NEW MEANINGS AND MEASURES OF ACCESSIBILITY IN THE
AGE OF INFORMATION AND COMMUNICATION TECHNOLOGY

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1. INTRODUCTION

First wave civilization saw accessibility in terms of food gathering and production:
people generally settled near fertile areas. The second wave treats accessibility in terms of
transportation of raw materials to processing facilities, and then to the customer. During past
three decades, especially in the last one, societies are invaded by information technologies
and are observing the information revolution. All this sweeping diffusion of
telecommunication infrastructure and services have given accessibility a new meaning, so
that it can no longer be described as spatial separation only, as virtual space is also playing
an important role (Gould, 1997). Use of Information and Communication Technologies
(ICTs), is changing every aspect of human life. People can access opportunities (like jobs,
shopping, public and private offices) both in physical (space of places) and virtual (space of
flows) spaces. By this change in conducting activities, the most affected fields are
transportation and communication, as space of places may be substituted, modified,
enhanced, or may result in the generation of more traffic by space of flows. Hence what will
be the new measures of accessibility? For this purpose, first of all a literature review of
different schools of thought related to this issue will be presented. In this age of information
technology, the opportunities can be divided into three broad categories, one that can be
accessed by using only ICTs, the second by using the physical space and third by using
both of them. Accordingly, people can also be categorized into three categories, one who
have the ICT skills and use it for accessing opportunities and the second who have the ICT
skills but don’t use it for accessing opportunities. The third one who don’t have ICT skills,
which means they can access the opportunities in physical space only. On the basis of this a
conceptual model for measuring the accessibility in this hybrid space is developed.

2. WHAT IS ACCESSIBILITY

“Accessibility… is a slippery notion… one of those common terms that everyone uses
until faced with the problem of defining and measuring it” (Gould, 1969).

Accessibility is not a distinct physical entity easily counted or measured, it is a concept,
a perception, something each one of us will experience, evaluate, or judge differently (Scott,
2000). Accessibility is indeed a relative and contextual notion, and the correct definition
largely depends on the scope and context of the investigation.

In the case of locational aspects of urban areas, accessibility is the geographic
definition of opportunities. Opportunities individuals have to participate in necessary or
desired activities, to explore new ones, is contingent upon their abilities to reach the right
places at the appropriate times and with reasonable expenditure of resources and efforts
(Coudelier, 2000). According to Shen (1988b), urban space is defined as the whole set of
geographical relationships among urban residents and their socio-economic activities.
Accessibility is a measure of the strength and extensiveness of these geographical
relationships. This relationship can be in the form of residence to job place or to shopping
area etc. Hence there are different aspects of accessibility, like physical, social and economical. Generally accessibility is defined as:

- A dictionary definition: “the ease with which one place may be reached by another” (Johnston et al., 1994).
- A definition related to the geographical aspects: “the potential for interaction, both social and economic. It is determined by the spatial distribution of potential destinations, the ease of reaching each destination, and the magnitude, quality, and character of activities in each destination” (Handy, 1994).
- A definition related to the economic aspects: “the logsum of expected utility of all potential destination and mode choices” (Ben-Akiva and Lerman, 1985).

These traditional definitions of accessibility focus on physical proximity, that’s why, three major approaches to measure accessibility used are, constraint-based, attraction-based, and benefit-based. Constraint-based measures demarcate the activity locations that are available to an individual, typically from a space-time perspective. Attraction-accessibility measures assess the trade-off between the attractiveness of destinations versus their interaction costs. Benefit measures involve a similar trade-off but attempt to measure explicitly the benefits accruing to the individuals from a choice set. In all three approaches, there is an explicit assumption that physical distance is a major structuring factor that influences spatial choices and therefore accessibility (Batty and Miller, 2000).

As the accessibility is the potential interaction between the places and for performing different activities at different times, people use different modes of transport or communication in order to overcome the friction of distance. Hence earlier transport, land-use, temporal and individual components were considered as major components of accessibility (Geurs and Ritsma van Eck, 2001). Now the fifth component, that of ICTs, which facilitates the people to access the opportunities by using virtual space, due to its ability to give freedom from time and distance is getting more in use. People all over the world are telecommuting, teleshopping and doing distance learning by using this. This affects the overall accessibility of the people. According to Handy and Mokhtarian (1996), a desire for more free time may be a strong motivator for telecommuting. It will also reduce the requirement of office space, as most of the back office activities, like administration and accounting can be telecommuted (Couclelis, 2000). Thus according to Shen (1998b), the people who don’t have the ICT skills will have less accessibility to the opportunities as compared to the people who have ICT skills and use them for accessing opportunities in virtual space. As the geographical relationships between the urban residents and their socio-economic activities are taking place in hybrid space, so their strengths and extensiveness are taking new forms.

