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Université de Montréal

The Rebirth of a Communications Network:
Europe at the Time of the Carolingians

par

Edda Claus

Département de sciences économiques

Faculté des arts et des sciences

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THE REBIRTH OF A COMMUNICATIONS NETWORK: EUROPE AT THE TIME OF THE CAROLINGIANS¹

LA RENAISSANCE D'UN RESEAU DE COMMUNICATION: L'EUROPE A L'EPOQUE CAROLINGIENNE

Abstract: This paper attempts to explain the accelerated economic growth of medieval Europe by incorporating communications technologies in the analysis. During the reign of Charlemagne, written and spoken Latin was effectively standardized which reduced the cost of information storage relative to transmission. This development fundamentally changed the existing communications network, based on the spoken word to a network based on the written word. Whereas large parts of Western Europe had been integrated into the centralized Roman empire of Charlemagne in 800 AD, by the turn of the millennium, Europe had evolved into a decentralized system of semi-autonomous counties and duchies. The new communications network enhanced the diffusion and eventual improvement of existing technologies, mostly related to agriculture, which contributed to Europe's economic take-off between 1000 AD and 1300 AD.

Résumé: Ce travail de recherche tente d'expliquer la croissance économique accélérée de l'Europe médiévale en incluant, dans l'analyse, les technologies de communication. Sous le règne de Charlemagne, le latin écrit et oral a été standardisé, ce qui a réduit le coût de stocker des informations par rapport à leur transmission. Ce développement a changé, d'une façon fondamentale, le réseau de communication, d'un système basé sur le langage parlé à un système basé sur le langage écrit. En A.D. 800, la plupart de l'Europe occidentale faisait partie de l'empire centralisé de Charlemagne, mais, à l'arrivée du nouveau millénaire, l'Europe a été transformée en un système décentralisé de comtés et de duchés semi-autonomes. Le nouveau réseau de communication a renforcé la diffusion et l'amélioration des technologies, principalement agricoles, déjà connues, ce qui a contribué au décollage économique de l'Europe entre A.D. 1000 et 1300 A.D.

¹ Special thanks are due to Leonard Dudley for suggesting this topic and for helpful comments. I would also like to thank François Vaillancourt for useful remarks. The views expressed in this paper are solely those of the author and all errors are my own.

PREFACE:

This Master's thesis is the extension of a theory developed by the Canadian economic historian Harold A. Innis which was further elaborated by Professor Leonard Dudley. Much of the findings of this paper are based on the results of a joint research project from Professor Dudley and myself entitled *Born Again, The Written Word and the Break from Path Dependency in Medieval Europe* (1997). Innis (1950) proposed that the communications technology is an important factor in determining a society's institutions and its economic performance. Innis pointed out that the Carolingian minuscule, a new style of writing created in medieval Europe, “became the basis for more efficient communication” (Innis 1950, p.148). This idea was taken up by Professor Dudley and subsequently elaborated in our 1997 project. The paper joins paleography and network theory in order to explain the economic take-off in medieval Europe. The standardization of the pronunciation, grammar and orthography of Latin as well as the creation of a new minuscule writing permitted Europe to become a major economic power between 1000 AD and 1300 AD. The changes in the written language, largely contributed to an Anglo-Saxon clergymen called Alcuin of York, reduced information storage cost relative to its transmission. This development caused early medieval society to move away from oral towards written communication which consequently brought about political decentralization and the rapid diffusion of knowledge.

Most of the above findings are a direct result of Professor Dudley's research. I did, nevertheless, contribute to the argument. I provided the statistics

concerning the number of documents produced between 0 AD and 900 AD which clearly indicate the shift from an oral society to one based on the written word. I also contributed ideas derived from recent literature such as Ganz (1987), Brown (1994) and McKitterick (1994). I provided examples concerning language heterogeneity and the changes in punctuation. Most helpful were the multiple discussions Professor Dudley and I had concerning the subject which were valuable food for thought.

The main argument of both papers, the joint research paper and my master's thesis, is the same, more specifically, the contribution of the change in the communications technology in the rapid economic growth of medieval Europe. However, my thesis differs from the joint paper in some important ways. First, the graphs used in explaining the theory are different. In the joint paper the isoquant-isocost analysis depicts the combination of inputs permitting the defense of X_0 units of territory. I chose to let the isoquant denote total economic output in order to underline the impact of the change in the communications technology on output. I also selected a different second traditional explanation for Europe's take-off, namely, the population approach instead of the institutional approach. Furthermore, I put a special emphasis on the role of the Church. The latter not only handled spiritual matters but was also involved in economic activity. The Church, having monopolized the new communications technology, was an important player in medieval economic growth.

Even though this thesis deals with the same subject as the joint project, it is in large parts complementary rather than substitutable for *Born Again, The Written Word and the Break from Path Dependency in Medieval Europe*.

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I. INTRODUCTION:

A full analysis of the production - and growth - process clearly lies far beyond the traditional boundaries of economics.

Wassily Leontief, 1959

Contrary to the belief of many, in the early part of the Middle Ages (from *circa* 500 AD to *circa* 1150) Europe experienced great technological progress and the second half of the "Dark Ages" (*circa* 1150 to 1500) marked the beginning of the predominance of western societies which continues to the present day. After a period of economic and cultural stagnation, Europe showed first its signs of economic expansion before, and seems to have really taken off after the turn of the millennium. The Western world experienced rapid economic growth between 1000 AD and 1300 AD. There have been attempts to explain this accelerated growth which are somewhat unsatisfactory. This paper presents an alternative approach to traditional economic growth theories. It encompasses the importance of communications technology and demonstrates that the catching-up and eventual overtaking of the Chinese and Arab world was made possible by changes in the European information network during the reign of Charlemagne (742-814).

On Christmas Day 800 AD, Charlemagne was crowned Roman emperor by Pope Leo III in Rome. For this occasion, Alcuin, an Anglo-Saxon scholar and former teacher at the Carolingian palace school, sent a copy of his Bible to the new Frankish emperor. This particular event marked a turning point in western

history. The Bible was written in a brand new style of writing which is now known as the Carolingian minuscule. This new writing style fundamentally changed the existing communications network based on the spoken word to one based on the written word which, in turn, transformed a highly centralized Carolingian empire into a decentralized system of semi-autonomous counties and duchies. From this angle, the gift of the Alcuin Bible marked the ending of an old and the beginning of a new era in European history.

In the year 800 AD, Europe was comparatively little populated and communities were small and very dispersed. Aachen (Aix-la-Chapelle), city of the Carolingian palace had only *circa* 5,000 inhabitants (Appendix, table 1). The only two large cities in western and central Europe were Rome and Naples with both roughly 50,000 inhabitants. Some 200 years later, *i.e.*, at the turn of the millennium, the picture had changed only slightly. The largest cities in Latin Christendom were Rome, Salerno, Venice and Regensburg with 35,000, 50,000, 45,000 and 40,000 inhabitants respectively. However, advancing another 300 years, the face of Europe in 1300 had been modified substantially. Four great cities, namely Paris, Genoa, Milan and Venice, each with 100,000 inhabitants or more had emerged. Other cities, such as Brugge (Bruges), Montpellier, Rouen, St. Omer, Köln (Cologne), London, L'Aquila, Bologna, Cremona, Ferrara, Naples, Palermo, Pisa and Siena constituted medium size cities with population between 35,000 and 100,000. Europe had evolved from the Western Roman Empire of Charlemagne to a system of semi-autonomous counties and duchies in

the second half of the Middle Ages. Looking at the overall picture, total European population rose from roughly 30 million in 800 AD to 36 million in 1000 AD. During the eleventh century, population increased by more than a fifth, in the twelfth by more than a quarter and in the thirteenth century by more than a third. At the beginning of the fourteenth century, European population reached an unprecedented 80 million people.¹

Turning now to a different aspect of civilization, more specifically the production of documents (some of which are rolls of papyrus), there had also been important changes. The number of documents produced per decade dropped from 25 in the period of 0-700 AD to only 1 in the period of 700-750 AD. The number increased to 10 in the second half of the eighth century and then exploded to 700 in the ninth century (Appendix, table 2). The two developments, namely the rise in the rate of European urbanization and the increase in the production of documents, are seemingly unrelated but it is the argument of this paper that there exists an important link between them. The change in the amount of documents produced indicates a change in the predominant technology of communication, from the spoken to the written word, which had an important impact on the organization of society, the creation of urban centres, and on economic growth.

The second part of the paper outlines two traditional explanations for Europe's accelerated growth in the Middle Ages, the geographical approach and the population pressure approach. The third part gives the theoretical background

¹ Colin McEvedy and Richard Jones, 1979, pp. 18 and 22

of an alternative argument, namely, the importance of a change in the technology of communication. According to Harold A. Innis, every technology of communication has a bias either towards time, space or number. When this technology changes, so does the bias which marks the beginning of economic expansion. This theory will be illustrated using an isoquant-isocost analysis. Part four is the historical analysis of a period when the predominant technology of communication changed. It outlines why such a change was needed. During the time of Charlemagne, agents mainly communicated orally. However, the system was becoming increasingly inefficient which made reforms necessary and the birth of the Carolingian minuscule, which encompassed a standardized form of Latin is then discussed. Part five outlines the implications of this new style of handwriting. The early medieval society was moving from a centralized system which relied on the spoken word to a decentralized system which relied on the written word. The new network also enhanced the flow of ideas which augmented economic growth. Most new technologies, such as the heavy plough, the three-field system, the horseshoe, the harnessing and the stirrup, the waterwheel and the wind mill had been not been inventions of the time but had been known at the advent and certainly during the first half of the Middle Ages. What permitted European growth was the diffusion, adoption and consequent adaptation of technology. This process is closely tied to the exchange of information which is, on the other hand, highly dependent on the prevailing information network. The Church was the major producer of books. It is therefore indispensable to have a close look at the

role of the Church in the diffusion of ideas and technology. This last point will be discussed in part six. The paper closes with some concluding remarks.

II. TWO TRADITIONAL APPROACHES:

The Middle Ages are often called the Dark Ages which can be somewhat misleading. This particular era saw a number of important changes for western society. Europe entered the Middle Ages backward and with a low level of urbanization but by the start of the sixteenth century, Europe had secured its predominance, had a high level of output and an increased level of urbanization. It had moved from a subsistence economy to being the leading economic power in the world.

i) Geography

Jones (1987) argued that the existence of a system of European states was mainly due to the characteristics of the environment. Europe is a scatter of regions of highly arable soil which constituted the centre of many sovereign states. Since progress in agriculture was slow up until the beginning of the Middle Ages, good soil was very valued. Most core regions became the seats of both civil and ecclesiastical administrations and lay at the nodal points of trade. These areas offered the largest tax bases to support offense and defense activities. Since agricultural productivity was low, state-building efforts succeeded in the relatively wealthy zones, such as the Parisian and the London basin, Flanders and the Po valley. The core-areas were separated by enclosing forests, mountains, marshes,

or sandy heaths. States began to emerge around 900 AD and there were still *circa* 1000 polities in the fourteenth century.² Linguistic uniformity supported internal political stability whereas natural barriers, such as the Alps, the Pyrénées and the mountain chain between Norway and Sweden or the riverine marshes of the northern Netherlands, kept amalgamation costs almost prohibitively high which secured external stability. Ethnic and linguistic diversity also added to the amalgamation costs. The peculiarities of European trade can also be explained through characteristics of the environment. Even though the portfolio of natural resources was extensive, not everything was found in the same location. Therefore, the choice of regional specialization was decisively influenced by environmental circumstances. Salt and wine from the South was exchanged against timber and minerals from the north, or wool from England, fish from the north Sea and cereals from the Baltic plain.³ Jones' geographical argument is very compelling. However, it has one fundamental flaw: geography did not change in the second half of the first millennium AD. Geography can, therefore, not explain why Europe developed into a decentralized system of multiple semi-autonomous counties and duchies and why there was such a sharp increase in the level of urbanization. It also cannot explain the large-scale, long-distance, multi-lateral trade that developed around the turn of the millennium.

² E. L. Jones, 1987, p. 106

³ E. L. Jones, 1987, p. 90

ii) Population

Boserup (1981) argued that the changes which occurred in Europe were due to population pressures. A long period of population increase started around the end of the first millennium AD and ended with the plague epidemic of the mid-fourteenth century.⁴ Population numbers before this period of growth had declined or stagnated due to major epidemics. People in pre-medieval Europe subsisted by long-fallow agriculture and had a tribal tenure system where all members of the local group had free access to pasture and cleared plots on all land dominated by the group. This systems persisted as long as population was so small that there was abundant land for grazing and cultivation. When increasing population size created a shortage of land and/or water, this system of common ownership broke down. Families then obtained a permanent right to the land they had been using.⁵ Population growth raised densities in Europe to medium levels. An increased number of people needed to be fed which caused important changes in agriculture. The system changed from long-fallow to medium/short-fallow. The loss of soil fertility was compensated by more sophisticated agricultural equipment such as the heavy plough and the improved horse collar. There exists a general tendency for short-fallow agriculture and urbanization to appear together and Medieval Europe did not represent an exception. When population density in a particular area became so high that agricultural systems required permanent investment in land or water supply, a secure title to the land had to be given to the

⁴ Boserup (1981) argued that population grows naturally. Henceforth, it is not population growth that has to be explained but its decline or stagnation. p. 94

⁵ Ester Boserup, 1981, p. 63

person who either organized or carried out the investment. The tribal tenure system changed to peasant-and-landlord tenure and the creation of permanent villages facilitated investment in rural infrastructure and supported the production and transfer of surpluses for urban use. Furthermore, urbanization was promoted, since improved equipment made it possible to expand short-fallow agriculture at the same time that population increases enlarged the labour force. By imposing taxes and labour services on the village communities, kings, churches and other landlords could force peasants to produce a surplus to feed the towns and the construction workers. Sparsely populated areas could export live cattle on foot but they could not export cereals. Therefore, European towns supplied by long distance water transport could develop only when other parts of Europe had reached population densities and a stage of agricultural development that made organization of food transport possible.⁶ Although Boserup's argument is also compelling, it has two major flaws. The first is the exogenous growth of population. Boserup claimed that there exists a steady increase in population interrupted by epidemics, natural disasters and warfare. One therefore needs to explain slowdowns in population growth rather than the acceleration. Yet, Boserup fails to provide a convincing justification for her claim.⁷ Furthermore, the link between the increase in the number of people and the rate of urbanization is

⁶ Ester Boserup, 1981, pp. 96-97

⁷ Lynn White's argument that the technological changes in European agriculture were the main cause for the later multiplication of the European population seems to be more intuitive. However, there most likely exists an important feed-back effect, going in both directions, between technological progress and population growth. Nevertheless, one needs to establish a causality and the direction from agricultural progress to population appears to be more compelling.

not clear. Both seem to happen simultaneously which does not prove a clear causality between them.

III. THEORETICAL BACKGROUND:

The Canadian economist Harold A. Innis argued that there exists an important feedback between a society's change in communications technology and its economic activities.⁸ Any technology of communication has a bias towards either: i) time, ii) space or iii) number. Parchment, a heavy and durable medium has a bias towards storing information over time. Papyrus or paper, light and perishable, are rather biased towards the transmission of information. Both are therefore biased towards space. The telephone and even more so the facsimile and the internet, on the other hand, are biased towards the number of people exchanging information. The different bias translates into different relative costs which, in turn, allow for different production possibilities *ceteris paribus*.

i) Isoquant-isocost analysis

Figure 1 shows a two dimensional isoquant-isocost analysis with information storage in units of bit-years on the abscissa and information transmission in units of bit-km on the ordinate. The two isocost curves AA and BB in figure 1 represent two different information networks. For an information technology which is biased towards space, the transmission of information is cheap relative to storage. Therefore, a typical isocost representing a space biased technology (line

⁸ Leonard Dudley, 1996b, p. 1

AA) has a relatively steep slope. Information may be regarded as a factor of production. With falling transaction costs of exchanging information either across time or across space, higher output can be attained. Decreased transaction costs can be achieved through an improvement in the communications technology. Therefore, a movement in a north-east direction represents a higher level of output. The isoquant (curve Y_0) represents total constant economic output when varying information transmission and storage,⁹ holding everything else, such as the absolute quantity of information in the economy, technology, labour and capital input, constant. Point C, the point of tangency between the isoquant Y_0 and the isocost AA, indicates the optimal combination of units of information stored and transmitted (s_1, t_1) for an economy where the predominant information technology is biased towards the transmission of information.

If the bias moves from transmission to storage, the absolute cost per unit of information transmitted increases which translates into a lower intercept with the ordinate. On the other hand, the absolute cost per unit of information stored decreases which translates into a larger intercept with the abscissa. Line BB in figure 1 represents a typical isocost for a time biased technology of information where the storage of one unit of information is relatively less costly compared to its transmission. Therefore, line BB has a flat slope. Point D, the point of tangency between the isoquant Y_0 and the isocost BB, denotes the optimal combination (s_2, t_2) in an economy where the predominant communications technology is biased

⁹ Figure 1 shows the pure Hicks substitution effect between units of information transmitted and units of information stored.

towards the storage of information. If the decrease in the cost per unit of information stored is large enough compared to the increase per unit transmitted, then the total cost of information, used in the production of a given economic output, falls, holding every thing else constant. Therefore, BB denotes lower total costs than AA.

The isocost FF (figure 2) represents the same level of total cost as AA and the same network as BB which translates into the same relative prices of information storage and transmission as BB. Consequently, FF is parallel to BB but has a lower intercept with the ordinate than AA, since the absolute cost of transmitting one unit of information is greater for the time biased technology than for the space biased technology of communication. The optimal point E (s_3, t_3) represents a higher level of output than D (and hence C ($Y_1 > Y_0$)), since it denotes a higher level of both units of information stored and transmitted ($s_3 > s_2, t_3 > t_2$),¹⁰ keeping all other factors of production fixed. Therefore, a change in the information network structure, which translates into a fall in the cost of information storage and a rise in the cost of information transmission, permits an increase in total output assuming the fall in the cost per unit of information stored more than offsets the rise in the cost per unit of information transmitted .

ii) A centralized versus a decentralized system

Figure 3 shows the organization of the information flows for these two technologies of communication. The first diagram illustrates a centralized system.

¹⁰ s_2, s_3 and t_2, t_3 are the pure Hicks income effect of a fall in the cost of information storage.

Information flows from the centre to the periphery. There is no direct connection between the different peripheral points. Information always flows through the centre. The first diagram corresponds to point C in figure 1. Since the storage of information is relatively more expensive than its transmission, it is stored at only one central point. The second diagram illustrates a decentralized system. Instead of one big centre, there are multiple smaller centres. It is important to note that the exact same points as in the first diagram are reached just the way they are interlinked differs. Information flows from the peripheral points to the smaller centres with which they are linked and then to the largest centre in the system. The second diagram corresponds to point D in figure 1 (and point E in figure 2). Since the cost of storing information has fallen relative to the cost of transmission, it is stored at different locations rather than at one main point. Furthermore, the average distance between two peripheral points linked with the same node has decreased reflecting the relative increase in the cost of transmitting information to storing it.

IV. HISTORICAL ANALYSIS:

i) A centralized society

The empire of Charlemagne (742-814) was a centralized society whose main means of communication was the spoken word.¹¹ At the centre was the court of Charlemagne who was giving oral instructions to his subjects. Official documents

¹¹ Giles Brown in Rosamund McKitterick, 1994, p. 27

were not drafted in full text but served rather to recall the content of royal commandments made orally.¹² The *bannum*, the spoken word of the emperor, ranked above the written text in the order of authority.¹³ This system corresponds to diagram (a) in figure 3 with the Carolingian court at the centre point and the peripheral points representing different locations inside and outside the Frankish kingdom which was later to become an empire. The heavy reliance on oral communication was not a Carolingian phenomenon. During the times of the Merovingians, the use of the written word had been decreasing steadily. Literacy levels as well as the quality of documents had declined significantly.¹⁴ However, during the Carolingian era that followed, the system of communicating orally became increasingly inefficient. Whereas during and after the fall of the Roman empire, mostly everybody that mattered had spoken or understood Latin, different dialects started to develop in the different regions inside and outside the Carolingian territory.¹⁵ In northern France, for example, Latin had evolved considerably more than in Italy, which made it very difficult for non-native speakers, such as Germanic and Anglo-Saxon people, to converse with the French.¹⁶ Therefore, oral communication was becoming inefficient. Furthermore, the different pronunciation caused another serious problem, namely an increasing

¹² Brian Stock, 1993, p. 16

¹³ Brian Stock, 1993, p. 17

¹⁴ Some suggest that after about 700 AD, no more legal documents or judgments were issued in the name of the Merovingians.

Giles Brown in Rosamund McKitterick, 1994, p. 4

As mentioned earlier, table 2 indicates the decreasing book production prior to the Carolingian renaissance.

¹⁵ The Carolingian territory encompassed modern western Germany, the Low Countries, France, Austria, Switzerland and northern Italy. Consequently, not everybody in the kingdom and later empire was a native Latin speaker.

difference in spelling. Since people wrote what they said, the same word would be spelled differently in different areas. These differences, in turn, caused the grammar to also develop differently. In France, for example, through the disappearance of the silent endlettres most declinations were dropped.¹⁷ Furthermore, the style of writing was not universal which also contributed to rising difficulties in communication. Various scripts for both documents and books developed in the various kingdoms of western Europe.¹⁸ The scripts used by Anglo-Saxon and Irish scribes differed from the Merovingian or Langobardian scripts. These increasing inefficiencies were very counterproductive to economic activity since they increased the cost of decoding information. With constant total cost, the amount of information available decreased which put downward pressure on output. The early Middle Ages, before Charlemagne, were a period of very sluggish economic activity. Europe stayed at point C in figure 1 over a prolonged period of time, or even moved to the south-west of C, which represents economic contraction, due to increasing cost of both transmission and storage of information.

ii) The birth of the Carolingian minuscule:

Up until around 800 AD, the major source of income for the Carolingians originated from warfare. The habitude of tribute payments and plundering (the taking of slaves was an important form of plundering¹⁹) had been handed down

¹⁶ Roger Wright, 1982, p. 103

¹⁷ Reinhold Kontzi, 1978, p. 408

¹⁸ Rosamund McKitterick, 1994, p. 232

¹⁹ Timothy Reuter, 1984, p. 77

from the Merovingians. During the ninety years between the accession of Charles Martel and the conclusion of the peace with the Saxons in 803 AD, the Franks took the field practically every year.²⁰ However, the military expansion of the Carolingian empire slowed down quickly after 800 AD and came to a standstill under Louis the Pious, son of Charlemagne. The crushing of the Avars in the 790s AD was the last large scale military operation of the Carolingians.²¹ The Franks, therefore, had to turn to alternative sources of revenue. One such alternative was taxation. However, in order to raise sufficient funds, a more sophisticated bureaucracy which depended on reliable information of who owned what was required. Written records were necessary to adequately register this information. Property rights needed to be established, recorded and protected and hence the need for written and universally applicable law arose. Hence, the ending of the great Carolingian expansion marked the beginning of increasing use of the written word.

However, as the inefficiencies of the latter rose so did the need for reform. A key figure in the great change was an Englishman called Alcuin, former teacher at the Carolingian palace school. Albinus, alias Alcuin of York, then abbot of the Benedictine monastery of St. Martin at Tours²² introduced a new script which came later to be known as the Carolingian minuscule. Rather than inventing an entirely new script, Alcuin combined different features of different scripts already in existence. There had been, for example, a steady evolution of minuscule scripts

²⁰ Timothy Reuter, 1990, p. 391

²¹ Timothy Reuter, 1990, p. 391

²² Leonard Dudley, 1996c, p. 14

at the monasteries of Corbie, Luxeuil, Bobbio, Tours, Verona, Lyon and Reims.²³ Important features of the Carolingian minuscule were its uniformity, consistency, regularity and clarity. But even more important were the novelties concerning the text layout, punctuation, form and type of script and letter forms.²⁴ Individual words were separated by a space, the beginning of a sentence was marked by a capital letter and the end by a full stop. The use of paragraphs was also adopted and a clear hierarchy of scripts was introduced. Chapter headings were written in Roman capital letters, the first line in half uncials²⁵ and the remaining of the text in Carolingian minuscule.²⁶ The custom of leaving a fixed amount of space between individual words, double the space left between single letters, was imitated from the insular scripts. On the present day British and Irish isles, the separation of words was commonly adopted around the end of the seventh to early eighth century.²⁷ In addition, the new script was saving precious space on the expensive material parchment, the preferred writing material of the time. Furthermore, Alcuin established a comprehensive grammar, as well as rules for pronunciation and spelling. He effectively standardized both written and spoken Latin.

²³ Bernhard Bischoff, 1981, p. 5

²⁴ Rosamund McKitterick, 1994, p. 234

²⁵ Half uncials are primarily capital letters used prior to the invention of minuscule writing. However, they are marked by extensions above and below the line of many vertical strokes which clearly indicates the movement towards a minuscule writing.

²⁶ Albertine Gaur, 1984, p. 172

²⁷ Paul Saenger in Henri-Jean Martin and Jean Vezin, 1990a, p. 451

In the second century AD, Romans had separated words using a full stop. However, there was no precise concept of the word as it is known nowadays and the use of full stops was abandoned.

Paul Saenger in Henri-Jean Martin and Jean Vezin, 1990b, p. 447

V. IMPLICATIONS OF THE CHANGE:

The introduction of the new script had an important impact, not only on the social organization but also on the technological progress of medieval Europe.

i) A decentralized society

The reforms of the script brought about an important reorganization in all layers of medieval society. The social and economic structure experienced substantial changes. At the root was the change from a basically oral society to one based on the written word, from a centralized to a decentralized system (figure 3). The bias was moving from transmission to time, the economy was moving from point C to point D (figure 1). At the kernel of each small centre was now a monastery whose libraries increasingly stored important information. The abbey of La Chiusa is said to have contained no less than 6,500 volumes before its destruction by the Saracens in 905 AD.²⁸ The centre of gravity for most aspects in medieval society was moving away from the royal courts towards the Church. The use of writing was monopolized by the Church and education was becoming a solely clerical matter. The production of books, the copying of existing ones and the creation of new ones, was almost exclusively carried out by monks.²⁹ Literacy was not spreading throughout the population as whole but was confined to a small élite. The bias was henceforth not moving towards number. The written and the spoken word were complements rather than substitutes. Communication between the smaller centre points and the peripheral points was mainly oral, whereas

²⁸ Geo. Haven Putnam, 1962, p. 134

²⁹ Nuns were more involved in the production of parchment rather than the actual writing/copying of books.

communication between the different centres (the dotted lines in figure 3) was basically written. Therefore, one mode of communication did not replace the other.

The standardization of the spelling, pronunciation and grammar of the Latin language created a distinct difference between this Latin and the local vernaculars. Some argue that with Alcuin, medieval Latin was born.³⁰ The important point, however, is that the standardized Latin was easily understood by educated native Romance/Latin speakers, such as the inhabitants of present day France, Italy, and Spain, as well as educated non native speakers such as the different Germanic and present day British and Irish people. Latin was becoming the language of the *intelligentsia*.

The reign of Charlemagne clearly marked the period of change. Whereas, as outlined above, the written word had been steadily losing importance prior to the Carolingian Renaissance, this development started to reverse. King David, as Charlemagne liked to be called, ordered, for example, that the unwritten laws of all the tribes which came under his rule be written down.³¹ Furthermore, property rights were recorded. Written documents constituted the legal proof of the legitimate ownership of a particular piece of land.³² As mentioned above, the motive for this rise of recording information was the need for taxation revenue.

³⁰ See, for example, Roger Wright 1982 and 1991.

