, like numbers. Numbers have a peculiar capacity of being able to lose every earlier identification (Crump, 1990) p.9) and thus travel lightly on an endless journey. The other side of this process is, however, that this simple construction gives rise to other translations and transformations, sometimes far from the original point of departure. Translations can take many different paths and meanings in different situations. Translations cannot be controlled. Still, to construct time as a distinct chronological event, to experience time as objective, it is necessary to see time as a numerical phenomenon. But I will also point to the importance of *Metamyths* of time which give some direction of what and how such translations (into numbers) can be made, if they are made at all.

I will start with a short summary of my stay in the PTO. This section will be followed by the presentation of the time network presented in three shapes: *Gregorian calendar*, *Clock time* and *Metamyth*. In the last part, I discuss the construction of time, its non-innocent character and its connections to accounting as a social practice.

Picture: Instruments and technologies used at the PTO

The PTO and time – some background

Tore, the bus driver

I followed Tore, the bus driver, one early morning and saw how he translates the timetable he has brought with him. We travelled through a landscape, picking up waiting people who are going to work, school or some other destination. Tore is a competent driver, not only because he handles the bus in an experienced way, an important capability for a passenger, but also because he is good at translating clock-time. It seemed that his body could automatically translate the movements as he drove the bus into clock-time. When a route was over, the time on his wristwatch and the specific timetable of that bus more or less matched. Tore translated every point on the timetable to routes that were specified by a list of specific time points and geographic names. Tore never drove the bus off the planned route – with respect to the geography or to clock-time. But it is not just Tore who helps to put clock-time in (re)circulation. It is all the people who take public transport. These people become passengers with the help of their own watches and by the timetable at the bus stop, as well as the timetable which is sent home to every household in the area. They become passengers when they go to a bus stop and board a bus with the correct route number. It is quite easy to see how time construction affects many people and connections which are remote from both Tore and his organisation.

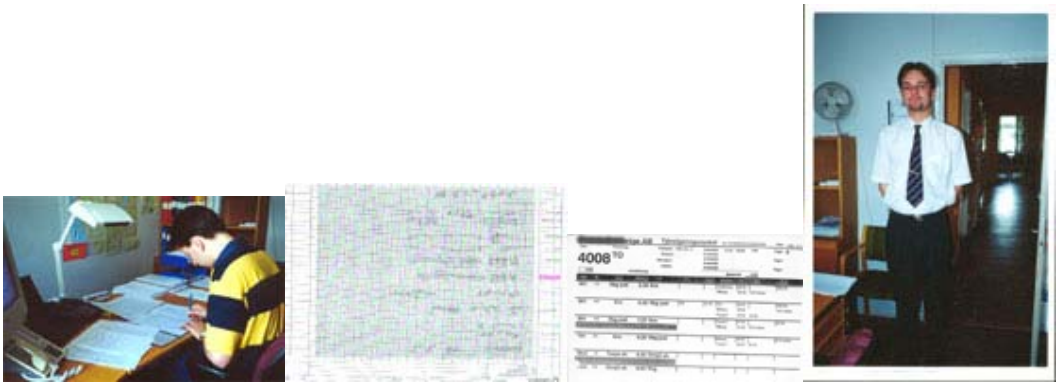
This observation made me curious about where the timetable came from. I went to the Authority which has control over the timetable. They "own" every route of public transport, in the sense that they decide what streets a route should take, where the stops are, the frequency of routes, which kind of buses are used, the design layout of the buses, and many more details. Through different packages of routes in a geographical area, with very specific details, they arrange tenders every 3rd-5th year and those who are interested can submit a bid. Over the years the bids have become more and more specified. The most important issue concerns the length and timetable

for each route number[1]. This is also specified by the Authority in each tender. The contract is then awarded to the successful organisation.

Schedules

The next stop was where the timetable was translated once again. The timetables from the Authority cannot be used as operational routes at the PTO. Something more was needed, something more locally based. Here again both calendar and clock-time were put into action in a detailed way. It is Peter who creates this at the PTO. Peter first takes each route (each of them from Monday to Sunday) and writes them down, now translated into a straight line on a special time- (chequered) paper. This paper makes it easy to translate every line back to specific time. He places some routes/lines more or less directly after each other. This makes some lines short and some long, or translated into time, lines are from 3 to 12 hours long. These lines are called duties. These duties are then moved to and connected with different schedules with a calendar as a reference. This schedule also includes days where no duties are planned. All this information is put into a computer program that is crucial for the translation. This program is intertwined with bus drivers through employment arrangements. Each driver is connected to a specific schedule and has her/his own number (every driver becomes a number). If several drivers connect to the same schedule, each driver has her/his own line to read from, where different duties and days off move in line with the calendar. The first duties she/he starts with will always repeat on the same weekday, like a small time-circle. In this way, every driver will be connected to routes on specific days, which makes the calendar a glue between drivers, routes and days off. Or as Zerubavel (1981) says at the end of his book, it is the calendar and the schedule that are directly responsible for much of the rigidification (author's term) of our lives, but at the same time they can also be seen as the foremost liberators of the modern individual. With the help of a computer, it is easy to keep track of the calendar and to (re)construct time. For the driver, the schedule is also a connection to compensation, a connection that also works in the opposite direction when something disconnects them – for example, sickness or a computer failure.

[1] Here a route means one specific time and geographical distance between A and B, = route no 1. When the bus goes back from B to A this becomes route no. 2. When many routes are drawn together they are translated into a whole route number, for example 64. A route number represents a specified journey with a destination. It is the route number that passengers connect themselves to and can identify on the bus and timetable.



Pictures in following order: Peter working with schedules, a time paper, schedules, and Peter now also working as a bus driver ready to translate his own work into "here and now".

By these kinds of planned activities, drivers, buses, time and space are connected. Still, each day these connections have to be translated anew. Besides Peter who works with clock- and weekday time in a long planning horizon, there are more people who try to support these kinds of translations in order to make them real. This was my next stop. The text below shows different situations in one day.

A day at the traffic office

Lars is busy putting replacement buses in circulation so that the exchanged bus can go for service. He also organizes routes and sees that each route is translated into "here and now". The room he is sitting in is filled with timetables, telephones and two computers.

Picture: The traffic office

One of the computers is used to view and adjust the work which Peter has done. The other has a connection to all buses which have a mobitex (mobile phone system). On the screen Peter can see the bus number, the route number and the driver as a personal number. The clock-time is 10.55 and the phone is ringing. One bus driver calls in sick. The route he was to drive starts at 15.00. Lars has four hours to find another bus driver. Right now there is no extra bus driver. Lars has to make some phone calls. The phone rings again. This time it has to do with buses. There is

now one less bus available. Lars talks to the bus driver, Hans, who will have his bus exchanged for another one and at the same time Lars asks him about his wife, Helen, who is also a bus driver. Will she be willing to drive a bus on her day off? She will be at the depot to see him about 11.30. It is now 11.30 and another person calls in sick and that person's duties begin at 14.28. Only three hours left. No solution is in sight and the planned translation is about to fail. All decoupled routes are written down on a paper (they are decoupled in the sense that driver and routes/buses are separated). This decoupling is also registered in the computer.

Helen enters the depot and Lars sees her immediately. He tries to convince her to go to work. The connection he is trying to make is not about money. It is about helping one another, but also about the fact that such help makes the PTO function:
Lars: You start your route at 15.00!
Helen: Oh yeah?!
The tone between them is friendly and suggests many earlier meetings. Lars notices her hesitation, but continues:
Lars. Good. I will write it down now. It is ink and it is not possible to erase it.
Helen: Your plan is that I drive this route?
Lars. Yes. The last time you drove a route, you forgot the way. We must prevent this from happening again, don't you think? Have you driven this route before?
Helen: Yes, I have.

One problem less. Lars deals with the present routes and with tomorrow's. Today he can *see* on the monitor the results from Peter, and all drivers as a personalised schedule file. He can also see routes on the paper that he has printed out. This gives Lars an overview of connected and disconnected duties for tomorrow. Some drivers are missing compared to the plan. He tries to solve this when he can. But there is another kind of problem. For example, some drivers do not know the real geographical routes they are scheduled for. In other words, they can not translate the planned routes into "here and now" properly. So Lars tries to change routes between bus drivers who know the routes better and thereby bring about the desired translation. At the same time a driver calls and informs Lars that he cannot do tomorrows planned route. More routes are de-coupled. Lars continues to make calls.

Lars: Hello, are you awake now? (--------)
Lars: Have you baked any buns today? (--------)

Lars: Well, I am not fussy. (--------)
Lars. I would like you to start a bit earlier today. At Lakestreet 14.28? You will have bus number 3533. (--------)

The day goes by. Lars tells me that those who work here at the traffic office know the traffic very well. Most of their knowledge is inside their heads. Lars thinks that this knowledge is not appreciated by the main office. He gives me an example: one route is crowded during the summer, and extra buses are planned for this reason. The PTO organisation's main office had a strong opinion about the time this extra bus should run and made a deal with the Authority accordingly. Lars had another opinion, based on his long experience with bus traffic, including this route number. But the main office would not listen to Lars and as a consequence, the extra bus was nearly empty while the crowded regular bus had to leave people behind.

Increased pressure and time

Next I visited the workshop and saw that they are also organised around the calendar- and clock-time, those schedules that came from the Authority and were translated into local situations by Peter. The problem is always how to keep the operation running, or, to put it in other words, everything seems to circulate around the timetable by referring to the Gregorian calendar with a small modification. The Authority and the PTO use a variation of the Gregorian calendar, a transportation calendar (see below), to construct public transport. During timetable A most transportation is carried out and during timetable C less transportation is carried out.

Period of Timetable	From	to
A timetable / winter timetable	School starts year 1, week no. 33 in August.	School finishes year 2, week 24 in June
B timetable /summer timetable	School finishes year 2, week no. 24 in June	The industry holiday year 2, week no. 26 in June
C timetable / summer timetable	The industry holiday week year 2 week 27 in July	The industry holiday week year 2 week no. 31 in July
B timetable / summer timetable	The industry holiday, year 2, week no. 32 August	School starts, year 2, week no. 33 in August

Source: Specifications from Västtrafik Ltd.

As previously noted, many of the activities are translated into money terms through time and space constructions. These activities are translated into equivalents with cardinal numbers, so that

when these associations are accomplished and stabilised, they can be easily exchanged with one another.

One important number is the number of kilometres driven by Tore and other bus drivers: this is what they will get paid for[2]. The question is, how many kilometres? On one hand, it is quite simple because kilometres are already defined by the Authority. For those kilometres driven, the PTO organisation will get so many kronor, in accordance with the winning bid. But how to collect these connected planned routes and the "here and now"? A solution is to place an instrument in each bus, by negotiating how long the distance between A and B really is, and determining how many routes have been driven. Let me explore this point about kilometres a little further because it was related to an increased pressure that the PTO was facing. This has to do with the new owners and with changes made by the Authority and which they associated with time.

The new owners

The new owners are not Swedish. Their interest is translated into expected profit figures. These figures translate into the PTO's budget. Budget figures, according to Karin, the accountant, and Olof, the manager of the unit I am visiting, are based on a misunderstanding, to put it politely, of how public transport in Sweden is organized. Olof says that the new owner had an image of the PTO as a state-owned organisation, with lots of dead weight, which they easily could get rid off make some money. This misunderstanding was also reflected in the price the new owner paid for the PTO organisation. But they made a mistake. The Authority, as a spokesperson for citizens' needs, has for many years run detailed tenders in a very competent way. The only thing a bidding organisation might do is to offer the lowest price, because every other variable is already defined. Winning a bid is the only way a transport organisation can obtain routes and money. A contract is in effect during a period of 3-5 years. The price is indexed, but unfortunately this index does not reflect the combination of prices that a transport organisation has. Wages are a big part of the costs, and when wages rose, the index did not in the same way. The way of organising transportation was the same in at least 10 years, while in this time the price for the service declined and so did the profit for the companies involved[3].

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[2] This payment could be seen as a balanced reciprocity compared to universal reciprocity according to Crump, T. (1981) *The phenomenon of money,* Routledge & Kegan Paul, London. The former is more economic and when tested pragmatically, there will be an intolerance of not to be able to create two way flow under given period of time. The latter is when expectations of receiving direct material certainly is improper. In this case, the expectations of reciprocity are imprecise and infinite with respect to time, quantity, quality.

[3] According to the 1998 statistics of the Swedish Bus Federation (a trade union), public transport (routes and school buses) in the whole country had a turnover of around 11 billion SEK per year. There were 630 valid contracts. 50% for 4-5 years, 12% longer,

Another misunderstanding that Olof pointed out was that the owners' home country has a differently organised public transport. Their Authority does not dictate every detail and is not the spokesperson for citizens' needs. All this is up to the so-called market. Thus the owners demand numbers that have little, if any, connection to the situation in Sweden. Actions cannot be translated into the numbers the owners want.

It will be Karin's task to handle the money numbers. She will control which numbers enter the accounting program in the computer and later become inscriptions on paper, i.e. the reports. She knows they are important and sooner or later will claim some kind of relationship with her unit. (see Robson (1992), on the power of inscriptions). Karin tries to act as a gatekeeper with respect to what numbers are to be recorded. This is not an easy task. Many of the numbers are created by the computer, and are automatically transported to the accounting program. All wages and all extra charges related to the payroll will immediately be transported through wires to Stockholm and the headquarters.

Karin tries to keep a close watch on the actions. She wants to know and *see* the associations between "here and now" and the numbers that are produced. This is not a popular idea at the main office. Nevertheless, she is the one who counts the kilometres driven and sends an invoice to the Authority each month. The cancelled routes will not be reimbursed and they will also be punished with a fine. If the PTO forgets to notify the Authority about excluded routes and it is discovered later, the fine will be much higher.

The invoice is worked out in two ways. Each month the numbers referring to kilometres according to plan are reported. This means that all routes together represent a certain amount of kilometres per weekday. But there are different kinds of weekdays. At the PTO the weekdays of each kind in the present month are counted and then multiplied by a price per kilometre. They can charge 90% for these kilometres. The remaining 10% will be charged every third month when they have checked cancelled routes and extra routes and the nation-wide used Consumer Price Index (CPI). The PTO has succeeded in convincing the Authority that the CPI should be replaced with a combination of 50% Labour Price Index and 50% CPI.

30% shorter, while 8% was automatically renewing contracts. In 1999 the same federation made a study from all transport organisations' annual reports and made the conclusion that the result for the whole line of business was negative.

Every month, at a specific date, Karin will definitely be at the main office when the income statement will be prepared. On a special date at a certain time, the accounting program closes: no new numbers may enter the computer. If the postman has not arrived, if an invoice has not been signed, or if another subsidiary has entered the wrong identity number, it does not matter. The program is closing and the numbers printed out will provide an argument to change how things are done for the owners. Numbers count and it does not matter if they are associated with mistakes or with kilometres driven. It is as Czarniawska (2000) well illustrates: the difference between "fictitious" and "factual" is never obvious or stable. Another problem is that the resulting numbers cannot be transported to next month, since every month a number is finalised. Numbers are then compared to a budget.

A budget could be said to be a construction which images the future as if it could be handled and controlled in the present (Ezzamel and Robson, 1992). It is a construction which has an impact on what must be done in the present, and on what numbers must be shown at present. This is why Karin wants her own direct connection in order to create her own argument in time which she will present to the managing director. The solution is to watch the actions directly and use this observation to hide numbers if necessary – until another month comes. Look now, results are much closer to budget! Still not close enough.

The Authority

The Authority decreased the space of negotiation and as a result controlled and defined kilometres even more. In 1995 a clerk from the Authority was given the task of improving the database they used for the public transport, starting with a geographical area of a city and connected route-numbers. The problem was identified as the uncertain length of kilometres of each route. Earlier it was the transport companies that informed the Authority of how many kilometres they had driven. Now the Authority wanted to be in charge of the kilometres. Thus, what they needed was a new instrument. Earlier they used a small measuring wheel which they drove over a map. The number shown on the wheel became the kilometres between points A and B, as inscriptions, and as a reference for each bid the Authority declared available. This instrument was not very precise. It gave space for negotiations. Now the Authority used the Global Positioning System (GPS) instrument instead. They GPS-measured each post in the city area, bus-stop by bus-stop, and drove and measured each route. They discovered that many routes were quite in line with the old numbers, but those routes passing through the city area were often associated with wrong numbers.

The Authority had also bought a map-program called MapInfo from the Swedish Landsurveyors Agency's organisation called Metria, which they resell. Those maps are also measured and produced with GPS. With this special program in a computer, all roads in the area were now available for easy handling. With the help of this map the Authority created a net of routes with many connections where each length between two connections had a GPS defined length (see picture below).

Picture: Mapinfo in use

Picture: A closer look at Mapinfo

The next improvement was an algorithm which calculated the shortest way between points A and B, as there could be more than one road between two bus stops. The algorithm ended this choice – it is not by chance that it is called "the shortest way algorithm". But when the Authority wants the bus to go another way, they can eliminate the algorithm's choice. For example, when the Authority knows that the shortest way will take more time to drive because of queue and heavy traffic. It is these kilometres which are inscribed in numbers which can be found in the new database (see picture below).

Picture: The server where the database is placed

As the Authority knows that the measure they made by GPS and the map are equivalent, it will be enough to have one person continue this work, but only with the help of the computer map. This situation has enhanced the Authority's position vis-à-vis the transport companies. Now they specify nearly all details such as colours, and types of buses and routes are GPS-defined and controlled in such a way that the PTO has a difficult time arguing against them. It is not the only thing to argue about, but the calendar and clock-time are taken too much for granted (even though not translated in a homogeneous way). The space for negotiation is reduced which makes the situation more difficult to deal with for a transport organisation.

The length of clock-time that the bus drivers have to drive from point A to point B is another story. It is based on historical experience, i.e. driving the route and taking the time. These timetables refer to a more general timetable that the driver will take with her/him to the bus for translation. But this is not an easy task – to translate from a general timetable to the "here and now" situation – when such things as the roads conditions, the condition of the bus, and number and type of passengers this specific route will have, will influence how long it takes to drive the route. I asked Dragan (a bus-driver) whether there are many passengers on this route:

Dragan: Not on Monday to Thursdays but on Fridays. Then the bus will be full. The schools finish early so they will choose this route. The time to drive to the end station will not be enough. I will be late.

A very long list of reasons why a general non-local timetable cannot be translated correctly each time could be written. Still, the translation is necessary if this kind of public transport is to exist, and to become an object of a public tender. The winning organisation will later be given this timetable and other details on a CD, a paper document or a disc which they can translate into their own activities, as Peter does. In this way, both the bus organisation and the Authority have the same timetable and kilometres.

Time construction comes into play from many directions: organisation of kilometres, routes, money and accounting. Accounting is not the driving force for the translation of time, but rather an actant that helps to define time and distribute it by its well-organised production of numbers. In this way, accounting can organise its own practice and that of the other operating activities in the organisation (Loft, 1990). One could say that accounting as a practice of translation

accentuates and makes use of this time construction in a very effective way and at the same time (re)constructs time.

I have tried to show that construction of time is heavily present and intertwined in the construction of organisations and accounting practices. It is now time to say something about the construction of time as a network. This is not to say that the translation and meaning attached to it by each person is the same, but that it has much importance. This finding of time construction led me to leave the PTO and follow this time network.

Construction of Time

Without materialising time in a detailed and durable way, public transport would be difficult. To construct, co-ordinate and distribute time takes several operations and translations which have lasting and wide-spread effects. Construction of time is accomplished by a network of many actors, objects and technologies – some of them with a scientific claim. Using the ANT-approach (Latour, 1998), I tried to follow how time is translated and thereby transformed, to show how this network is organised. I do not suggest that my analysis embraces everything. I only wish to show some part of this huge network, the connections and the technologies which make this construction materialise but also how non-innocent this taken-for-granted time construction is, not least because of its intertwining with the practice of accounting. It is a network which reaches and passes quasars, satellites and instruments connected around the globe.

A time-network

Everyone has experienced change that can be translated into time. It could be simple things like the rising/setting of the sun, the moon's different phases, the stars' movements in the sky, changes of seasons or life or others' death. The years, days and nights, months and even hours could be associated with nature. Eco (1999) claims that, more importantly, it has to do with our body. He argues that we can never exclude or ignore our relationship with our body in relation to a sense of time, simply because we are all ageing. I noticed this relationship when Tore was driving – his body through its movements in space could sense *a* time which could easily be translated into clock-time. But also, and more importantly, his body through space became a medium of time/space, thus creating a part of his life story.

Defined events are connected to terrestrial and celestial phenomena. These associations create a relationship and a context with a more stabilised and certain frame of reference, the "nature", and

reduce the temporary and uncertain character of what we sense as some kind of "event"("nature" is of course a problematic issue in itself, but this is beyond the topic of this paper). In this way "nature" contributes to a different status of the "event". Events may be translated into ceremonies whose scope reaches far away from the specific person and therefore can be seen as some sort of boundary to create a "we". The connections between definitions and "nature" help to organise our lives. Douglas (1986) points out that these connections are important when institutions and definitions are to be created. Often religious institutions have been behind the search for new definitions and calculations of time, originating from the desire of salvation and not the calculation of exact lapses of time as such (Crosby, 1997).

To organise time gives one a sense of control. It reduces the agony about the unknown, which could explain why days have to be counted. Without a calendar it is hard to remember events in the past in a structured way or to plan what is to come. To construct time as objective instead of time as a continuous flow, Crump (1990) argues that cultures have to translate time as distinct chronological events, which means giving time a sort of order which numbers can be applied to. The numbers can then be seen as a technology to help the translation between time experienced as distinct chronological events and time experienced as objective. With these small steps of translation, time expressed as a numerical phenomenon seems to be quite reasonable. Measuring time depends on two concepts: one linguistic and the other arithmetical. The connection between the two concepts goes through ordinal and cardinal numbers. The linguistic idea is to give names to different things, and the arithmetic is about measuring time for a specific purpose. Here Crump makes a distinction between what he calls traditional and modern society - a distinction that according to him has great importance for how to use numbers. Even though Crump (1990) or Crosby (1997) clearly does not make use of an ANT approach, they still have some points relevant to the time issue. So for this reason I interpret Crump's distinction between traditional and modern society, and Crosby's change of mentalité as different associations and translations as such.

One of these associations is about what kind of time it was, not how much time had passed. But the work of connecting the system of measures to ordinal numbers is very old, as it was seen as a method to create and consolidate a specific relation between numbers and a desired order. Time, astronomy/astrology and mathematics have become intertwined for this reason. Paradoxically, these relations of numbers and order have contributed to the mystery of numbers (Schimmel, 1994). Crump ((1990) p. 91) exemplifies the connection between order and numbers with an

example from Japan: to lose face is more than anything the consequence of making an arithmetical error. This, he argues, explains the almost Pythagorean respect for numbers as the basis of the moral system in Japan. Mistakes are deviations from order and thereby create disharmony.

To (re)construct, co-ordinate and distribute time demands a delicate handling of these issues. It is also important to create some kind of interest so that many connections between the actants can be made. One example is from the Nile Valley, and the production of grain. Keeping a record of all the assets this rich river created was seen as an enormous administrative problem for some. The construction of time around a solar calendar instead of the old moon calendar was one solution, but also a network of actants and technologies was developed to create a centralised administration. The annual flooding of the Nile is easily translated into a solar year, which transformed the Nile into a large solar calendar called the Nilometer. The former calendar was a moon calendar, based on the synod month, a calendar for a religious purpose. But the difference between what the Nile produced, and the moon calendar was too difficult to tackle (Spalinger, 1999). The Nile year, seen as a solar year, is hard to translate into the cycle of the moon because this cycle is 11 days shorter and soon lags behind both seasons and the solar year. [4]

Joerges (2000) refers also to Luhmann and his idea that chronological time is a way to create distance. The idea of chronology functions as a universal thought of evolution, whereby with a combination of simple rules with complex functions, we can say time comes very close to money. What we regard as before and after constitute some sort of axiom about time. For example, Dragan, the bus driver, talks about being late. Lars tries to find people to drive disconnected routes before it is too late. Karin has to organise her work because the accounting program is closing: all this is done with a time construction as a reference. The next section considers the issue of how the Gregorian calendar creates the "before" and "after".

Gregorian calendar or loose heterogeneous associations

If the Authority dated the timetable based on a different calendar there would be problems immediately, not only for the bus drivers, but also for all people with the smallest relation to a timetable and public transport. The table shows some alternative calendars and dates, with reference to the Gregorian calendar and date 1st of January year 2000.

[4] There are of course cultures which combine the solar year with the moon year, like the Jewish, Chinese and Hindu calendar. Ackermann, S. (1999) In *The story of time* (Eds, Eco, U. and Gombrich, E. H.) Merrell Holberton Publisher Ltd, London, pp. 48-51.

Date	Calendar
1 January 2000	Gregorian calendar
19 December 1999 *anno Domini*	Julian calendar
23 Tebeth 5760 (the fourth month)	Jewish calendar
24 Ramadan 1420 (the ninth month) Hijira	Muslim calendar
25th day of the 11th month in the year of the rabbit, and the 16th year of the current 60-year cycle.	Chinese calendar
25th day of the month of the Margasira in the year 1921 of the Saka era	Hindu, religious moon calendar
11th day of Pausa in the year 1921 of the Saka era.	Hindu, civic sun calendar

Source: *The Story of Time* (Ackermann, 1999)(p. 48)

Joerges (2000) discussed the survival of the Gregorian calendar, pointing out that this calendar brings together many unrelated things and meanings. This is an important point because when this time-network is visualised, it becomes obvious how fragile it really is. The Gregorian calendar is not perfect, but it works; it is functional. Often it has worked side by side with other calendars. Ackerman (1999) says that when China introduced the Gregorian calendar in 1912, it also used its old calendar for religious purposes. This flexible way of conceptualising human life can be one of the explanations why the Gregorian calendar and its imperialistic idea of time have survived in cultures where one would expect another kind of development. Flexible functioning in different contexts permits different interests to work side by side. This flexibility also permitted the calendar to be translated in a new context, with new technologies. Each new translation both threatens and stabilises the construction.

How has this calendar been put together? The moon was probably the first reference for a construction of a calendar used for religious purposes. The sun as a calendar reference is usually related to Egypt and the Nile with its annual flooding (Duncan, 1999)[5]. Around 753 BC, the Romans had a moon calendar which was 10 moons long (or synod months). The year was then only 304 days long. The first four of these months were given names after Gods. The following months were given names for numbers five to ten. Today we still translate three of these words as *Octo*ber, *Nove*mber and *Dece*mber (eight, ninth and tenth). But it did not take long before the

[5] There are different kinds of solar years, the tropical and sidereal. The tropical year has associations with seasons and the sidereal year is the time the earth takes to make one full circle around the sun with a star as a reference point. It is the tropical year which this text refers to, if not stated otherwise. It is the tropical year which often refers to the construction of calendars.

Romans included two more months and put them in front of the others. This is a reason for a disconnection between months and numbers. The year then had 354 days, and because even numbers were considered evil and brought bad luck, one more day was added. But even this new year, 355 days long, was not in tune with the seasons. When Julius Caesar brought the solar year from Egypt to the Roman Empire, their old moon calendar was chaotic. One reason for this resided with the priests who were in charge of calculating time and the calendar, and who changed it often with their own interests in mind. There were huge practical problems –nearly two months' difference from the solar year. To put the calendar in line with the seasons Caesar introduced the Julian calendar, with a fifteen month-long year. It included 90 extra days distributed through three extra months, one in relation with February, and two between November and December. This year became 445 days long, a very, very long year that created many practical problems and was therefore called "Annus confusionis" (Duncan, 1999), (Lippincott et al., 1999).

Caesar also moved the beginning of the year from March to January so that the new year would be more in line with the midwinter. This was not a new invention but it was too rarely translated before. He also changed the length of the months to give space to the extra ten days that were needed for a solar year, from 355 to 365. There were now 12 months with 30 or 31 days, with the exception of February that had 30 days each fourth year and 29 days in the years in between. To honour Caesar, the Senate changed the name of the month Quintilius (Fifth) to Julius. Later on, Augustus also wished to be honoured and changed the month Sextilis (Sixth) to August (Duncan, 1999). But this was not enough. Length was also of importance, which made him change August from 30 to 31 days like Julius, by borrowing one day from February. To avoid three months with 31 days in a row, Augustus changed the lengths of September, October, November and December. But something else also happened when the solar year was introduced. Instead of trusting priests for calculation of time and listening to egocentric desires from kings, a more secularised calendar associated with science was introduced (Duncan, 1999).

Even though this calendar was the best ever seen, it was still not perfect. One of the assumptions was that the length of the year was 365 ¼ days, whereas today the claim is 365,24219 (Duncan, 1999). This miscalculation was later on to be the reason for the next big change of a calendar – to the Gregorian in 1582[6]. The miscalculation with the Julian calendar was a problem because it was

[6] The Gregorian calendar introduced a leap year. It is a 400 year-long leap year cycle. – every year that can be divided by four into even numbers is a leap year (excluded from this rule are years that can be divided by 100 into an even number). Centuries are leap years if they can be divided by 400 evenly.

impossible to know when to celebrate Easter, a very important event for Christians. Already in 300 AC, the Julian calendar and Easter were too disconnected to satisfy Christians. And perhaps the Christians would have remained dissatisfied if it were not that Constantine needed an ally when the Roman Empire was crumbling. Christianity was connected in a network of ideas and beliefs, and this network could also function as a unifying force for the Empire. It was a belief that was not bounded by borders. Thus Constantine converted to Christianity and the Christians were now connected to a unique military force. The possibility for the Christians (Catholics) to build the church they wanted was then within reach, and with that arose an opportunity to save everyone. Through this alliance, the associations with the Christians' ideas of constructing time became strengthened and later on made a new calendar possible (Gregorian). One reason why Constantine chooses the Catholics could be the similarity of the organisation. It was easy to connect the Roman Empire's administration to that of the Catholics, as they both used a hierarchical way of thinking and organising[7].

This new alliance and association was made in 325 AC in Nicaea, in a congress when Constantine changed the earlier secularised power, introduced by Caesar, to a more religious association. It was decided that Easter should fall on the first Sunday after the first full moon (a Jewish tradition), after the vernal equinox. The vernal equinox was to fall on the 21st of March, although nobody really knew whether this was true in astronomical terms.

It is not easy to bring together the movements of the moon and the sun, and at that time, the knowledge was too limited for a correct calculation. As Joerges (2000) puts it: "The unpleasant truth: the regularities in nature are not numerical, God must have been a lousy mathematician when he created. The earth's rotation around itself and the sun, and the revolution of the moon cannot be expressed as even multiples of each other. Nature offers only fractionally to infinite decimal places here". This "defect" is what every calendar tries to improve upon. Also, at that time neither the place value system nor the 0 were in use, which certainly did not make it easier to calculate, with or without decimals (Crump, 1990, Ifrah, 1998, Menninger, 1992). So the problem of the miscalculation of approximately 11 minutes in the Julian calendar remained after Nicaea.

[7] Gnostics (100-300 AC.) had at the same time a very different view of Christ's actions, death, resurrection and the Bible. This also was seen in the different way they organised their activities. Catholics believed in a hierarchical way to organise and interpret the Bible but also to make their beliefs public. Gnostics did not really organise; it was more of a loosely coupled network, more individualistic, and more elitist: a person had to find their own insight into the truth. They also wrote their own holy texts. There were of course many discussions between the two groups of Christians. But after Constantine's conversion that made Catholicism a religion of the Roman Empire, the Gnostics disappeared and with them their holy texts. Some of the texts were found in 1945 in the desert of Egypt. Pagels, E. (1999) *De gnostiska evangelierna,* Wahlström & Widstrand, Stockholm.. The question here is how would the construction of time be like with this kind of idea? Pagel's book could also be read as advice on how you organise to eliminate undesired translations.

The big difference the congress introduced was the religious aspect. But the idea of counting years from the birth of Christ came only in 525 AC. A monk called Dionysis Exiguus came upon it when working with some changes of the calendar. (Duncan, 1999, Eco, 1999). Unfortunately, the place value system and 0 were still missing, which is a pity because he could have started the calculation from year 0 and not year 1, as he did.

Weeks are more difficult to associate with astronomical cycles, but they seem to be connected with the Babylonian cult of the moon. Around 753 BC, under Romulus' rule, each month had three main days. They were named: *calendae, nonae* and *idus*. These days worked as a sort of an index for when to know which day it was in the month, e.g. two days before nonae. The first of these days was *calendae*, and this is the word for our "calendar". Later, an eight-day long week was introduced, which changed into a seven-day week, which correlated well with the Jewish calendar. This Babylonian, Roman and Jewish construction of the week was later adopted by the Christians, but with the change from Saturday to Sunday as a day for rest and recovery.

What I find interesting is this enormous amount of energy put into the introduction, connection and association and distribution of various kinds of time constructions. To construct and distribute changes of time is not easy. It is not only about defining or calculating time but also about convincing others to translate the idea and to use it, especially when ceremonial time was changed. To introduce the Gregorian calendar took a long time because it was difficult to convince people to use it. (Ackermann, 1999, Crosby, 1997, Joerges, 2000). In general it took longer for the Protestants than for the Catholics to change to the Gregorian Calendar (Duncan, 1999, Joerges, 2000, Lippincott et al., 1999). Reasons for changing can be different, too. Sometimes it is in connection with political, religious, and economical issues like taxes, or sometimes just to honour someone. The point is that the resulting organisation of time, for example, the Gregorian calendar, is a consequence of random events, intentions and compromises. [8]

Our heterogeneous calendar is still being translated and used in various contexts but for different reasons. Nevertheless, it is still the fact that it gives room for various translations that accounts for the survival of the calendar. Timetables for trains were one of the technologies that were easy for many people to accept. During my visit to the PTO, the calendar was present in all sorts of timetables. Accounting and time is also not a new relationship as Loft describes (1990). But time

[8] For a critical perspective on the Gregorian calendar see homepage www. digitalfarmers.com/tinc/991229.html

construction is a big network and needs to be studied more, and from different angles, a subject Ezzamel and Robson (1992) put forward and discuss. I will therefore try to put accounting practice in a context of time construction, to present it as emerging from time constructions. I do not intend to say that accounting does not influence time construction – it does – but I wish to shift the focus to present the accounting practice as an emerging actant of time construction, an actant that stabilises time constructions. In order to do this, I also need to turn to clock time.

Clock time

The Egyptians developed the 24-hour long day by using 36 stars to coincide with the sunrise. They measured when one of these stars was visible in the sky together with the sun. The following day the star was a little late (four minutes). After 10 days the time between the stars in sight and the sunrise was ten times longer (40 minutes) and they changed the star. This amount of time during 10 days was later called by the Greek one *decan* (*deka* =10). In this way they developed our 24-hour day. Later, when they made the month 30 days, they also modified decans. They used 24 stars instead of 36, which had to be measured by a 15 daylong lapse of time (Spalinger, 1999).

Crosby (1997) points to a change of associations from qualitative to quantitative associations. He points to the construction of time as one example. The first mechanical clocks were made around 1250 and gave the western world a new way of imagining things - a clock as a "world machine". He claims this even though he is aware that little is known about what ordinary people thought of time and clocks. His argument is based on the observation that almost all large cities between 1300-1400 had a big clock that everybody could hear and see. This, according to Crosby, taught people that the invisible, silent and seamless time quantified time in the same way that money is quantified. The clock could therefore be seen as a huge educational technology, teaching people how to think about time and, as a consequence, how to live their lives and think about them. But it also created a time, which could reach beyond people's ordinary lives.

According to Betts (1999) there was no big change in how the clocks were made until around 1650. Clocks of more sophisticated design used for astrological purposes were still strongly associated with God's universe. The pendulum clocks were a breakthrough in the effort to create a precise measure of time. The knowledge that these innovations were based on was scientifically derived. The public clocks became more numerous, but almost every city had its own local time. This situation created problems for the railways and for the passengers. In 1847, the British

Railway translated every timetable in relation to Greenwich Mean Time (GMT) (Zerubavel, 1982). The Greenwich Observatory was the only place that measured the right time. This time was distributed by telegraph and by 1855, almost every public clock was connected to GMT (98%). It took 25 years, however, to convince the remaining 2% to go along with this time construction.

It was not only England that had problems with standardised time. Many countries dealt with this problem, particularly with the expansion of the railroads. The problem grew bigger when co-ordination was required between different countries, and in 1884, 25 nations with 41 delegates gathered in Washington, DC USA (Lippincott et al., 1999) where seven common principles were established[9].

When the wireless telegraph come into being it became easier to distribute time. When radio waves were introduced by Marconi in the beginning of the 1900's, it became possible to distribute and receive signals from all over the world. In 1922 the British Broadcasting Company (BBC) introduced the first public radio time signal. Two years later it was replaced by the BBC's six pip Greenwich time signal (Betts, 1999) p.137). In France, time service through the telephone became available in 1933.

Today, the Earth Tellus rotation around the sun is more or less abandoned as a reference for time. The reference is caesium: "The second is the duration of 9.192.631.770 (Hz=cycles/second) periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom"[10]. This standard second is calculated and distributed by BIPM (Bureau International des Poids et Mesures, in Paris). BIPM uses over 200 atomic clocks in over 50 nations and it functions as a currency basket to calculate TAI (International Atomic Time)[11]. The idea is to give some kind of weight to all these clocks so that the standard second can be (re)established. This is the World's Centre of Time. The USA or USNO (U.S. Naval Observatory) is considered to be a relative heavy weight in this time basket. When I connected to their homepage (010303), they had 38 clocks, 7 SIGMA TAU hydromasers and 31 HP-5071 caesium clocks, which all contribute to TAI's calculations. These clocks are kept beneath the ground and separated from each other, sometimes by as much as 300 meters. They are connected either with coaxial cables or fiberoptic connections. Through these clocks, USNO

[9] http://greenwichmeridian.com/
[10] http://www.bipm.fr/enus/3_SI/base_units.html
[11] http://www.bipm.fr/enus/5_Scientific/c_time/time_1.html.

calculates their time and sends it to BIPM but also uses this as their own USNO Master Clock. This is a master clock that has the same synchronised frequencies as those 38 clocks, and thus will be able to produce mean time. It will then distribute its time signals called UTC (Coordinate Universal Time (USNO)).

BIPM has a clock-time signal called UTC, which today has replaced GMT and thereby has become the civil time reference[12]. The difference between the two UTC's is that BIPM has more clocks in its foundation for time calculation. USNO's UTC is used to update, every 12th hour, atomic clocks of 24 satellites which have these clocks built in their machinery and which receive these signals from the earth. These satellites circulate around the earth at a height of 20.000 meters, with a 55° angle and in six different orbits and work as GPS (Global Positioning System)[13]. GPS is a technology to construct maps, to navigate by sea and land, to determine lengths of routes, to calculate time of arrivals or to build bridges like Öresundsbron in Sweden[14]. The small time differences between BIPM's UTC, USNO's UTC and TAI can be seen on their homepages[15]

The earth rotation is not a good reference for precise time relative duration of caesium 133. Caesium looks like a better reference point in people's struggle to define time. The earth is rocking its way through space with many random anomalies in the rotation and this does not help people in their agony to understand[16]. Earth was thus replaced with caesium, but the earth still has a place in time construction. It is a time construction called UT1, which considers the earth rotation in a very special way. As it is not a good idea to let the earth rotation and the more precise atomic clocks differ too much, there is a span of time for how much they are allowed to differ (UTC-UT1= 0,9 seconds). This span is sometimes translated into actions, namely to add or subtract a second to the atomic time UTC, because it is easier to change the clock than the rotation of the earth (TAI is still working without any adjustment of earth time). To measure the earth rotations, a combination of Very Long Baseline Interferometry (VLBI) and different satellite techniques, for example, GPS, are used. The reference point is 400-600 quasars and the sound they make, which then can be captured by satellites above earth and by telescopes on earth. VLBI is what they call an absolute point of reference to measure universal time.[17] More

[12] http://wwwghcc.msfc.nasa.gov/utc.html, www.bipm.fr/enus/5_Scientific/c_time/time_server.html
[13] http://tycho.usno.navy.mil/gpsinfo.html
[14] http://www.e.kth.se/~e97_mbl/gps.html
[15] http://tycho.usno.navy.mil/bipm.html
[16] http://maia.usno.navy.mil/eo/whatiseop.html
[17] ftp://casa.usno.navy.mil/navnet/. & http://hpiers.obspm.fr/eop-pc/

could be said about UT1 but just let me draw attention to the fact that the earth rotation and atomic time differ and this mistake is adjusted through a leap second added to UTC[18].

Now then, is all of this relevant for the PTO and their daily activities? The point is not just that this time construction is supported by science and advanced technologies. It is also about how difficult it is for a PTO to change this time construction, or to be able to reject this time construction. The present way of distributing the time construction worldwide is such that it is hard to escape. Organised time like this is used to create timetables for separate routes, for a net of routes, for calendars of timetables (A/B/C), for accounting practice, for geography and for holiday planning. Organised time is embedded in the machinery all over the world – or at least that part of the world that uses electronic circuits. Operations that transport large amounts of data (1, 0) with high speed in sectors like banks or TV stations require a huge network, like an operative system, for example UNIX. It is the operative systems that co-ordinate many of the world's computer networks and synchronises them day and night. Many of the connections to time are associated with law, like a contract between the Authority and the PTO. Joerges (2000) argues that media, entertainment and computer-based economic operations carry the western world's order of time far away from where it is put into circulation. The connections to this time construction are increasing – like the requirements of the synchronisation and distributions of time, when Telecom, IT, Media and Entertainment are put together in one big sector called, ironically, TIME sector.

All of these systems have direct or indirect connections to UTC, but this time network also has a great importance for position technologies like GPS, or, geography translated into time. One has only to try to change one's birthday in order to understand the importance of time. It is easy to sympathise with Aveni (1999) who says that hierarchical societies will bureaucratise time to expand their power, if not for the fact that such societies are the result and not a cause of this organisation.

Time as Metamyth

Time could be experienced as numerical; still numbers cannot stand-alone. Instead, numbers support and stabilise words as Czarniawska (2000) explains. It is a way to bind what is being translated. This includes calendars and clocktime. To stabilise translation of time is a tricky issue. On the one side, it has to be made simple for long reaching distribution, where numbers give the

[18] http:tycho.usno.navy.mil/leapsec.html

interpreter this opportunity, and at the same time, this simple form gives us an opportunity to translate and associate it differently, far from the original purpose. So even though that a common translation of how a scientist uses numbers, Crump ((1990) p. 59) discusses: "the West sees the universe as a physical rather than a metaphysical construction: if then, mathematics, as one of the exact sciences, belongs to physics, it has no place in metaphysics and there is no synthesis between the two" - this is not to say that the scientist actually uses and associates meaning with them in this way. Translations could never be controlled. Still it is worth mentioning that some of these ideas, because they have to say something about time (and space), in some sense influence associations.

Some of these narratives are what I call metamyths or ideologies, both religious and political. Two types of time constructions are frequently used: time as linear or circular construction. In almost every culture there are both of these conceptions of time, but usually one of them dominates. Associated with religion, the Jews, Muslims and Christians are those who are usually connected with the idea of linear time. Christians went so far in their ambition to diffuse this idea that they considered the idea of circular time as heresy (Fernándes-Armesto, 1999). The idea of linear time permits a story with a beginning and an ending, a text that is heading to heaven. Sometimes the story of Genesis in the Old Testament is presented as a series of pictures where the reader can follow the creation, picture by picture. The story makes sense only in one direction.

It is suggested in *The Story of Time* ((Lippincott et al., 1999) p. 17) that the linear idea of time is connected with an abstract God. In cultures where the gods are present among humans, the idea of circular time is more frequent. The linear image of time was inspired by the Greek tradition assuming the wish to explore and control nature, and it made it easier to separate humans in the western world from the Word of God as the knowledge authority. But the gradual separation of time from God created the later connection between time and progress (von Wright, 1993). As the book, *The Story of Time,* illustrates it seems that these differences of time as linear or circular have had importance for how to associate and construct time. And in the previous text it is well illustrated that both political and religious issues are strongly associated with different kinds of chronology.

The calendar could be seen as an infrastructure of time (Joerges, 2000), which in turn structures our thoughts and actions. When time associates with an ideology where life and death, linear or

circular, or qualitative or quantitative aspects stabilise the structure of time, then perhaps something different would come through. Words and numbers are used to create order. Our time infrastructure is often built on the Gregorian calendar. But what would we think and how would we structure our lives if we constructed time in such way that the present, history and future existed side by side? If everything that happened was imagined in geography through time as distance between different places instead of distance between events? Space as a sort of time is what Aborigines construct (Morphy, 1999). Or could it be that time is going backward instead of forward as we usually think? Backward, because what we can see is only what we know, and what we see is in front of us, while the unknown is unseen and therefore behind us, as in the Maoris' construction of time (Lippincott et al., 1999). We go backwards into the future. Would we then still construct, think of our stories and lives, and would our clock and calendar be the same. And, what is important in this context, would buses still come on time?

Summing up

To summarise, the traditional ideas about order relied upon connections to terrestrial and celestial phenomena with help from ordinal and cardinal numerals and calculations. Often these calculations were associated with religious beliefs and order. The abstract God led the religious leaders and their associates to an idea that time was a linear time construction, whereas others had more earthbound gods who permitted a circular time construction. The linear and traditional time construction was replaced with another kind of time, which had a quantity like money or distance, not a quality. A linear idea of time and the introduction of 0 and place value system importantly influence the ways of calculation. Time is now replaced with caesium, quasars and progress – without, so it seems, an association with religious beliefs. Is this kind of time construction distributed in every part of the world today?

The answer is not simple. Time is translated into a simple form to be efficiently distributed worldwide. It is practical, but also so flexible, that almost any meaning could be attached to it when translated into locally specific situations. To make time stabilised/flexible in this is, as Luhmann (1982) points out, "to make something available and manipulable in a meaningful way in order to increase and reduce complexity at the same time". For Tore, the bus driver, the PTO, the Authority and the passengers, the focus is on the timetable, calendar and clock. It is hard to argue against such an instrument as GPS, scientifically produced with connections to quasars and caesium (Latour, 1987). There are no arguments against this time construction as such. At least, the present is not a period when this construction is questioned, as Czarniawska & Sevón (1996)

call periods of change. Tore and others at the PTO (re)construct this distributed time each day, translate it and connect it to time with their own operations. Time becomes clocks and calendars. Still the construction is fragile. It will fall apart if all these actants translate it differently. But all these technologies, scientifically produced and connected to many activities, infiltrate even the least action in our daily life, which gives the network some kind of stability. This makes this network a non-innocent construction.

The density of translation makes the time-network stable, but does it make it precise? Not yet. Today scientists still work hard to reduce time anomalies to one second in 15 million years. Using the so called "iron trap", they want to reduce anomalies of the standard second to 1 second in 10 billion years. Some believe that the time span as a reference to reduce defects of the standard second is the lifetime of the universe (Betts, 1999)[19]. Those alive then will know.

As a consequence of my fieldwork of how "here and now" in transportation translated into accounting numbers, I learned two important things about the construction of the time network. The first has to do with the timetable, around which everything circulated at the PTO. It was a kind of professional pride, to keep the timetable and public transport running, no matter what. The second was the increased pressure on the PTO – both from the Authority and the new owners – which reduced the PTO's space of choice. Both these situations had intimate connections to accounting practice. The accounting numbers both reflected and re-constructed time as based on the calendar and clock-time. Time construction could not be ignored, as it is so present in nearly every activity. The time network I followed is huge and it seems that the construction of time is *a process* that the accounting recreates and surfs on, an actant in the construction of time. A human actant, a human who can act but do not speak for her/him self, who is able to recruit time-ANT into his or her own network becomes powerful. My conclusion is that time construction is one of the processes that accounting practice relates to, a process that allows this practice to seriously affect our organisations and organised life.

[19] http://www.bldrdoc.gov/timefreq/ion/index.htm.

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