3. EFFECTS OF ICT ON ACCESSIBILITY

Earlier people could access opportunities by four modes of transport namely, road, rail, water and airways, now the fifth mode, the ICTs have facilitated to access opportunities through virtual space. It means that they can telecommute, can do teleshopping, can have the distance learning and even can visit different places of their interest virtually. All this has lead to different questions about, how the accessibility is being affected by using all these new means of communication. One can decide his route and travel time by getting the online information by using the Intelligent Transportation System (ITS). Even one can work while traveling on his mobile laptop, which is the active use of the dead time earlier. Different people have different opinions about the effect of ICTs on accessibility, like it is argued that it will result in “death of the distance”, which means that people can commute over distances of thousands of kilometers without facing the friction of distance, that one can communicate to distance of thousands miles in a timeless manner (Cairncross, 1998). The death of the distance is mistakenly interpreted as disappearing geographies, differences of the places because people are communicating in the cyberspace (Wilson et al., 2001). But actually Internet has brought different places into a common realm where differences matter; hence
the problem of the space is not eliminated but intensified by crumbling of spatial barriers. Hall (1999) and Indovina (1999) have the same idea. They have negated ultimate results of death of cities caused by death of distance by arguing that this idea ignores the significance of face-to-face contact and that of agglomeration, which is very likely as human nature requires face-to-face contacts. There is another aspect that by the use of ICT the transportation saved time will be used for visiting clients, or for delayed commuting trips (in order to avoid the traffic jams), or it can be used for visiting friends or family with ambiguous but neutral travel impacts (Mokhtarian, 1998).

The effects of the ICT on the accessibility is quite complicated, as it has changed the concepts of space and time (Gepts, 2002). Alongside the historically rooted spatially organized space of places, the space of flows has arisen (Castells, 2000). The space of flows refers to the technological and organizational possibility to orchestrate social practices simultaneously without physical proximity. Graham and Marvin (1996) have tried to capture the impact of telecommunication upon patterns of urban forms, which has direct links with the accessibility, by taking into consideration the effect of ICT on space of flows. However they stated that this dichotomous model fails to grasp the complex and contradictory nature of linkages. Gepts (2002) has modified it by taking into consideration Castell’s idea that space of flows. He has developed a theoretical model for the interaction between space of flows and space of places, in order to find the effect of ICT on accessibility of people for their opportunities in this age of information technology. His model lacks the effect of modification of traveling patterns, which has been incorporated. As shown in the Fig. 1, this framework now consists of five relations between electronic spaces and urban places: synergy, substitution, modification, generation and enhancement.

**Fig. 1** A typology of the relations between physical places and virtual spaces

Source: Adopted from (Graham and Marvin, 1996) and (Gepts, 2002) with some additions and modifications.
4. MEASURING THE ACCESSIBILITY IN HYBRID SPACE

Despite the fact that ICTs are now playing a critical role in determining the strength and extensiveness of various geographical relationships virtually, all existing accessibility measures take into account only transportation without considering other means of spatial interaction (Shen, 1998b). As still, the major part of the activities are taking place in the physical space, hence the existing models for measuring the accessibility needs to incorporate the virtual accessibility component. Scott (2000) has given a model, which combines a traditional spatial interaction model with the $G_i$ local statistics (Getis and Ord’s $G_i$ statistics measures the degree of association or spatial clustering associated with a single variable distributed over a spatial surface) to shed new light on the notorious spatial mismatch phenomenon. Unlike the Scott’s predecessors, her model can be extended to the study of accessibility to employment in hybrid space. Heikila (2000) has combined the fuzzy logic with club theory (this examines the economic rationale by which individuals voluntarily form groups or clusters in order to derive tangible or intangible benefits through mutual association) to model the accessibility in both the geographic and non-geographic context. Shen (1998a) and Shen (2000), has used a composite measure (by categorizing the population according to their job type and means of accessing) of accessibility to jobs for Boston residents, which seems to be quite promising.

According to Couclelis (2000), Couclelis and Getis (2000), and Shen (2000) under the influence of ICT, the opportunities can be divided into three categories:

- First, the opportunities that are accessed through telecommunications, at least in part. ICTs are an indispensable component of these opportunities.
- Second, the opportunities that can be accessed either through transportation or ICTs. ICTs are preferable means of accessing these opportunities, but are not an indispensable component of these opportunities.
- Third, the traditional type of opportunities that belong exclusively to the physical space, and therefore are accessed by transportation only.

Hence, the opportunity seekers can also be divided into two broad categories based on whether or not they have ICT skills. On the basis of this we can formulate a broad conceptual model for measuring the accessibility of opportunity in the hybrid space, as shown in the Fig. 2.

The opportunities can be divided into a number of categories. For example in the case of jobs, people can commute and telecommute. If they telecommute, then it can be further categorized into two main classes, either it can be home based or centre based (called the tele-centers), which is mostly provided to the people near to their residences or the place, which is easily accessible to them. Both of these home-based and centre-based opportunities can be part time, full time or occasional. To these opportunities only the people having the ICT skills can access. While the opportunities in the physical space, has no limitation, those can be accessed by both of them either having or not having the ICT skills. This is same for other activities, like shopping, leisure etc.
There are several types of activity based accessibility measures, among them five are widely used: a contour measure, a potential accessibility measure, the accessibility measure with competition, the inverse balancing factor and accessibility measure from space time geography (Geurs and Ritsema van Eck, 2001). Among these, potential accessibility measure, with gravitational model given by Hansen (1959), with some modifications, by introducing competition factor has been widely used. As it was found that the measure given by Hansen accounts only for supply side. The demand side, the spatial distribution of demand for available opportunities are limited in capacity and if the demand is not uniformly distributed across space, then the competition factor needs to be incorporated.

The modified Hanson’s model by incorporating the modified demand factor under the influence of ICT as suggested by Shen (1998b) will be applied, in order to measure the accessibility of the people to their jobs, shopping and entertainment centers, hospitals, and other public offices. The results will be discussed in full paper.

5. REFERENCES:


