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► **To cite this version:**

Olivier Klein. TRANSPORT - SPACE - SOCIETY : FROM DETERMINISM TO SOCIAL AND TECHNICAL INNOVATION THE EXAMPLE OF HIGH SPEED TECHNOLOGY. Communication at the 8th World Conference on Transportation Research, Jul 1998, Antwerp, Belgium. halshs-00720494

**HAL Id: halshs-00720494**

**<https://shs.hal.science/halshs-00720494>**

Submitted on 24 Jul 2012

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**Communication at the 8th World Conference on Transportation Research**

**Antwerp, Belgium, 1998**

F1 : Transport and Spatial Development (SIG)

**TRANSPORT - SPACE - SOCIETY :  
FROM DETERMINISM TO SOCIAL AND TECHNICAL INNOVATION  
THE EXAMPLE OF HIGH SPEED TECHNOLOGY**

Paper n° 706

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## **INTRODUCTION**

Major transport facilities are still considered as a favouring item in town and country planning. Nonetheless, the decisions concerning big projects in France nowadays are taken on the basis of financial and sometimes political criteria. Arguments in terms of town and country planning are very rarely sufficiently reasonable to convince those scientists who usually work on the transport-space theme. At the same time, the reappraisal of the structuring effect concept [Offner, 1993] does not seem to give rise to any reaction or even any debate among these same scientists. What's happening ?

It seems difficult to consider that this field of research should be abandoned when no answers have been found to the questions which it raises. It seems more like research in this field nowadays has lost a lot of its legitimacy. It appears to have become less and less operational at the same time as the aim, the methods and the results have become more and more complex. Times are gone, from a scientific point of view, when such evidences as motorways being a means to prosperity were put forward. Furthermore, this field of research hasn't managed, in the course of its evolution, to integrate contemporary scientific concerns. Socioeconomics in transport and town and country planning seem to have strayed too far from their own basic disciplines as well as from the intellectual constructions which make up our contemporary vision of the world.

Instead of going on and on about this state of affairs, this paper aims first at giving a conceptual framework for relations between transport and society. This follows a rapid retrospective of those views which have prevailed up to now. One will notice that there is a slow change from a causal-type relation to a wider point of view including evolution in society. While referring to the grid thus developed, the second part of this article will give a few main trends which make up today's general environment in transport supply changes. The third part of this paper details the example of 4 main cities for which the connections with Paris have changed as a result of the opening of a TGV service. Details will be given of the local context. This study is partly based on the results of specific mobility surveys concerning the detailed motives for long-distance travelling and their evolution in the course of setting up a high speed railroad service. These concrete observations will illustrate the prior interpretation grid.

In order not to lengthen the debate, only business trips will be studied, since they are directly linked to an economic activity. The examples given illustrate the fact that the characteristics of transport supply, social evolution and the economic situation at a given time, the specificity of such and such city, as well as the travelling behaviour of various categories of the population make up a whole, which has to be studied as such in order to make any sense of the concrete changes noticed.

### **1 TRANSPORT, ECONOMICS AND SOCIETY**

The representation of the place of transport supply in economics and society have changed. There have been three major phases : starting with a perfectly deterministic approach - transport supply as dispensing riches (1.1), one then sees a first attempt at breaking away from too strict a theory - transport supply has to be valorised by various parties (1.2). It is finally by making the most of the weaknesses of each of these approaches that we will suggest a more contemporary concept framework (1.3). There is no precise chronology for these various approaches although they are presented here in order of appearance. More important, one approach has nor replaced another, they are all piled up, competing, articulated and even complementary according to varied schemes which depend upon the views and the uses which are being backed.

## 1.1 Transport supply as dispensing riches

By opening up markets, by allowing production and exchanges, transport is a source of wealth for all in all circumstances. Thus, the effects of improving transport supply appear automatically. In this sense, transport supply represents generalised -inasmuch as everyone has access to it -, economic - inasmuch as it produces wealth -, assets [Colletis, Pecqueur, 1993]. That is a brief presentation of the first image one has of links between transport and society.

This representation is prominent in political views. The recent debates which have shaken up the French microcosm over the necessity of a high speed railroad line between Paris and Strasbourg is only one enlightening example among many others. The analysis of how political views develop and of their need for over-simplistic views (or symbols) could be applied with fascinating results to the field of transport. However this is not today's subject. One will simply notice that, on one hand, there is a heavy social demand on transport analysts to provide matter for political views and, on the other hand, political views only give a deterministic representation in terms of the effects (mostly the positive ones) of transport supply on society.

Concerning political views, however, one notices a certain reappraisal of this deterministic representation. One might wonder at first if it isn't part of a much wider movement of citizen wariness of political views. But it is mainly the eruption of ecology in the debate on transport facilities which has brought about the change. The arguments based on an opposition to ever-increasing productivity can only be totally opposed to those arguments which make of the removal of all obstacles to movement what determines socio-economic progress. The less ideological opposition from residents (the NIMBY - not in my back yard- syndrome denounced by technocrats who claim to work in the general interest) is finally based on the same reasoning inasmuch as it puts up certain quality of life arguments against traffic forecasts. There are therefore other views than the deterministic ones concerning the socio-economic effects of transport supply. Furthermore their efficiency, in terms of actual construction work, has seriously decreased.

The same type of deterministic link between transport and society is partly behind the most commonly used method for technical and economic investment appraisals in the field of transport. Based on a few theories taken from classical micro-economics, the cost-advantage method consists, as its name suggests, in listing and adding up the monetary advantages and disadvantages that can be found in a given project. It follows a perfectly linear logic inasmuch as it implies the establishment of a direct causal relation between a fact (an investment) and its socio-economic consequences (for instance, the advantage of gaining time or travelling further). The aim here is not to criticise the cost-advantage method. It is however interesting to note that the direct causal relation does not appear nowadays to be as operational as it in the past. The measure of the "induced traffic" on a given facility tends to show a much more complex relation between transport supply and uses [ECMT, 1996].

Finally, concerning economic theory, the most common models, whether on location (Weber, Isard, Moses), market areas (Lösch, Hotelling) or land use (von Thünen) all consider distance as being linked to transport cost. In such a logic, there is by nature a direct link between transport supply improvement and its consequences -mostly beneficial - for the users. From this point of view the *core-periphery* model developed by Krugman [1991,1995] and popular at the moment among space economists, is no different from any other previous model. Transport costs remain one of the items in deciding on activity locations. It differs however by proposing several solutions for a given configuration. The

initial conditions, the history of the project and its vagaries influence the final choice<sup>1</sup>. The model takes into account a certain dose of socio-historical context and a smattering of rationality (through auto-prophetic anticipation) [Ragni, 1995]. In this it differs from the original linear model.

