

TELECOMMUNICATIONS SUBSTITUTION FOR TRANSPORTATION

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Summary

Sustainability specialists frequently cite telecommunications as an obvious technology for reducing the need for human travel and goods movement, and in turn reducing the resource consumption and environmental damage caused by transportation. Unfortunately, telecommunications have many characteristics that influence humankind toward more consumption of transportation resources rather than less. The relationship between telecommunications and transport is complex. Some aspects of telecommunication cause people to travel less, and other characteristics cause them to travel more. Overall, expanding telecommunication does not reduce overall travel demand. At the same time, there are many opportunities for designing telecommunication applications that could reduce unnecessary, unpopular travel. This article examines the fundamental relationship between telecommunications and transportation.

1. Introduction

Telecommunication (or telecom), like transportation, is an applied technology that affects the location and movement of people and things. Transportation (or transport)

provides a mechanical means of movement for people and things—physical mass—from one location to another. Telecommunication does not move mass, but it is now the most important means for people learning about distant attractions—people, places, and events—and for stimulating a demand for movement to and from those attractions.

Telecommunication means transmitting information via electromagnetic energy through the atmosphere or cables, and is explained in detail in other EOLSS articles. The scope of telecommunication discussed in this article is any transmission of voice, pictures, or data over the same distances to which transport applies: more than a few hundred meters or so. Telegraph, telephone, radio, television, video and audio conferencing, radar, telemetry, electronic mail, Internet, computer wide area networks, and satellite communications are common examples of telecommunications. The volume of telecommunications traffic is growing dramatically year by year, especially wireless and Internet traffic. Telecommunications over short distances, such as a signaling circuit within a single machine or an intercom within a building, is not important to the topic of this article, since mechanical transport is not usually important for spanning short distances. (The special cases of mechanical short-range transport for people with movement-related disabilities, and for material handling for production and storage processes, are covered in separate EOLSS chapters.)

Not all telecommunications applications bear particularly on transportation. Many telephone conversations, faxes, e-mails, and Internet sessions do not impact transportation one way or the other. The focus of this article is on the many uses of telecommunication that do bear on transport.

Two major ways that telecommunications can change transport are inherent in the technologies. The aspect to be considered in this article is how telecommunication influences the need or demand for travel, and thus changes the volume, trip timing, mode choice, and other statistically measured characteristics of transport as a whole. The existing travel volumes, environmental impacts, and other characteristics of the various modes of transport—private passenger vehicles, mass transit, aircraft, and marine shipping, for example—are covered in separate EOLSS articles. Linkages of these characteristics to telecommunications are covered below.

The second way for telecommunications to influence transport is by altering the characteristics of an individual journey as influenced by passenger amenities, guideway capacity, traffic congestion, the potential for accidents, and weather. While alluded to in the following, this impact of telecommunication is primarily considered in the separate EOLSS articles on roadway transportation control and communications systems (ITS), railway control and communications, marine transport navigation and communications, and on air traffic navigation and control. (see: *Intelligent Transportation Systems*)

Some telecommunication applications influence transport in both ways. For example, traffic-reporting systems using the Internet to display videos and maps of roadway congestion are increasingly available to urban car drivers for use in planning travel. This information influences drivers' departure time for a trip, the exact route they take, and even if they go at all. By influencing these choices, a traffic reporting system makes trips take less time, and thus makes the transportation system work better.

Computerized dispatching that optimizes routing for a large fleet of delivery or home service trucks is another example of a telecommunications application that influences both transportation demand and system performance. By minimizing the driving distances of these trucks, the system creates more space on the road for other vehicles.

The steady growth in both telecommunications usage and in travel demand in the developed world since the point in the twentieth century when telecommunication became ubiquitous shows that there is no reason to assume that telecommunications result in an overall net reduction in personal trips or freight shipments. Statistics describing travel and communications show that both are rising simultaneously, and likely stimulating each other.

2. Comparing Telecommunication and Transport

Transportation planners sometimes draw analogies between moving information and moving people and goods. However, despite some similarities, telecommunication and transport are fundamentally different technological processes, and analogies should be drawn with great care. The key similarity is that both offer a means of achieving the interactions, transactions, and other relationships that make up human social and economic activity: conversations, meetings, teaching, helping, sharing, buying, selling, trading, and making agreements.

Another similarity is that both are a means of connection. The popular expression “information highway,” used by journalists and government officials, captures the analogy of connection. However, advanced telecommunication is a much larger phenomenon than the movement of information. It includes storing, transforming, adding value to, filtering, and retrieving information as well. Telecommunications as “information transportation” semantically implies that information moved by means of telecommunication could have been moved in physical formats (such as documents or disks) via transportation. The phrase also implies that information that is being moved in transportation vehicles (for example, in the minds and briefcases of workers traveling between meetings on a highway) could be moved just as well via telecommunication channels. There is some truth in both of these implications, of course, but not complete truth.

Some telecommunications traffic does amount to information streams that were previously delivered by physical transportation. For example, a worker faxes a report that used to go by messenger. A professional attends a mandatory meeting by teleconference rather than by driving across the city. It is very clear, however, that the vast majority of telecommunications traffic would simply not happen if the information it carried in fact had to be delivered by transport vehicles. A worker who makes twenty phone calls, sends five faxes, and sends or receives fifty e-mail messages in a day is invariably not replacing seventy-five personal journeys and document shipments that would otherwise have been made.

The second implication, that much physically transported information could alternatively be sent electromagnetically, is widely claimed in order to emphasize the

opportunities for substitution of transportation by telecom. One can send a document through the mail or an overnight delivery service (transport), or one can send a fax or an e-mail message (telecommunication). One can either visit another office to talk to someone or else make a telephone call to take care of the same business. One can go out and buy the news as printed in a newspaper or magazine, or one can gain access to news services via television, touch-tone telephone, or Internet connection. One drives to the store or orders by telephone or web browser.

However, the kind of simple communications represented by these examples are not the main reason that travel is generated and transportation is used. Rather, physical proximity between people provides a much richer experience than simple messaging.

3. Comparing Remoteness and Proximity

Treating telecommunication as a mode of transportation, an alternative to the modes of bus and car, train and airplane, obscures the sharp and obvious distinction between transport and telecommunication: proximity to a destination as a result of travel vs. communication with the destination across a distance.

Physical proximity is intrinsically different from the remote communications access offered by telecommunication. Human interaction when people are physically proximate has numerous qualities that are difficult or impossible to duplicate with telecommunication. Physical proximity provides very different perception-shaping characteristics than foreseeable kinds of telecommunication.

Video conferencing is not equal to everyone being in the same room. Distance learning is not the same as learning in a classroom. Electronic shopping is not the same as going to the store. There may be equivalent functionality, but there is not complete physical equivalence. The differentiation shows up in performance gaps between the two modes of interaction. The differences between the two modes of interaction are critical. Neither one is always better than the other is. Remote interaction is better in some circumstances; face-to-face interaction is better in others.

A list of distinctions between face-to-face presence and remote interaction is presented in Table 1. Research describing the distinctions is covered in the EOLSS article on media choice.

Distinction category	Example
Focus of attention	Meeting creates more focus than a telephone conference.
Concern and commitment	Making a trip shows more caring than a telephone call.
Sensory input	Wider range of senses is employed in visiting than by telephoning.
Information bandwidth	More information is available in a visit than through e-mail.

Mixed media issues	Attending a meeting by speakerphone is a different experience than sitting at the meeting table, which means that mixing the two modes is an issue in critical meetings.
Personal skills	Some people are better at video presentation and some are better in person.
Power and status	Making people visit instead of letting them call is symbol of power and status.
Peripheral opportunities	On a visit one can do many additional things, unlike with a telephone call.
Flexibility opportunity	Being on the scene usually allows more flexible response than a telecommunication interaction.
Confidentiality	Face-to-face conversation is more secure than using telecommunications.
Unique proximity value	Saying you've been there has different value than saying you watched on television, for instance.
Value of the journey	Sometimes what happens on the trip to get there has value apart from the reaching the destination

Table 1. Distinctions between remote and face-to-face interaction

The differences between proximity and remote interaction have many consequences:

- Face to face conversation or other in person interaction in a confined, dedicated space can focus attention differently than telecommunicated interaction. A sharper focus of attention can lead to greater reinforcement of learning and retention of information.
- Traveling to visit someone demonstrates more concern and commitment than a telecommunicated message or interaction.
- Visiting in person allows for sensate input, temperature, vibration, aroma, taste, and crowd noise, for example. In addition, the ability to touch a person, animal, or object occurs in a visit.
- More information is available in a physical setting, for instance, traveling to a meeting room located in another company allows one to learn more about the organization and its people than interacting with the video images of persons in a meeting room.
- Mixing face-to-face and telecommunication connections in a single meeting creates important qualitative differences in the character of the communications between participants that can put some participants at a disadvantage. The people sitting with the boss in the conference room may have a distinct advantage in being persuasive in comparison to the group that is coming into the room only via speakerphone or video conferencing console. This distinction could motivate the distant participants to try to attend in person.
- Some people have a comparative skill or other advantage in face-to-face communications; they are attractive, intimidating, or particularly effective in face-to-face conversation. People can also be relatively disadvantaged in the use of telecommunications media such as video conferencing, and find face-to-face more

effective. Training makes an enormous difference in the effectiveness of an individual who communicates via a video channel.

Power and status are acknowledged when one goes to the office of a powerful or otherwise high-status person. Similarly, visiting the office of a customer can be a demonstration of respect. Face-to-face communication also make persuasive statements of concern and commitment to those present: The visitor could be communicating with anybody, anywhere, but in fact the visitor is standing in front of you, giving full attention to listening and reacting to what you say.

Physical proximity of workers in an office usually yields a high level of casual, serendipitous, spontaneous, nonintrusive communications among office staff. Communication between people who are nearby can be more easily synchronized to times when all parties are mentally ready to focus on the communication. The process of synchronization is much easier in an environment where people can see each other peripherally. Staff located in separate places must be much more intentional in their efforts to communicate.

Physical proximity in a work setting and the accompanying face-to-face synchronous communications also provide a sharper focus of attention. Well-designed office buildings strive to provide environments conducive to focusing completely on the organization's business.

Research has shown that the relative effectiveness of remote electronic interaction in comparison with face-to-face proximity between people depends on what the actors are trying to do. For example, Fujitsu in Japan reported in 1994 the results of research on the effectiveness of remote electronic communications as practiced in their company. These researchers developed a hierarchy of communications purpose, where telecommunication was shown to be more effective for informed people to share information and knowledge with uninformed people and for coordination, while face-to-face communication was best for persuasion, negotiation, and creation of new knowledge.

Visiting in person offers the opportunity to exercise flexibility of purpose at the intended destination and at add-on destinations. For example, one can easily drop in on a customer while “in the neighborhood,” even though getting through on the telephone may normally be difficult.

Many feel that confidentiality of communications is more certain when messages and interactions are being handled face-to-face, and not passed through telecommunication channels vulnerable to eavesdropping and recording.

Many people value proximity to certain special places or people, such as celebrities, separately from the operational significance. For example, a person may value a visit to an office where his grandfather once worked quite apart from the functionality of speaking with the present occupant.

Sometimes the act of traveling itself has value quite apart from the purpose of the trip or the destination. Traveling provides time to think, work, and relax.

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Biographical Sketch

John S. Niles is founder and president of Global Telematics <<http://www.globaltelematics.com>>, a policy research and management consulting firm based in Seattle, Washington since 1986. He is an independent

researcher working with innovators from business and government on regional telecommunications strategy, public transportation revitalization, and economic development.

He holds appointments as Senior Fellow for Telecommunications and Land Use at Center for the New West (Denver), as Transportation and Technology Fellow at Discovery Institute (Seattle), and Research Associate at the Mineta Transportation Institute of San Jose State University.

In the 1990s he led study projects that linked telecommunications growth to public policy for economic development in California, Washington, Oregon, Montana, Idaho, Minnesota, and Kentucky, as well as for the US federal government and the United Nations. He was principal investigator for a study ordered by the US Congress, *Beyond Telecommuting: A New Paradigm for the Effect of Telecommunications on Travel* (US Department of Energy, 1994). The conclusions of this study led to policy analysis projects by Global Telematics for regional transportation planning authorities in St. Louis, Seattle, and Los Angeles, creating recommended next steps for using telecommunications as a substitute for travel.

In 2000, John Niles participated in the Washington State Telework Coalition that made recommendations to government and business leadership in the State of Washington. In 2001, he began working on the Washington State Digital Emergency Services Initiative to fulfill the promise of wireless communications for enhanced safety and reduced travel delay on the highways. In support of equitable economic development, he is advisor to the Community Technology Institute (voicemail for homeless or phoneless people) and the Rural Coalition (Internet marketing for family farmers in the US and Mexico).

Since 2000, he has focused more on planning methodologies for transportation investment that better recognizes the interaction of technology and markets. Results include *A New Planning Template for Transit-Oriented Development* (Mineta Institute, 2001) and *Regional Freight Logistics Profile: A New Tool for Metropolitan Planning Agencies* (Mineta Institute, 2002).

As a management consultant, John Niles has been on the development and start-up teams of eight successful businesses and community service enterprises. He has intermittently provided counsel to business and government leaders in North America, Asia, Australia, and Europe. He has published 25 articles and several books, including *The New Management: Line Executive and Staff Professional in Future Firm* (McGraw-Hill, 1976).

He earned a Bachelor of Science degree in Mathematics from the Massachusetts Institute of Technology in 1968, and a Master of Science in Industrial Administration from Carnegie Mellon University in 1970.