Introduction

The background for this article is my final thesis “Minimetro, tramway or light railway”, elaborated at the Institute of Technology and Social Sciences, unit of Technology Assessment, DTU, June 1995.

It is made through my surprise over the debate which arose in the press following the Ørestad Consortium's choice of a mini-metro in preference to a tramway or a light railway as Copenhagen's new city-line, three apparently very similar solutions but where each solution clearly had its proponents and opponents. The debate was emotionally charged and the arguments forwarded concerned matters very different to those presented by the Ørestad Consortium as being important.

Following the decision in favour of the mini-metro and my own surprise concerning the links which developed among the actors' arguments and actions, especially concerning things not mentioned in the debate, I have deconstructed the Ørestad Consortium's choice of the mini-metro. The article, therefore, is based on the Ørestad Consortium's own presentation of the mini-metro in preference to the other two choices, and subsequently an unravelling of the process which led to the Ørestad Consortium's choice. This unravelling considers the participant in the debate, hereafter 'the actors', and the choices which influenced the requirements of the mini-metro.

The background for the actors' power struggles lies in the rationalities. To unearth them would require a deeper dig. Transport- and town planning in Copenhagen express the ideologies, wishes and expectations of future society. The rationalities are reflected in the objectives of these plans.

Rationalities are the actors' perception of problems and solutions attached to a specific distinct, in this instance transport planning in Copenhagen. Attached to a rationality is a relevant social group, which is a group of actors who have the same perception of objectives, for example with respect to transport planning,, i.e. in other words a relevant social group is a group of actors who share the same rationality. The rationality, to which the actors, methods and structures (both institutions and infrastructures) are attached, is defined by the rationalities they hold. Rationalities are a part of society's discourses [1] and elements of these discourses are made concrete in the rationality.

Tove Frederiksen

[1] In discourses it is not possible to differentiate between; *history* - which is an expression for an earlier period's discursive debates and the current discourse interpretation of them, *structures* - which are the actual result of historical discursive debates and which exist by virtue of the interpretation the debaters give them, *debaters and their actions* - which are the new carriers of the discourses and which through their actions develop - or transform - the discourse and change or re-interpret the structures. *Focusing* - is that wide range of parameters which are expressed purely according to attitude and which reflect the perception the debaters have of what is important. Focusing is an expression of the individual debater's rationality within a certain problem type.

Mini-metro, Tramway or Light railway

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The process which led up to the Ørestad Consortium's choice of a mini-metro as Copenhagen's new city-line exemplifies how technological development is far from being merely a choice between alternative technologies. The important decisions were made long before there were any concrete options to choose from at all. Due to the attention paid by certain actors to their own particular interests, to the establishing and dismantling of structures, and to decisions on future development, decisions were reached which were decisive for how the city-line will appear. Thus, alliances between actors which, by means of promoting their own particular interests and objectives, have resulted in preventing other actors from influencing the development, have been significant in the technological development process. As far as Copenhagen's new city-line is concerned, it has been a case of decisions which gave the Ørestad Consortium[2] a clearly defined "sphere of influence" in which to operate.

Copenhagen gets a minimetro

On the 27th October 1994, the Board of Directors of the Ørestad Consortium agreed that the new city-line in Copenhagen would be a mini-metro.

The Ørestad Consortium's justification for choosing a mini-metro is that, it has the fastest journey time and the largest passenger capacity, of the three options of a tramway, a mini-metro, and light railway. In addition, this choice will change least the existing street scene, and the Medieval city will keep its present appearance. The mini-metro is presented by the Ørestad Consortium as the one option of the three where, according to experience from other countries, the likelihood for accidents is least. According to the Ørestad Consortium's analyses, there are no great differences between the three city-line options apart from those already mentioned, neither with respect to consequences for the rest of the city nor with respect to environmental impacts.

Purpose of the city-line

According to the Ørestad Consortium the purpose of the new city-line is to strengthen the city's public transport system and, not least, to ensure that there are stations close to the anticipated new jobs in Copenhagen's new Ørestad district. Ørestad will be a new district which will attract new international businesses to Copenhagen within the next 10-30 years. The new district will be on Amager Fælled and will be linked by the Øresund Bridge to Sweden.

The city-line is, therefore, an important step in the improvement of the public transport system and the environment in Copenhagen. In particular, central Copenhagen and Amager will benefit from the city-line.[3] The city-line is presented by the Ørestad Consortium as a high class public

[2] Ørestad Consortium I/S is a private company and has responsibility for the establishment of the urban railway and Ørestad Boulevard together with sale of the State's and the local authority's land on Amager Fælled, according to the Ørestad Act, Ministry of Finance j.no. 91-703-30. 24th

[3] The new urban railway in Copenhagen, Ørestad boulevard, Ørestad. Ørestad Consortium, pamphlet January 1995

transport system, and as a realistic alternative to the car. A third purpose is therefore "to attract passengers away from their cars thereby reducing the number of cars in the city centre"[4]

The Ørestad Consortium's choice of mini-metro, tramway or light railway

The Ørestad Consortium's task was to choose an city-line which provided the best service to the future Ørestad region. With that background the Ørestad Consortium set up three different city-line options: a mini-metro, a tramway and a light railway. The Ørestad Consortium presented the options as follows:

Mini-metro[5]

The mini-metro will run underground in densely built-up areas. In other stretches, e.g. in Ørestad, it will run above ground. The track area will be fenced in and all roads and paths will be taken over or under the track. The mini-metro will be fully automated and, therefore, will be able to run unmanned. The Ørestad Consortium believe that this will create the possibility of employing service personnel to serve passengers. The electricity will be supplied from a third (conductor) rail.

Tramway[6]

A manned tramway would interfere with the other traffic along the reach between Nørreport and Lergravspark and the University, although it would have its own track where that is possible, but in all cases, it would mean less space for the remaining traffic. It would also require that the tramway has priority at traffic lights in order to ensure a reasonable journey time - that is 25 km/hour. When the tramway gets to Ørestad it would get its own track but nevertheless still interfere with other road users at cross roads. Electricity would be supplied from overhead lines.

Light railway[7]

A light railway would run underground from Nørreport to the university on Amager. In Ørestad it would come above ground and have its own area. In the reach from Christmas Møllers Plads to Lergravsparken it would run entirely in the street area, as for the tramway. The light railway would get its electricity from overhead lines.

Essential differences

The Ørestad Consortium emphasized that the essential difference in the three options lies in the reach which, for each option, runs either at street level or underground. They also emphasized that the mini-metro is unmanned and that the other two options are not. All three options run on their own track in Ørestad and on the former Amager railway. It is the reaches in the inner city and on Amager Bridge where the options differ from each other.

[4] The new urban railway in Copenhagen, Ørestad boulevard, Ørestad. Ørestad Consortium, pamphlet January 1995
[5] Ibid
[6] Ibid
[7] The new urban railway in Copenhagen, Ørestad boulevard, Ørestad. Ørestad Consortium, pamphlet January 1995

Data for examined city line system			
	Mini metro	tramway	Light railway
Passenger pr. year (fully upgraded)	70 - 90 mill	40 - 50 mill	60 - 80 mill
Average speed for the journey	40 km/h	25 km/h	35 km/h
Frequency in peak hours	1 1/2 min	2 1/2 min	2 1/2 min
Service reliability	99 %	90 %	95 %
Necessary length of train	50 m	35/70 m	70 m
Price (all three stages)	5,2 bill	3,9 bill	4,9 bill
Time for repaying	yr. 2010	yr. 2014	yr. 2010

Figure 1. The Ørestad Consortium's comparisons of the three city-line options.

Traffic planning rationalities

Using as point of departure a series of historic traffic plans for Copenhagen from 1926 up to 1987, I have identified three traffic planning rationalities which have been decisive for traffic planning in Copenhagen; a traffic growth rationality, a traffic needs rationality and a traffic displacement rationality. The objective of traffic planning determines how the actual planning develops. It is the objective of traffic planning which is the fulcrum for the actors' power struggles. The actors, expert models and physical structures and institutions are formed through struggles between relevant social groups and rationalities. The rationalities are expressed through the modern developments for transport in Copenhagen, for example the decision to build a minimetro.

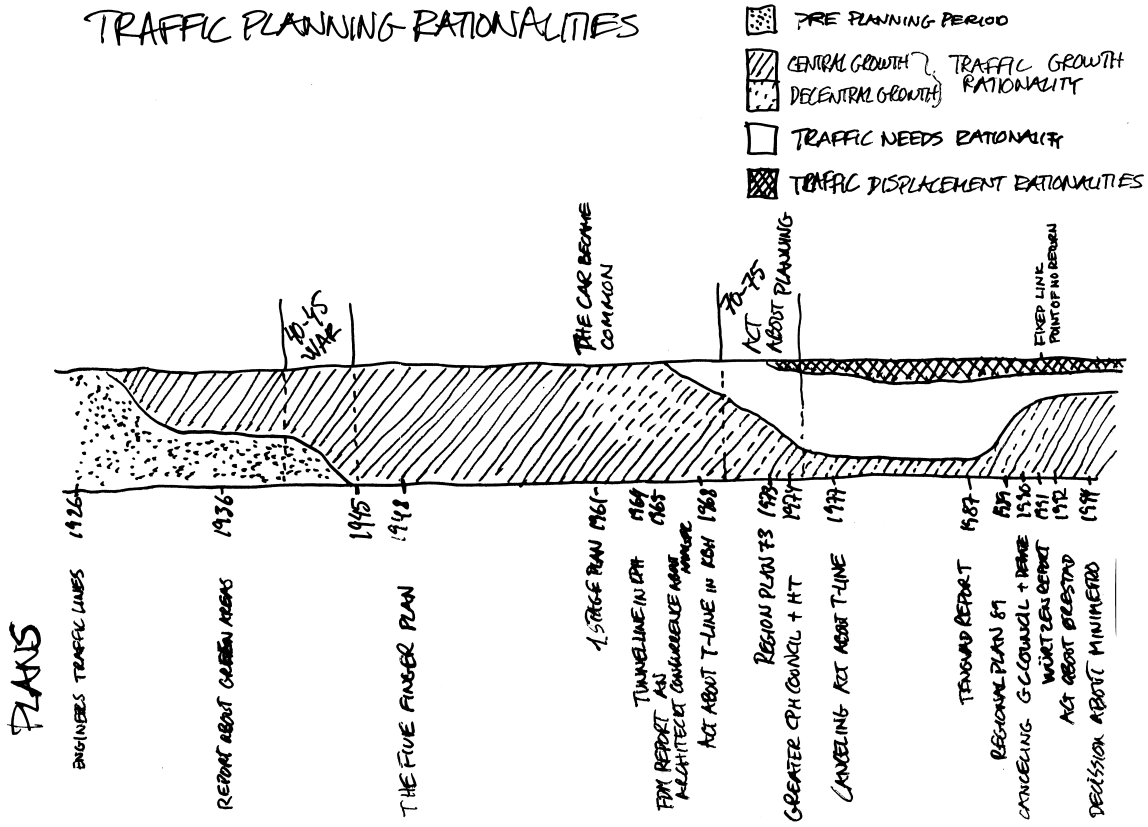


Figure 2. The domination of the three traffic planning rationalities through the period from 1945 to 1995

Underground plans in Copenhagen

Proposals for underground systems appear in the planning history whenever a central location of jobs in Copenhagen has been planned on the basis of expected growth in the number of jobs. The objective of the underground railways is to relieve pressure on the streets in the inner city and on Amager from the traffic which the growth in the number of jobs would cause. They function, thus, as an extension of capacity. The underground act for Copenhagen was repealed in 1977. Included in the plans was a potential track bearing service of the existing district on Amager. In '87, the discussions on an city-line for Amager were taken up again on the basis that it should serve existing needs. From 1977 to 1990, the traffic needs rationality has interpreted the track bearing servicing of Amagerbrogade, based on the servicing of the existing city, as the remains of historic plans for an underground.

The underground proposals represent the traffic growth rationality, and the significant parties in the relevant social groups are as follows: DSB, the Copenhagen local authority, the State, the Social Democrats, and the trade union.

Power and planning Rationalities in the 90's

There are three transport planning rationalities in Copenhagen in the 90's. The rationalities are represented through different relevant social groups. Each of the rationalities is associated with it a set of existing structures and plans for development, methods to describe phenomena based on the particular interests of the rationalities, together with discursive elements which are reflected in the rationality by means of arguments and the grouping of like opinions.

It is the traffic growth rationality which is the strongest. It ties in with the growth philosophy of the welfare debate and there are strong political actors within the relevant social groups. In addition there are strong structures, for example the Five Finger Plan which, by virtue of its interpretation by the relevant social groups, promotes the rationality's actors ahead of others.

The traffic needs rationality is a reactionary rationality. Planning which is based on this rationality is reactionary since it is intended to ensure that the existing transport needs are fulfilled. The traffic needs rationality has dominated planning throughout the 70's and 80's.

The traffic displacement rationality is the weakest of the rationalities. It has never dominated planning and has not made its mark in any way in the form of the construction of infrastructure or institutions. It is mainly institutionalized in the university environment. Neither does it have a strong scientific background in the form of models. The basis of the traffic displacement rationality is that other objectives can be achieved through transport planning, for example, to remove cars from the city. The actors in the traffic displacement rationality relate their arguments to elements from democracy and the environmental debate.

Rationality	Structures/plans	Relevant social group	method/ model (focus)	Discursive elements
Traffic Growth Rationality	**Existing structures** S-train Bispebuen High ways Høje Tåstrup **Plans** Tunnel lines Harbour Tunnel Øresunds bridge Ørestad and minimetro	Copenhagen Municipality Frederiksberg Municipality Ministry of Finance The Social Democrats Conservative Venstre DSB Ørestadsselskabet	Traffic Growth = Growth in households and jobs Capacity Free access to city Speed frequents	Welfare Discourse International - concurrence growth The least possible pollution without hindering growth
Traffic Needs Rationality	**Structures** existing structures flexible busses busways **plans** light rail on Amagerbrogade Lightrails as supplement to the existing S-train	HT Copenhagen County Universities Noah	Persons daily travel transport needs PEtra	Welfare discourse Public transport is a service the welfarestate Ensure Environmental care under condition of growth
Traffic displacement rationality	**Structures** Mixed traffic Town ecology plan act **Plans** Live where you work Taxes on cars and gasoline Trams in Copenhagen Cars out of the town	Noah Universities Local societies	The act of planning local societies an democracy	Decentralisation and local democracy. Fresh air and light and environmental sustainability locally, regionally and globally

Figure 3. The three rationalities, plans, structures, relevant social groups, methods and discoursive elements in the 90's

Transport Planning - why ?

The Tengvad Report from 1987 and the Regional Plan 89 both assumed that there would be no significant economic growth in the community. The main message was that cars should be removed from the city and that the public transport system should be strengthened and extended in order to meet the existing needs.

By 1995 the Ørestad Consortium was working on the assumption of growth in residential areas and jobs on Amager, and more traffic in the city. Its objective with the mini-metro was to maintain the same proportion of road users using public transport as growth takes place.

There has been a change in the objective of the planning of public transport. It has shifted from being a question of satisfying existing needs as a basis for public transport and a reduction in the number of cars, to a question of growth in the number of jobs and housing in Copenhagen. In the following the process which has led to the choice of the mini-metro is examined.

From stagnation and accommodation to the minimetro - a power struggle

Struggles have been fought between relevant social groups in the planning process from the time of the Tengvad Report up to the mini-metro. I am not talking of a well-considered strategy by the actors. However, it has not been completely coincidental which actors have allied themselves to each other or which technologies have resulted.

I have focused all the way through on the actors and on the technology in the actual plans and decisions. This is why it is the actors who develop the technology through their actions, and thereby, due to their struggles the plans are crystallized. It is therefore very significant which actors can influence the technology, because it will be on the basis of their rationality that the solution will be formed. Here, therefore, I will concentrate on the alliances between actors, the processes which form the basis for them and which have led to the choice of a mini-metro.

The role of the capital

Re-interpretation of the Five Finger Plan from '47

In the Tengvad Report from 1987 and the Regional Plan 89 emphasis was placed on the old Five Finger Plan. The Five Finger Plan 's principles were re-interpreted and used in a new context i.e. a close-to-station location of businesses, where earlier it had been a close-to-station location of housing since the business district lay in the City.

Using the S-train network as the backbone of the Municipality was again taken up as a fundamental idea. A sixth finger on the Finger City was considered along with a limiting of cars in Copenhagen by means of various traffic regulating measures. No growth in the Municipality was anticipated. Therefore, the Five Finger Plan was used as an argument for the transfer of road-users from private to public transport. An underground or city-line was proposed for Amager with the objective of improving the public transport system in Amager's residential areas and the airport.

In both it was mainly arguments from the traffic needs rationality and from the traffic displacement rationality which were used in the plans but with a re-interpretation of the Five Finger Plan 's principles of close-to-station, an emphasis on the S-train network as the principal structure, and a proposal for a track based city-line on Amager which gave DSB a wider sphere of influence in relation to transport planning in Copenhagen. The worn-down S-train network required renovating.

DSB and the Five Finger Plan are respectively a actor and a structure in the traffic growth rationality. DSB have not been involved in planning in the S-train system since '77 when the S-train network was laid under HT. The S-train network was returned to DSB as a result of the Tengvad Report. Through focusing om The Five Finger Plan, DSB has an interest in Copenhagen's infrastructure because it is infrastructure mannaged by DSB . The emphasis on the Five Finger Plan triggered off the struggle between the rationalities. Because the Five Finger Plan is also a plan for the central location of jobs in the Copenhagen local authority.

Abolition of the Greater Copenhagen Council - new possibilities for alliances

The abolition of the Greater Copenhagen Council in 1990 gave the counties and local authorities in the Municipality a wider sphere of influence. The Greater Copenhagen Council had had responsibility for the overall planning in the Municipality. This planning, thus, disappeared and the counties and local authorities were able to form new alliances. The Copenhagen local authority had the opportunity to negotiate directly with the State without involving Copenhagen County.

The abolition of the Greater Copenhagen Council is a dismantling of an organisation giving the actors the opportunity to re-interpret their sphere of influence. The County and the local authority have fought for new jobs since the beginning of the 70's, and HT have re-extended their sphere of influence to include transport planning through the traffic needs rationality, in order to build up a flexible, well co-ordinated public transport system which could serve all areas according to demand.

Suddenly, Copenhagen local authority were no longer able to negotiate with the other counties in the region on investments. All the counties had the possibility to plan independently of each other. Copenhagen local authority for many years had had to give up jobs to the surrounding regions but were very interested in obtaining new jobs. The local authority has had an old dream to build on Amager Fælled. The plans for this have flourished since the 60's. The area is owned together with the State. This is in accordance with the welfare debate because the objective is to create growth
The County no longer has a natural ally. HT has operated on the basis of an objective to serve existing demand, otherwise HT would be a natural ally. However, it is not geared to plan large investments in infrastructure. DSB have strengthened their position by virtue of existing structures, the emphasis on the S-train network, and an old tradition for planning underground railways for Copenhagen.

National interest in the capital

The parliament debate in 1990 focused on the role of the capital. This focusing awoke interest in Copenhagen at the national level. The catalyst was the work towards economic growth through the inner market. With admission to the inner market in 1992 the nation has had a need for a locomotive in order to be competitive internationally. Parliament considered Ørestad as such a potential locomotive. Thus, Copenhagen became worth prioritizing. The debate on righting up "The lopsided Denmark" became uninteresting. Now it was quite in order for Copenhagen to be the centre of gravity for the rest of the country.

There are now three central actors who all exist in that relevant social group which contains the traffic growth rationality. DSB are strong because of the focus on the S-train network. Copenhagen local authority are strong for several reasons; they no longer need to negotiate with other counties, the close-to-station location of jobs renders them strong because of an old self-perception of being a central district, and because the S-train network supports this. Finally, the State is interested in the capital's role in Denmark due to the focusing on international competition.

Central location of new jobs

The Würtzen Committee's task was to prepare a plan for transport investments in the Municipality. Thus, there was a focus on traffic. Appointment of the Würtzen Committee resulted in the formation of an alliance of DSB, Copenhagen local authority and the Ministry of Finance. These three parties became central to the work of the Würtzen Committee and it was their interests that influenced the final report. Copenhagen local authority wanted economic growth, DSB wanted an underground in Copenhagen and the Ministry of Finance also wanted economic growth and a strengthening of Copenhagen, so long as it did not affect the budget.

The focus on transport investments was changed by the Würtzen Committee. In the evaluation, investments which were self-financing or growth promoting were favoured unlike in the earlier Tengvad Report where the focus was on investments which would regulate traffic with the aim of removing cars from the city and on improving the transport service on the basis of existing demand. In the growth rationality a connection is made between growth in the number of jobs and growth in traffic. Therefore, transport investments were now evaluated on the basis of whether they were growth promoting.

The Würtzen Committee set up three scenarios, a central growth model, a decentral growth model and a stagnation model. Of the three scenarios the Würtzen Committee recommended the central growth model to be the future development model in Copenhagen. (or the model for future development in Copenhagen)

That recommendation restricted the stagnation model and the decentral growth model along with those actors who had interests in decentral growth and stagnation. The most significant of those who lost influence was the Copenhagen County who wanted decentral growth in Copenhagen.

Earlier experience and knowledge of the traffic growth rationality in planning can now be drawn on.

The Ørestad Act creates a closure and define the area

The Ørestad Act was passed as a construction act on the basis of the Würtzen Committee's work. The responsible organisation was specified in the act to be the independent Ørestad Consortium thereby restricting the degree of influence DSB and HT would have on future work. The appointment of the Ørestad Consortium bypasses the transport companies who have interests in, and experience with, public transport.

HT are not members of the alliance. HT belong to a completely different relevant social group, namely the traffic needs rationality. The actors are, therefore, cut off from direct influence because transport investments have to be growth promoting. Anne Grethe Foss might well say that the mini-metro will not prevent HT from establishing a light railway, but there are no resources to invest.

DSB is also bypassed and that is perhaps more surprising since DSB is central figure in the traffic growth rationality by virtue of the many underground proposals for Copenhagen. The exclusion of DSB, though, did not have any great significance on the subsequent work which led to the selection of the mini-metro. The Ørestad Consortium's actors represented the traffic growth rationality and thereby helped the technical solution - the underground - along without DSB. DSB traditionally plan on the basis of the large streams of commuters and DSB have also planned that the underground in Copenhagen should be combined with the S-train network. However, the city-line will not be a S-train.

The fixing of the line layout by law restricted the choice of city-line in relation to the objectives which the city-line should fulfil. The act specified that it should serve the new Ørestad, the inner city and the airport. The passing of the layout by law meant that awkward actors, such as local resident groups from existing districts with a traffic needs rationality or traffic displacement rationality, were outmanoeuvred.

The Ørestad Act closed, consequently, many debates on development in the Municipality - all the discussions; growth or no growth, location of jobs, transport investments, objectives of public transport, discussions which have been held in the Greater Copenhagen Council since '73 have now been decided on by the State on the basis of the traffic growth rationality.

The Ørestad Consortium's tasks were precisely defined by the Ørestad Act. It was, thus, only the choice of the city-line option and the preparation of the plan as a whole which had not yet been decided. The consortium's structure can not be influenced politically or democratically through planning laws, nor technically since the transport companies influence has been restricted.

Mini-metro, tramway or light railway

Ørestad Consortium set up three city-line options; a mini-metro, a tramway and a light railway. On the basis of the criticism directed towards the choice of the mini-metro, I believe I can categorize the three city-line options according to the three transport rationalities. All three rationalities include some form of city-line service for Amager. The three rationalities, though, have very different objectives for the city-lines.

All three rationalities have an objective for the city-line on Amager, but here the similarities end. The mini-metro represents the traffic growth rationality, the light railway represents the traffic needs rationality and the tramway represents the traffic displacement rationality. In the light of the various rationalities, the objectives of the three options are quite different.

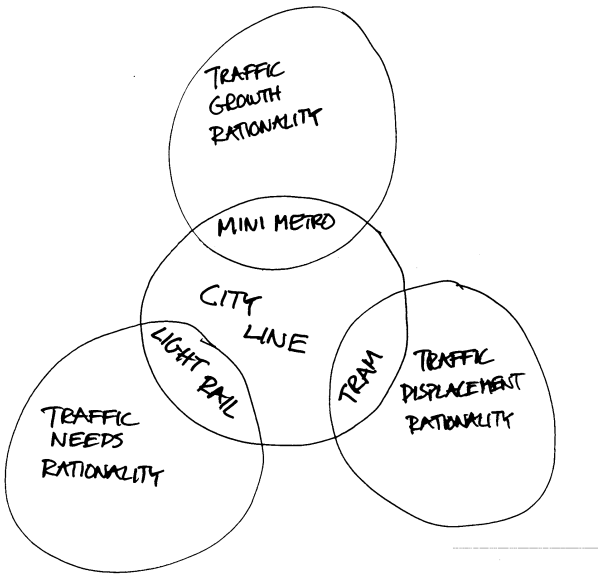


Figure 4 Illustration of how all three rationalities are included in the options set up by the Ørestad Consortium

The actors in the traffic growth rationality see the mini-metro as that option which best fulfils the rationality's aims, namely to create a good quality public transport service for the new Ørestad and City based on the assumption that investments in infrastructure will create growth. The mini-metro runs along its track for the whole reach in order to ensure that it will not interfere with the movement of other traffic.

The actors in the traffic needs rationality see the mini-metro as that option which best fulfils that rationality's aims, namely to establish a flexible public transport system which, by its structure, will serve the existing needs for public transport in Copenhagen and its surroundings. It should also be possible to extend the system beyond the Copenhagen local authority (due to its flexibility ?). The light railway, in its original form, should serve Amagerbrogade, as suggested earlier for example in the Tengvad Report. The light railway can run both in a tunnel and at street level.

The actors in the traffic displacement rationality see the tramway as the best solution because it is that option which takes up the most street space and, thus, forces cars out of the inner city. The tramway would preferably serve residents in Copenhagen. The tramway would run at street level both in the inner city and on Amagerbrogade.

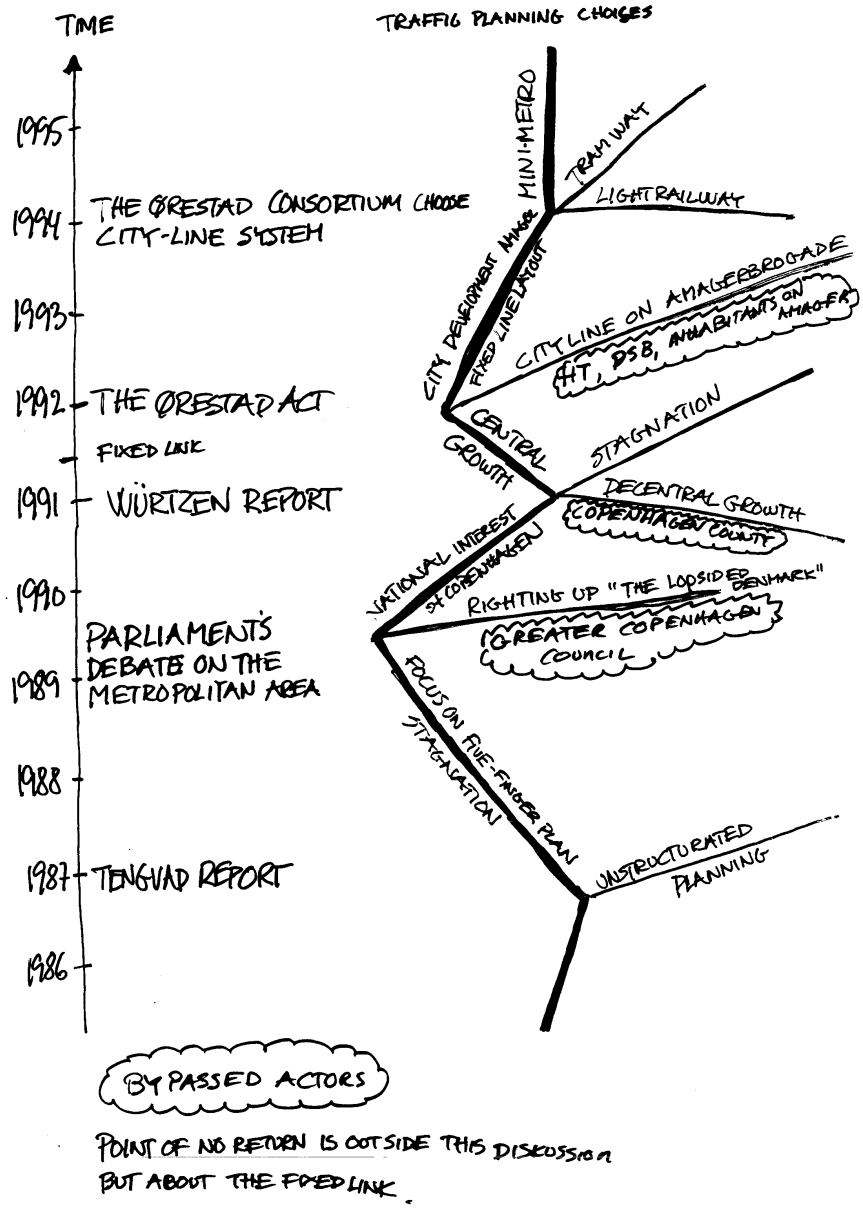
Associated with each rationality is a relevant social group, i.e. a group of actors who share the same rationality, a set of modern discursive elements and a model or method which can describe the traffic patterns which result from a particular development.

A differentiation is not always made in the debate between the tramway and the light railway. The two rationalities do, in fact, overlap with each other since the light railway also occupies street space and is really a more modern version of the tramway which runs at street level. However, it is only the mini-metro which satisfies the requirements specified by the terms of the Ørestad Act, which are all based on the traffic growth rationality. It is the only one of the three options that will not have significant consequences for the movement of the remaining traffic.

The results of the comparisons of the three options also favoured the mini-metro. The parameters which were compared, surprisingly enough, were also from the model used by the traffic growth

rationality's institutions. It was, therefore, the traffic growth rationality's particular branch of knowledge (yet another power struggle) that was applied to the three options for the evaluation.

With that statement I would like to conclude that two of the three options were presented in order to satisfy some of the relevant social groups whose influence had been restricted long before. The objective of the city-line was well-established in the terms specified by the Ørestad Act. Thus, the tramway and light railway were doomed from the start. The debate on the mini-metro, tramway and light railway has been a sham. The struggles among the rationalities took place earlier in the process in connection with the paying of attention to particular opinions, the incorporation of the growth assumptions into the Würtzen Committee and in connection with the



Ørestad Act.

Figure 5. The breaks in the figure indicate the points in the process where a choice was made which restricted the Ørestad Consortium's sphere of influence. The branches represent possible choices. The excluded actors are illustrated through the process.

Power is a process

The power struggle which has led to the decision on the mini-metro is an example of how the power struggle among the three transport planning rationalities occurred a long time before there were any well defined technological options. Very few struggles took place through confrontation but rather through emphasizing particular viewpoints, discussion of parameters, re-interpretation of existing structures and the application of branches of knowledge representing a particular rationality, and the establishing and dismantling of structures. Power is, therefore, far from being something that is manifested during the actual decision taking on technology. Power can be identified as the constant struggle which exists among relevant social groups concerning discussion of parameters, interpreting and re-interpreting existing structures and solutions, and also as the opinions and actions built up through discursive elements.

The struggles have been used to set up options and to campaign for some options in favour of others. The final decisions exemplify how a closure is established in such a way that the decision can form the basis for later power struggles.

The process exemplifies how technological development is far from being merely a choice of various technologies. The choice had essentially been made long before there were any concrete options to choose from. Those decisions that where made, which became preconditions for the technology, concerned anything but the technology itself. Thus, the alliances made between actors, which by means of emphasizing their own particular interests and objectives, had the effect of preventing other actors from gaining influence on the development, were very significant in the technological development process. The only thing that remained to be discussed was a choice among three almost identical city-line options, and even that was left to the Ørestad Consortium.