Recent theoretical space models show real progress. The phenomena they show up allow us to better understand passed changes. However, any approach in terms of transport costs turn out to be thoroughly inappropriate for describing an economic world in which competition occurs not only on costs. The development of above-cost competition, based namely on a capacity to innovate and to react, seems to characterise the evolution of the post-Fordist productive system [Veltz, 1993]. From an economist's point of view, the deterministic approach also seems to have its limits.

This rapid inventory shows in the first place that a direct causal representation of the relationship between transport and society is still very much up to date in the sense that it is the basis of a great number of intellectual speculations and concrete uses. At the same time, it appears, judging from various opinions, that the deterministic point of view is too strict to encompass new data, and needs to be somewhat widened. Finally, multiple attempts are made at doing away with this type of theory altogether. Thus we end up with a contradictory assessment of an intellectually dated representation, which remains nonetheless remarkably efficient.

## **1.2 Transport supply to be valorised by various parties**

The next representation to be developed has made transport supply valorisation depend on the capacity of the different economic parties to integrate this offer into their activity. This view is very close to that which makes transport a necessary condition of development. According to this view, transport supply is no longer an asset - since it needs putting to good use - but a resource. In the same way, it is no longer general, but specific to those parties who will know how to make use of it.

This is the main trend of today's technico-economic views concerning - and the terminology in itself indicates it - the valorisation of transport facilities. This idea of valorisation implies that the local government take "accompanying measures" in order to concretise the potential value. This leads to highly voluntarist, but not always successful strategies. At this level, there is no radical change from the former period inasmuch as the "accompanying measures" often hide the same fundamentally deterministic views. One has spoken on this subject of "the rhetoric of conditional structuring effects" [Claisse, Duchier, 1995].

This slight evolution in uses is due to an increase in theory renewal. In research fields concerned with transport and land development, there is a reappraisal concerning the existence of a direct causal link between transport supply improvement and changes in the social and economic entities in the areas thus supplied [Plassard, 1976]. One puts forward the fact that the transport system is produced by society and that it in turn influences society's evolution. One even designates mobility as the main element in the play of action and reaction. This notable progress has led to the development of a methodology to analyse the introduction into a given socio-economic context of a change in transport supply based on mobility studies. One must therefore distinguish between the two aspects, the theoretical one and the methodological one.

Concerning the theory, one has to admit that there hasn't been much effort in this field from socio-economists specialised in transport. Thus, the nature of the ties between

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<sup>1</sup> Another contemporary model, developed by W.B. ARTHUR [1995], is based on the same point of view.

transport system and social system have not been searched very thoroughly despite an opening around the idea of congruence [Offner, 1980]. The essential role given to mobility was not sufficiently challenged, probably because it was the foundation of a methodology which one then had to develop. The means by which society produces transport supply have been particularly neglected.

Concerning the investigation methods, the systematic use of mobility surveys has led to empirical progress in the knowledge of the phenomena one was to study. The main progress came from taking into account variables which characterise not only transport cost, but also the nature of the exchanges. The explanatory system set up on this occasion turned out to be more and more pertinent as the method developed. The analysis of the changes in travel habits due to the introduction of the Southeast and Atlantic-TGV has enabled to show a link between qualitative traffic changes and economic and sociological exogenous processes[Cointet-Pinel, Plassard,1986, Klein, Claisse, 1997].

However the effort at renewal was not important enough to avoid lapsing into empiricism. Following a proposition by Plassard, the analysis focused on concrete changes in mobility. In fact, only small term changes were subjected to a strict survey. Thus an initially extremely wide theoretical construction - i.e. the transport system produced by the social system - has led to very punctual observations. Not only are they difficult to generalise, being specific of a particular geographical context and a particular transport supply situation, but the results concerning travel habits cannot be replaced in the global social behaviour pattern of the surveyed parties, nor in the general economy of the firms that they are, in certain cases, travelling for.

Other works, from various origins, have tried to work around this obstacle by, for instance, making the occurrence of any effect resulting from a change in the transport supply depend on a strategy developed by the various acting parties. But no-one has managed to explain what exactly is behind these strategies. Still other approaches, based on models, work out "potentials" rather than forecasts [Burmeister, Joignaux, 1997]. However in both these cases, the translation of the technical fact of transport supply into an economic and social reality is partially over-looked. Thus, despite a theoretical framework developed with this one goal, research over the last 20 years on "transport and society" has led to very few results concerning the actual interactions between these two terms.

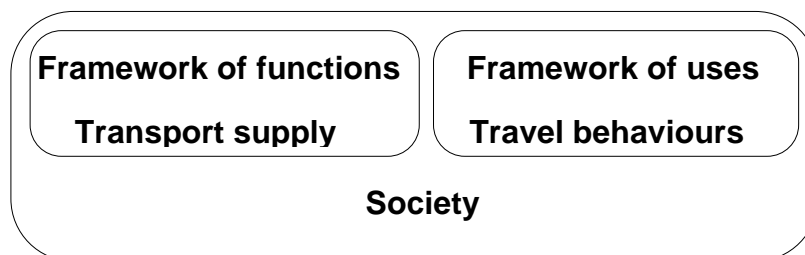
### **1.3 Transport supply actively involved in society**

In more recent research, transport supply is seen as the product of a society and of a technical system, which operates and is modified through it. The renewal comes from a serious attempt to learn as much as one can from that axiom. Since travel behaviour is most probably not the only interaction between transport system and social system, a more precise contents must be given to this two-way exchange process. Of course, there are several leads. One can mention here, in the field of economics, the theoretical approach to the idea of endogenous growth inasmuch as it take into account the use of public funds - namely for transport - among the growth factors. Other analyses, based on decision theories developed in political science, show that any decision process concerning facilities is a complex and creative social process.

These approaches based on the results in a given subject are essential inasmuch as they bring about, each in their own field, a real step forward in knowledge. Going on with this research is not contradictory with a more global approach of relations between transport and society; a more global approach being by nature less centred on one academic subject. The methodology given below follows this trend.

Starting from his works on communication, Flichy [1995] develops a theory on technical innovation in a recent book. His theory relies first on the assumption that technology is a part of society and that it cannot be considered on its own. Innovation therefore takes place inside "social worlds" and the "socio-technical" framework attached to each one of them. The social worlds meet around common "frontier-objects", when a combination of former innovations create a more complex one for example, or when users are confronted with a new object which is proposed to them and with its conceivers. At the same time, various socio-technical frameworks are combined into a larger one. The second novelty consists for the author in giving two dimensions to the socio-technical frameworks : they are both "frameworks of functions" determined by the technical aspects and "frameworks of uses". We will keep this image of two frameworks "of functions "and "of uses" within society.

In order to use this set-up to look into the question of relations between transport supply and society, one needs to give a more precise description of the contents of each of these frameworks. The functions framework can at first be given as the transport supply, on condition that one considers this supply in a wide sense, encompassing all the technical aspects. Although it has its place in this framework, we have chosen here not to take into account what concerns high speed railroad technology. Enough studies have been made on the subject to give a good idea of the socio-technical framework for its development [RHCF, 1995]. We will stick here to qualifying the various services offered to users. In our case, the uses framework is all that concerns mobility and a wider view of transport demand. The aim here is above all to re-examine through a new grid, the results of mobility surveys concerning the Southeast and Atlantic-TGV. On a transverse level, called "society" in the following figure, one finds elements which make up the space, time and ideology context of the two former frameworks given above.



**Figure 1 : Framework of social and technical innovation**

This representation given by Flichy is taken for a great part from interactionistic sociology. It therefore implies articulating micro- and macro-social considerations. These articulations are what makes up the idea of "social world". One must in fact distinguish between the various scales of facts. Everything cannot be explained on a local level, on a short term basis, or on an individualistic point of view. On the other hand, every step does not necessarily influence the destiny of our planet or of capitalism. These different levels must therefore be taken into account and the changes which occur at each level compared.

According to this scheme, we will distinguish between two levels : one global level (part 2) in which we will present the main changes which can be described in the field of interurban high speed business trips, and a local level (part 3) in which will be described the individual situation of various cities. Inside each level, mention will be made of the social environment before defining the contents of the functions and uses frameworks as described above.

## **2 FRAMEWORK OF FUNCTIONS AND USES : HEAVYSET TRENDS**

A global approach necessarily relates to major changes in society. It is therefore understandable that one will not detail here in a few pages the great tendencies of our times

which are the object of a great number of studies everywhere. You will only find here very scarce explanations on these social trends. The plan of this presentation is dictated by the analysis grid chosen : a few elements of the general socio-economic context (2.1), the contents of the framework of functions (2.2) and the framework of uses (2.3) of high speed travel.

## **2.1 The socio-economic environment**

There are two elements here which seem to us to be characteristic of trends in our modern society : a high social valorisation of speed and traffic (2.1.1) on one hand, and a transformation of the productive system (2.1.2) on the other hand. These two events have not occurred during the modern ages at the same rhythm or according to the same pattern. Traffic is one of the founding values of capitalism that economists were already praising in the 18<sup>th</sup> century. Ever since then it has wended its way into economics, politics, urbanism, life styles and has even acquired an undeniable cultural dimension. It is a long term trend. Today's changes in our productive system seem in comparison quite temporary. They can be dated at the furthest back to the late 60's with the progressive decline of the foundations of the Fordist system and of the type of regulation that went with it. It has not yet led to a stabilised paradigmatic model as complete as the one it overturned.

### **2.1.1 Traffic**

It is quite clear for everyone that trade developed capitalism. A market is where all goods circulate. Rosanvallon [1989] shows very clearly how the "market" concept changes in the "liberal utopia" that emerges in the 18<sup>th</sup> century; according to Adam Smith it is no longer "a particular place of exchange: it is made up of the entire society". It has become the means of social regulation of an ideology opposed to Jean-Jacques Rousseau's idea of contract.

However one mustn't mistake this utopia on trade with the economic habits of the bourgeoisie "in a situation of society management". There remains nonetheless that the idea of market and its fluidity is one of the foundations of our social organisation, even beyond the notion of economics.

In these conditions, one can wonder on the status of another more recent utopia, communication. It first appeared during research that led to the advent of cybernetics and rapidly acquired an ideological dimension, namely under the influence of Norbert Wiener. It was a question of "interpreting the whole reality in terms of data and communication" and of "recognising communication as the central value for man and society". Starting from this, Breton [1992] analysed an ideology representing a new human being whose essence is communication and no longer his own qualities. At the same time, "the new society is articulated around the theme of social transparency" and is no longer built by excluding some of its members but, on the contrary, by integrating everyone of them. This social dimension shows that the communication utopia was also born as a reaction to the barbarism which is part of the three great ideologies inherited from the 19<sup>th</sup> century, that is fascism, communism, and liberalism.

One must admit however that all ties have not been shed with capitalism. "Communication practices", non confrontational by nature, are essentially individualistic. In this sense, they become part of our society without (as yet?) questioning it. They make use of its produce which even make up today's main activities (computers, telecommunications,...). And both these ideologies converge around the idea of fluidity. The economic and social valorisation of traffic is backed by two strong ideologies.



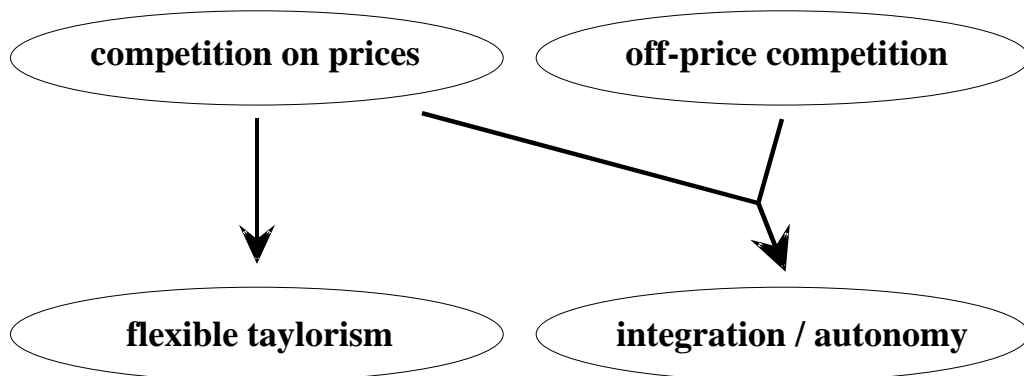
### **2.1.2 Changes in the productive system**

The crisis of the Fordist production organisation model is now obvious. This multiform crisis has spared neither the macro-economic regulation model it implied, nor the production techniques it used nor even the social links it was based on [Boyer, 1992, Mazier *et al.*, 1993]. The only thing we will insist on here is the importance which has become attached to the idea of flexibility, be it taken from the point of view of quality or quantity, on the long or the short term, strategic or operational,... as one of the keys for adapting to a situation of intensified competition. The productive system is undergoing a radical change. Although it doesn't seem likely that it will stabilise in the near future, one can however distinguish two evolution trends.

Veltz [1993] remarked upon the fact that competition between firms occurs on two levels: competition on prices and an "off-price" competition based on quality, adaptability to demand, innovation,...The ever increasing importance of this second kind of competition, despite the fact that price competition is still very high, is characteristic of today's changes in the productive system. In order to respond to this double challenge, firm organisation has had to undergo deep changes. Basically, there has been a change from a pyramidal and hierarchic organisation to a network or cellular one. However the autonomy of these production "cells" leads to a reinforcement of the general structure and to submission to its goals. There is a double movement of organisational integration and structural autonomy.

These changes can be seen at all levels of the productive system : inside firms from the distribution of know-how between subsidiaries to management of individual tasks inside a team. There has been a change from an inductive control of all actions to an *a priori* control on structures and people which leads to greater autonomy.

Despite the evidence of this trend, some analysts are not convinced. Work sociologists particularly, notice the persistence and even an increase in Taylorist methods [Sociologie du travail, 1993]. In this trend, work flexibility leads to the reinforcement of job insecurity, status deskilling,...This second trend appears to be just as present as the first one. It could even concern the greater number. We will use an expression made up by Durand [1991] to describe it : "flexible taylorism".



**Figure 2 : the two changes in the productive system**

Far from excluding one another, these two tendencies exist side by side in a dual productive system. The double integration/autonomy trend is characteristic of situations in which competition occurs on prices and off-prices. Flexible taylorism occurs when price is the main element in the balance of supply and demand.

### **2.2 The framework of functions**

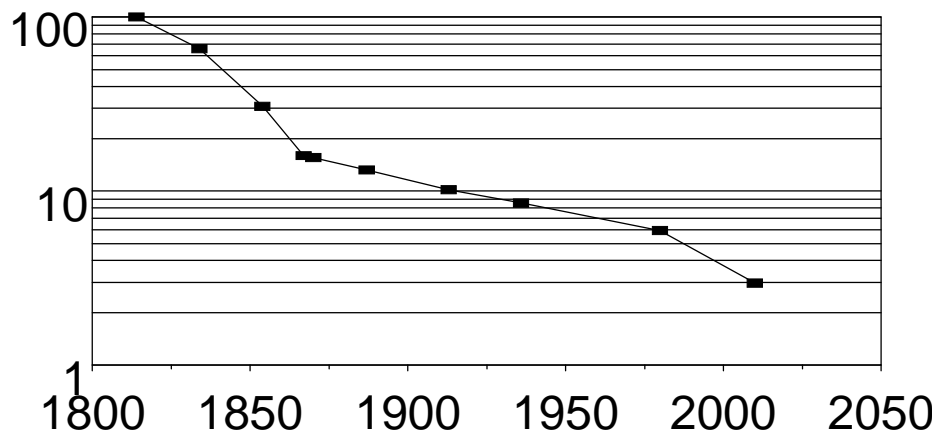
At this global level, three elements have been selected to make up the contents of the functions framework of high speed transport supply. The first one concerns the continuous

progression, over a long period, of prices - decreasing - and travel speed - increasing (2.2.1). The second one concerns an ascertained fact according to which the social cost of transport is not yet an obstacle to interurban mobility in Europe (2.2.2). The third deals with the specific logic behind the development of high speed transport supply (2.2.3).

### **2.2.1 A continuous progression towards lower prices and higher speed**

The following diagram illustrates far better than any words the decrease in travel time in France over the last two centuries. It is based on the time spent for overland travel (in carriages then by train) from Paris<sup>2</sup>. The last point on the chart, corresponding to 2010, was determined by estimating that the entire programme for high speed railroads in France will be completed, which we already know will not be the case.

One can notice that the increase in travel speed is a continuous movement, which started long before the first railroad line. The diagram also shows that the construction of the railroad network during the 19<sup>th</sup> century amplified the phenomenon until 1880. After that, improvement on the existing facilities kept up the trend all through the 20<sup>th</sup> century. Finally, the last part of the graph, although built on an excessively optimistic hypothesis, shows that the TGV is only an extension of a century-old evolution.



**Figure 3 : Decrease in overland travel time from Paris, 1840 - 2010**

Concerning the strictly monetary part of transport costs, the tendency is obviously the same. It is only slightly more difficult to illustrate because of the precautions one must take in comparing prices at different times. First one needs to bring all the monetary units down to a common reference. If one wishes to get an idea of the incidence of a monetary cost on the decision or not to travel, then one needs to introduce into the analysis a comparison of life standards. Finally, it is also necessary to determine precisely the service standards (speed, comfort,...) one wishes to compare.

Faced with all these hindrances, one is led to accumulate presumptions. For long-term data, we will refer to Toutain[1967] who was able to point out a continuous decrease in railroad travel prices from 7.1 centimes/kilometre.traveller in 1840 to 4 centimes/kilometre.traveller in 1913. For the contemporary period, the decrease in air fares over the last 30 years is a recognised fact. Since the early 80's competition between the plane and the TGV has gained an ever-increasing number of destinations, as the new railroad network has spread. Once a TGV line is operational, the technical performances of these two means of transport are more or less fixed. All competition takes place on the

<sup>2</sup> The data prior to 1940 was collected by Studeny [1990]. That concerning the 1980 period was taken from the SNCF statistics.

prices which means that the TGV also follows an age-old process of transport price reduction.

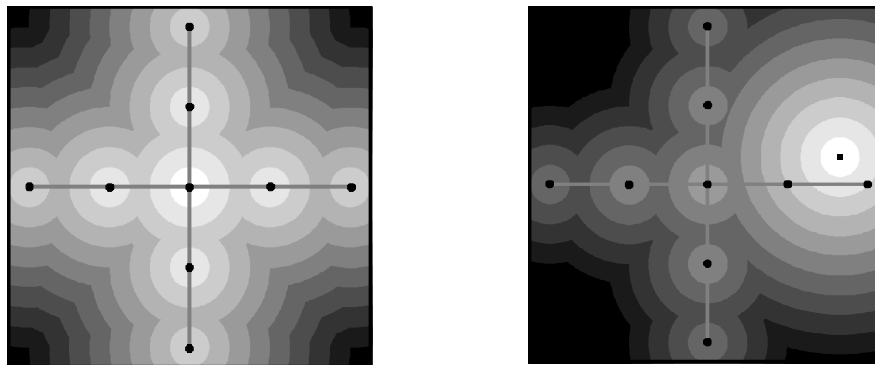
**2.2.2 Social costs are still ignored**

The social cost of long distance travel does not yet hinder mobility significantly. In France, this assumption is confirmed by all analysts, about urban mobility [Orfeuil, 1994]. Interurban travel is comparatively even less concerned by congestion and environmental problems.

Indeed the situation may change rapidly in this field. The pressure is strong to control mobility. Other countries seem to be ahead of us in this field. But on the other hand, there is strong inertia everywhere. Even in the most favourable situations, the efforts to internalise (make the user pay) pollution costs are only just beginning. And it is mainly in our ways of life, our urbanisation and our firm organisation schemes that we meet with the most resistance. Nowadays, the development of leisure activities, peri-urbanisation or the use of a traffic organisation logic, to mention only a few travel-consuming trends, are only marginally questioned. We will therefore stick to our view of widely ignored social costs.

**2.2.3 High speed logic**

Increase in travel speed brings about a change in transport supply which goes beyond the simple aspect of trip time. The outlook of the facility networks changes towards a concentration of flows and a decrease in the number of entrance places. The TGV stations and even more so the TGV junctions acquire a very special position in complete distinction with the area around them.



leaving from the central junction of the network

leaving from an isolated place on the network

**Figure 4 : Accessibility and high speed network : a theoretical approach**

These stations have a double advantage : one concerns the speed and the other the supply availability. Using a theoretical simulation which consists in superimposing a high speed network on an ordinary space, one has a simple illustration of the consequences in terms of accessibility of the high speed logic. [from Plassard,1989]. The central point of the network has the full benefit of increased accessibility to a large space symbolised here by the light colours. On the contrary, if one looks from a point in the graph which is not connected, the horizon darkens. One also falls back on a concentric proximity diagram,

which was very much different in the network case. In this example, travel speed is 4 times higher on the high speed network.

These changes in network outlook can be first seen as a result of the increase in flow speed. If one goes deeper, one sees that they also depend on a whole set of options which in turn depend explicitly on the set up of the functions framework. One can illustrate this by giving the differences between the French and the German idea of high speed : starting with a very similar technique, the former have set up a network of long-distance destinations competing with air travel, highly centralised around Paris, and which coincides with the classical network only on those portions of track needed to complete the TGV trips; the latter have developed a network of destinations integrating the classical system into the high speed one entirely, covering the whole of the territory, but basically oriented towards middle-distance travel. One can easily see by comparing the supply characteristics, what specificity for each country has led to the development of such and such a network.

### **2.3 The framework of uses**

Taken from a certain point of view, one could have inscribed in the framework of uses of high speed transport supply the elements presented in the socio-economic context. It is for instance quite obvious that the high social valorisation of traffic influences the ever-increasing development of the use of high speed means of travel. The same as the link between new forms of productive organisation and travel needs are evident. There remains to explain, through a description of the socio-economic context, the much wider dimension of the fore-mentioned phenomena than their direct implications in terms of transport.

Taken from this angle, the framework of uses gets its contents from the social practises which develop around the high speed transport supply. We will go into two different aspects here. The first one concerns the permanency of a strong social difference through the use of rapid transport means (2.3.1). The second one describes two different uses of high speed travel : as an opportunity to reduce travel cost or as a necessity to fit into new life or organisation patterns(2.3.2).

#### **2.3.1 Speed and social difference**

Of all times, the most rapid transport means have been developed by the dominating activities and social structures. This is already true concerning the hierarchy between urban centres. Speaking of the development of railroads during the 19<sup>th</sup> century, Pumain [1982] states that "[...] the network was mainly designed according to a hierarchy of size and dynamism which existed before its advent". This priority then given to connections between large urban centres still remains. In France, the first long distance motorway linked Lille, Paris, Lyon and Marseilles, and the first TGV line linked Paris and Lyon.

But the synergy between high transport means performances and high society can also be seen in other ways. Thus the activities which hold both power and a capacity to produce a high added value are always the first to make use of fast transport means. Braudel [1979] has given ample examples of this phenomenon concerning the spreading of news, bills of exchange or spices. Today, things are not quite so contrasted. One notices nevertheless a particular propensity in management activities on the one hand and activities linked with product conception, innovation and product/market articulation on the other hand to use

high speed transport systems. It is not a coincidence to find this power-riches association here again<sup>3</sup>.

Finally, this link can be seen almost as a caricature if one looks into the social position of the fastest transport means users. During the Ancien Regime, horses were the attributes of nobles. Nowadays, all the studies on the subject show that access to and use of rapid means of transport are first reserved to individuals with a privileged socio-professional status. The mobility survey around the Atlantic-TGV shows in all cases that a high proportion of the passenger population is well-off. Furthermore, there is another dynamic phenomenon in addition to this static social partitioning. Indeed most of the additional traffic due to the TGV also concerns the wealthier part of the population [Klein, Claisse, 1997]. There is a parallel between technical upgrading of a transport supply and social upgrading of the clientele.

Whatever entry point is chosen, there appears to be a constant conjunction between dominant social structures and travel means performances in the framework of uses which we are here attempting to describe.

### **2.3.2 High speed : opportunity or necessity**

The second aspect which makes up the framework of uses which we wish to describe, is more a work hypothesis, one must admit, than an analysis common to all mobility observers. It consists in considering that the social manifestation - through uses - of a high speed travel means technical performances occurs through two different mechanisms. According to the first one, high speed is an opportunity to speed up an activity which would have taken place, even without an improved transport supply. Time is then gained in an otherwise unchanged type of organisation or way of life. The decision on the opportunity will be taken according to criteria such as cost-advantage.

The second mechanism entails a necessity. It describes a situation in which the supply of saved time is a *sine qua non* condition in the given activity. High speed is then seen as a necessity for this particular type of organisation or way of life.

Two caricatural but nonetheless realistic examples may help in illustrating these two mechanisms. The first one is an executive who travels around a lot for business : he will take a high speed train rather than the plane if it allows him to gain time on a door-to-door trip and save money, his choice of the train is linked to an opportunity. The second one is a firm which will make the most of the improved travel conditions between two of its sites to share out the activity differently between them, thus saving money by specialising. These two complementary units will have to increase their communications. In this case, high speed travel technology is necessary for the type of organisation. Of course, reality is always made up of a conjunction of both aspects.

This theoretical construction is doubly interesting. On one hand, it creates a link between the framework of uses and the framework of functions. Flichy distinguishes between two types of users : the tactical user , who tries to make the most of the technical tool which is offered, and the strategical user whose actions will tend to modify it. The opportunity reasoning comes quite close to the first attitude. The relationship between necessity logic and strategical user is less obvious and calls for more details of the duo : changes in ways of life / changes in techniques.

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<sup>3</sup> It is also interesting to notice that in each epoch the dominant activities are those linked with the highest communication speed : the railroad, then the car industry and now computer science and telecommunications.

On the other hand, this theoretical construction links the use of transport means to a more general dimension in social organisation. It allows, for instance, while integrating the technical dimension of transport supply, to interpret the use of the opportunity of high speed as a part of a productive system according to the model of "flexible taylorism". On the contrary, high speed technology as a necessity recalls a "autonomy-integration"-type organisation [Klein, 1995].

### **3 A TGV LINK WITH PARIS : A VARIETY OF SITUATIONS**

Let us now leave aside general ideas, and look into real life situations of business-motivated interurban mobility and the part played by high speed transport supply. We have at our disposal ample supply of data, the result of two major surveys aimed at determining the evolution in transport uses and travel motivations before and after the Southeast and Atlantic-TGV were made operational. These surveys and their results were presented and published by the Laboratoire d'Economie des Transports [Bonnafeous *et al.*, 1981, Plassard, Routhier, 1986, Klein, Claisse, 1997] , should the reader wish to refer to them. We only wish to state here that the Southeast survey took place in 1980 and 1985 and deals mainly in trips between Paris and Lyon. This will be our first example. The Atlantic survey took place in 1989 and 1993 over a wider geographical area. We will deal here with trips between Tours, Nantes, Bordeaux and Paris.

In accordance with the grid which has been adopted, we will first detail the socio-economic context of each destination at the time of observation (3.1). Describing the functions framework will consist in giving details of the characteristics and the evolution of transport supply for each destination (3.2). The uses framework will be determined by a mobility behaviour analysis (3.3).

#### **3.1 Diversity in times and places**

The four towns chosen for their relationship to Paris present many differences, but to begin with we wish to insist on the incidence of time on each of the four examples. That is to say that this study deals with the relationship between high speed transport supply and society, not only in a given place determined by the specific railroad stations' catchment areas, but also at a given time determined by the survey dates. In this sense, the simultaneous analysis of the Southeast and Atlantic surveys shows all the importance of this time element.

##### **3.1.1 A key-element of analysis : the economic situation**

Observations on the Paris-Lyon trip lead to comparisons in work mobility between the two towns in 1980 (before the TGV) and in 1985 (after the TGV). The differences can be tied to the changes in transport supply between these two dates, but also to the changes in the economic situation, or more widely to any socio-economic change which might have occurred in the meantime.

1980 and 1985 showed very little difference in growth rate, namely +1.6 % and +1.9 %. But these two periods were dynamically very different since the growth rate declined rapidly in the early 80's, until it started going up again, precisely around 1985. Amidst this general tendency, some structural changes took place which showed their full effect when things started getting better (1986-1990). One of these elements was the specific growth of office buildings which contributed to the development of the area around the Part-Dieu station in Lyon, as well as to the development of service activities for firms. Finally one can consider that during this period of intense restructuring, the firms rationalised their national set-up, the next period being aimed more at European restructuring.

Between 1989 and 1993, things were very different. The general economic situation, to start with, went downhill, 1993 being a year of recession whereas 1989 was more like at the summit of the growth chart. The specific crisis in the office building sector strongly reduced the town development operations which accompanied the arrival of the TGV. The number of square metres of offices built was drastically reduced. The service sector, and especially services for firms, particularly sensitive to the economic situation, was very low. The general economic situation had a strong impact on the Atlantic survey, much more so than on the Southeast one. But this impact is only an illustration of the effect of the crisis on mobility. There is therefore no reason to study TGV integration in a given context outside of crisis periods, unless one were to imagine, against all odds, a future without economic recession.

Finally, one should mention here that 1993 will remain as the year of a specific railroad crisis. The "mishaps" when introducing the new marketing system "Socrate" were mainly solved when the survey took place in September. Nonetheless neither the problems of the former months nor the negative image of train travel, particularly by TGV, seen as expensive, were forgotten. That year, SNCF lost 7% of its customers on long distance travel.

### **3.1.2 The characteristics of four major French towns**

What first characterises Lyon, Tours, Nantes and Bordeaux is their size : 1.2 M for Lyon, 280,000 for Tours, 500,000 for Nantes and 700,000 for Bordeaux. They also differ by their influence range, the functions they have, and the diversity of their economic activities. For a detailed analysis of the place of each of these four cities, see Damette's study on the subject[1994].

Lyon appears as a particular case. It's the only city, with the exception of Paris, whose metropolitan character goes beyond the borders. On one hand, it's the capital city of the second biggest French region. On the other hand, its activities are part of a network of relationships which reach far beyond the regional borders. Although it comes a long way behind Paris, it manages to preserve a certain amount of activities in the field of economic co-ordination and regulation. Lyon's economic base is highly diversified and it seems to benefit from a certain autonomy in strategic fields. These characteristics were already valid in the early 80's, although the general economic context has changed since.

Nantes and Bordeaux have the same kind of exterior influence. They are among the biggest cities in France, and play the part of regional capitals over a large area, far wider than the administrative boundaries. However they do not seem to carry enough weight to develop wider intermediation capacities. As in the case of Lyon, but to a lower degree, they have quite a diversified economic base. They appear to be however less autonomous when it comes to a certain number of "higher functions" as analysed by Damette. Nantes and Bordeaux are typical French provincial capitals.

Tours has undeniably a much smaller influence range, limited by competition from its neighbours Nantes, Poitiers and Orleans. Most of all it is within the range of Paris's exterior influence. Finally, Tours is less economically-oriented and more turned towards what Damette calls "enlarged reproduction" (health sectors, universities,...). It is however quite diversified in its own field, has an active commercial base and a dynamic relationship with Paris.

## **3.2 Transport supply : on the look-out for the TGV**

Transport supply on a given destination can be analysed in two complementary ways : in absolute value in the first instance, by looking at its quantifiable values such as trip time,

frequency or price (3.2.1) and in the second instance by the opportunities of use it offers, in order to open up onto what is possible (3.2.2). However the situation here is one in which railroad performance has changed considerably. It is therefore also necessary to detail the position of each of the parties.

### **3.2.1 The quantifiable aspects of transport supply**

In order to give a physical description of the supply, we have chosen to give in the following table only those elements concerned with trip time. Trip frequency was not a discriminating factor in this case, since all four towns have numerous connections per day (from 14 daily between Paris and Tours, to over 20 daily between Paris and Lyon).

The reduction in travel time is highest for the Paris-Lyon connection, in absolute as well as in relative value. On the Atlantic-TGV connections, the percentage of time gained decreases with the distance. The same thing goes for commercial speed. Concerning competing travel means, we will say that for these three destinations travel time from airport to airport is about the same, and cannot be cut down to less than 1 hour ½ due to necessary delays for boarding and safety regulations specific to air travel. Finally, one can notice significant differences in the length of motorway trips.

from Paris to...	normal train (former situation)	TGV	Plane	Motorway
Lyon	4 hours	2 hours	yes	450 km
Tours	1 hour 45	1 hour	no	230 km
Nantes	3 hours	2 hours	yes	380 km
Bordeaux	4 hours	3hours	yes	580 km

**Table : transport supply**

Concerning prices, we wish to point out two important elements. The TGV connection between Paris and Lyon was set up keeping almost the same prices (the only addition to the ordinary price was a reservation which cost 14 FF in 1985). When the Atlantic-TGV was introduced, there was a much higher increase in price due to a much more expensive reservation. The second element is that this surcharge is a flat-rate tax. It penalises more the shorter trips. It has been worked out that the time gained by the TGV is, in 1993, sold for 25% more on a Paris-Tours ticket than on a Paris-Nantes one. Nevertheless, wherever train travel competes with air travel, the TGV connections were introduced with fares which on the whole were favourable to the railroad solution.

### **3.2.2 Another step in accessibility**

In a long-term process for increasing the speed of travel, the concrete changes are seen as thresholds. They mark the emergence of new possibilities for time and space use by society and individuals. The development of railroad travel in France brought the proportions of travel down to a unit of 24 hours around the year 1870, which corresponds to a time when the national market was very much unified. Today, the challenge is for individuals to be able to get around in a "normal" working day. The transport supply which answers this request for an economically reasonable price is sure of a success.

On an urban scale, this threshold was passed a while ago, with the use of cars and public transport. On an interurban scale, as soon as the distance increases, it is not always possible to take a trip in a day and have enough time to work when arrived, without taking the plane. From this point of view, the TGV connection between Paris and Lyon, by allowing time for return trips in a day, or even half a day, at a far lower price, not only won over a large part of the plane customers, but even developed different mobility behaviours with more frequent trips and shorter stays. The definition of an accessibility threshold



therefore combines the physical and price performances of different transport means with the time constraints due to various uses.

There is really no discussion for Lyon : the TGV has really been an important improvement in connecting it to Paris [Müller *et alii*, 1987]. The situation for Nantes is very similar to Lyon since the travel time is about the same. However the impact of the TGV connection is less important in this second case. Between Paris and Bordeaux the TGV takes three hours, which is the limit for the accessibility threshold described above. It makes some of the mentioned mobility behaviours possible, but not in the same conditions as with the plane. Besides, the relatively high prices on the Atlantic-TGV reduce the advantage it might have presented in 1993. This example, although it stays in the same trend, is a weakened image of the two former examples.

The situation is on the other hand completely different for Tours. First of all, the two only competing transport means are the car and the rail. Furthermore, it is possible with both means, as early as 1989, to go to Paris within a working day. Finally, one must take into account not only the question of the fares - which as we saw earlier, are not in favour of short trips - but also the TGV marketing constraints (such as the obligation to book one's seat). In these conditions, it seems that the TGV has certainly improved the accessibility by rail but no new threshold has been reached. The TGV has not taken over a significant amount of the road traffic on this destination.

### **3.3 Uses**

The arrival of the TGV in each of the 4 towns studied in this paper led to important changes in travel behaviour to and from Paris. These changes have been studied in the fore-mentioned surveys. We will purposely limit our investigations to business trips and have chosen to present these results town by town starting with the first connection, Lyon (3.3.1), then Tours (3.3.2), Nantes (3.3.3), and finally Bordeaux (3.3.4).

#### **3.3.1 Lyon in 85 : the use of high speed**

In 1980, the business traffic between Paris and Lyon was divided into an estimated third for railroad traffic and two-thirds for air traffic (the road traffic, being marginal was not taken into account) [Bonnafous *et al.*, 1981]. 90 % of this traffic was due to executives who for a good part already took return trips within a day (almost 40%). This kind of trip was more frequent by air. These business trips were taken for two main reasons : "merchant" reasons (purchases/sales) and "contact" reasons within a firm, a group, or a public service for which the traveller worked. The activity sectors which generated the traffic were representative of Lyon's industrial base. A great part came from heavy industry but also from service sectors developed in the area.

Between 1980 and 1985, the estimated traffic increase reached 60%. The distribution between travel means became very favourable to rail travel (approximately 85% of the market for the TGV) [Bonnafous, 1987]. At the same time, stays have shortened (55% return trips in a day) at the same time as trip frequency has increased. Furthermore, the number of joint trips (several people travelling together) has also increased, at the same time as trips taken by categories of professions which didn't travel until then. There appear to be two main reasons behind this increase in exchange : on one hand the purchase and sale of services (especially for firms) and on the other hand "internal contacts within firms". These changes do not jeopardise the established hierarchy between Paris and Lyon : Parisians come south to sell rather than to buy and it's the people from Lyon who go to Paris to meet their colleagues more often than the reverse. However the mobility study doesn't show an increase in this imbalance either.

On the whole, Paris and Lyon have moved closer insomuch as people have taken on relative proximity travel behaviour patterns. High speed transport supply has led to new ways of travel, but also to more integrated types of organisation between different locations in Paris and Lyon of the same firms.

### **3.3.2 Tours in 93 : Paris is getting further away despite the TGV**

In 1989, railroad traffic between Paris and Tours had a rather comfortable position : it concerned almost two-thirds of all business trips. The short distance between the two cities had made it a proximity traffic. 70% of these trips were return within the day. The high number of trips for reasons of internal meetings (within a firm, a group, or a public service) was a sure sign that the production organisation had also integrated a proximity-type relationship.

Starting from this highly favourable situation, the 1993 observations show a serious decline. On the whole, the volume of business trips between Paris and Tours has decreased drastically. This decrease is particularly felt on railroad traffic, reaching 40% on the survey days. It has affected particularly the trips for internal contacts (within a firm, a group, or a public service). Finally, the number of return trips in a day has decreased slightly more than the global traffic. It is as if Paris and Tours had grown further apart between 1989 and 1993.

If one looks into it in more detail, one can see that only two sectors of activity manage to maintain the same flow of traffic between Paris and Tours : that of non-merchant services, and mostly that of "studies-consultancies-assistance". The least unfavourable changes come from marketing and administrative executives as well as from professions. Finally it is interesting to see the high increase in return trips in half a day. But, confidential in 1989, this kind of travel is still marginal in 1993. Its development shows nonetheless that the technical performance of the TGV between Paris and Tours opens up new possibilities in mobility behaviour. The fact that these possibilities do not correspond to a necessity for new models of organisation can be due to any -or many- of the following : unfavourable economic situation, kinds of exchange between Paris and Tours, relative proximity between the two cities which favours car travel, or price and marketing policy of the railroad supply. It is only by taking into account the entire socio-technical framework in which the changes in transport supply between Paris and Tours took place that one will ever be able to explain why these two cities got further apart between 1989 and 1993, while at the same time railroad travel time on this destination was reduced by 46%.

### **3.3.3 Nantes in 93 : confirming the results for Lyon**

In 1989, the Paris-Nantes line was one of the few on which the traffic is almost equally divided between the three main transport means : the car (37%), the train (36%) and the plane (27%). However, each means had its specificity. Air travel was favoured by Parisians and mostly by executives who made up 80% of the clientele. It was used for short stays (over 60% of return trips within a day) and for activities dealing with internal relations. Road travel was mainly chosen by employees of the industrial sector who travelled around to sell or buy products or services. Despite the distance, almost half these trips were return-within-the-day. Railroad travel was used for several-day trips. It was also favoured by people living in Nantes (85% of the clientele) and civil servants.

This traditional situation was upset in 1993. To begin with, it is important to note the high increase in business trips between Paris and Nantes at this time (+40%) despite an economic crisis, which seems to have had less repercussions here at the time of the survey. Secondly the traffic distribution among the various means changed in such a way that air travel became marginal and the railroad traffic doubled, at the very least. This situation is

reminiscent of the one in Lyon, with the exception that a quarter of the trips are still taken by road.

The quantitative impact of the TGV on the general traffic can be found by examining traveller and trip characteristics. Road traffic has increased for several-day trips, but has decreased on return-within -the-day trips, although it still remains linked with purchase-sale motives. Railroad traffic has seen a tremendous increase on very short stays (return within half a day : x 10, return within the day : x 4.5) and is still increasing on the 2-3-day stays. There is an increase in the number of joint trips. It has won over an important part of the service sector clientele in general, and that of the "studies-consultancies-assistance" in particular. It has developed both for "purchase-sale" and "internal contact" goals.

Compared to the situation in Lyon in 1985, the main difference comes from the Parisians, who seem to have responded more strongly to the new supply than the people in Nantes. The first reason is that the Parisians had had time to learn from their experience on the Southeast network and took to the new TGV connection faster. But the economic situation and the relative domination of the Paris economy also play a part : with the crisis the traditionally provincial travel for "purchases" decreased whereas the travels from Paris for sales were maintained. In this context, the Parisians reacted faster and maintained their mobility. Finally, one has not noticed any "democratisation". On the contrary, mobility among lower job positions has decreased whereas that of executives has increased.

### **3.3.4 Bordeaux in 93 : high speed at a standstill**

In 1989, air travel already made up for more than half the business trips between Paris and Bordeaux and, because of the distance, road travel only played a marginal part. As in Nantes air travel was specialised in return-within-the-day trips and a clientele of executives. In the same way, train travel was reserved for longer stays and preferred by civil servants.

In 1993, the situation was completely different from the one in the other main city of the Atlantic coast. The volume of business trips measured by the survey had receded considerably (- 25%). This decrease was particularly felt on railroad traffic, although it was also true for air traffic. There seems to have been a general decrease in mobility between Paris and Bordeaux which concerned all traffic means and joint trips more than individual ones. This decrease in mobility concerned all job situations, but there was an increase in the relative volume of executive travel. It touched all sectors of activity evenly, with the exception of the "studies-consultancies-assistance" sector which was less concerned. Trips for purchases decreased drastically, and those for internal contacts were reduced. Only the sales sector maintained its activity.

The difference in changes between the air and rail traffic come from their initial positions, air travel offering a better resistance on its specific market. However there is little transfer of clientele from one means to the other. The only significant movement concerns, and only partly, the within-the-day return trips in favour of the TGV.

By looking at the Bordeaux situation, one can see that getting the most out of the potential of a high speed transport offer depends for a great part on elements which have nothing to do with transport. The 1993 crisis was decisive. The capacity for the TGV to take over part of the air traffic potential is real. It will show after 1993, when the economic crisis has died down, the SNCF has remodelled its price policy, and also, strangely enough, when the liberalisation of air traffic has increased the competition in this sector.

## CONCLUSION

The first point which appears after examining the four examples given above concerns the diversity of ways in which the traffic changes when the transport supply is changed. Even by only taking into account the volume of passengers, it is now obvious that the TGV does not systematically improve exchanges with Paris. If one looks into the contents of traffic flows, one sees an increase in the diversity of destinations. The myth of automatic effects stands up poorly to reality.

The second point we would like to stress can be boiled down to giving a better definition of what one can observe through the surveys one uses. At the first level, when analysing the data sheet by sheet, one sees trips. At the second level, despite the difficulties mentioned in 1.2, the statistic welding of these unitary observations leads to a certain idea of mobility behaviour on a given connection. At a third level, one may build an image of space and time use such as it appears from the study of economic activities.

When dealing with such problems as the interaction between transport and society, one refers more or less implicitly to this third level. From there on, it is easy to see that changes in transport supply are an element which must be taken into consideration for the analysis, but are not the only one. In the same way, one sees that the time element one must take into account is forever expanding, mixing the short and the long-term. It is the nature itself of the problems one wishes to solve, the global view one must take, which lends pertinence to the grid suggested by Flichy's work.

The systematic set-up developed here might have made this paper a bit laborious. It allowed us to insist on the necessity of crossing macro-social and macro-economic descriptions of various phenomena with finer and more precise approaches of reality. It also aimed at giving an example to prove that it is possible to give a contents to the socio-economic environment, and the frameworks of uses and functions which make up our analysis tools. On the other hand, the limits of a paper didn't allow us to do more than suggest the manner in which the different elements of the analysis are articulated. It is however important to insist on what it is which links these elements together, in order to give an overall structure to what has been presented point by point. For this we will trust the reader, thanks to his/her experience of impressionist painters, to step back and get a general view. One can also make use, and this is one of its strong points, of the grid suggested by Flichy to articulate both frameworks of functions and uses. Nevertheless, and for the main part, there remains a lot to be done to put all this into perspective.

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