³¹ Paul Edward Dutton, 1993, p. 37

³² Rosamund McKitterick, 1989, p. 66

ii) The Carolingian minuscule and technology

The new script spread rapidly³³ across Europe giving rise to increasing positive network externalities the more people joined the system. The number of people has a direct impact on the quality of a system. Furthermore, the more people join, the more people are induced to join the system.³⁴ Moreover, written records, in a language easily understandable to the literate, permitted the exchange of new and old ideas. Economic growth occurs when new ideas are introduced and adopted. If one assumes that fresh ideas arise from the new combination of old concepts³⁵ then the well functioning of the predominant system of communications is of foremost importance. With technological progress, point D in figure 1 then represents increasing output, holding the relative price of transmission/storage constant. During the early part of the Middle Ages, books and *ergo* ideas were exchanged between England, Spain, Italy, and Gaul.³⁶

The novelties that permitted the economic expansion of medieval Europe were not inventions and only some were indeed innovations. The most significant "new" technologies were the heavy plough, the three-field system, the horseshoe, the harnessing and the stirrup, the water wheel and the windmill. Most of these technologies had been known for an extensive period. The earliest mention of this new kind of heavy plough was in the first century AD by Pliny in his *Naturalis*

³³ After the year 800 AD, most manuscripts seem to have been using the new Carolingian script. This statement is based on the table of datable manuscripts in Ganz, 1987, pp. 26-7

³⁴ Michael Katz and Carl Shapiro, 1985, p. 424

³⁵ Martin Weitzman, 1995

³⁶ Rosamund McKitterick, 1994, p. 242

historia.³⁷ The waterwheel (albeit, it was horizontal rather than vertical), much like the heavy plough, was most probably a barbarian invention. Similar wheels were also found in China, as early as 31 AD.³⁸ Windmills, appearing in Europe in the twelfth century are believed to be inspired by the Tibetan wind-driven prayer cylinders which may have appeared as early as the sixth century AD and certainly by 823 AD.³⁹ Whereas in Tibet, this technology was only applied for religious purposes, vertical axle windmills were found in early tenth-century southern Afghanistan.⁴⁰ Marc Bloch concludes that the water driven mill was invented in the first century BC⁴¹ but its use became only common in Europe in the Middle Ages. The three-field system arose most likely out of the marriage of Baltic-north Sea spring planting and Mediterranean autumn planting. The stirrup is presumably a Chinese invention dating from the fifth century AD. Horseshoes are most likely an invention of nomadic riders of the ninth to twelfth century. The horse-collar and breast-strap types of harness also originated in Asia.⁴² Therefore, the economic growth in medieval Europe was due to the diffusion and assimilation of already existing technologies rather than inventions. The innovative aspect in Europe was that the new technologies were applied to a variety of existing productive pursuits. In China, for example, the water wheel was exclusively used for metal works, whereas, in Europe, it was not only used for grinding but also for the preparation of malt, the fulling of cloth, the sawing of wood and the

³⁷ Lynn White, 1962, p. 42

³⁸ Lynn White, 1962, p. 81

³⁹ Lynn White, 1962, p. 85

⁴⁰ Lynn White, 1962, p. 86

⁴¹ Lynn White, 1978, p. 20

production of silk thread.⁴³ Similarly, the windmill, commonly known in China, was adapted and improved in Europe. This cannot be solely due to the mobility of scholarly people within the Occident, since in China, people moved also.

It is sometimes argued that the ancient world failed to progress technologically because it possessed an abundance of cheap slave labour. The adaptation and diffusion of superior technologies was hindered since new technologies tended to replace cheap labour with expensive capital. For example, there had been great improvements in the use of animal power, of the horse in particular but also of the oxen. However, with inexpensive human power, there was no need to invest in expensive animal power. Therefore, improvements spread only slowly or not at all. In Europe, slaves were almost exclusively pagans. Once most tribes were christianized, the taking of European slaves disappeared, since Christians would not take Christian slaves. In Asia, no such religious considerations existed which contributed for the greater abundance of cheap labour in Asia than in Europe. O'Brian (1996) argues that European farmers accumulated 'know-how' and understood and appreciated the new technologies. This second argument is quite simplistic, since it is not mentioned of how the know-how is suddenly accumulated at the beginning of the second millennium AD. Furthermore, why would only European farmers understand new technologies, and not their Asian counterparts? The explanation also does not elucidate the timing of the diffusion of the different technologies. Moreover, both

⁴² Lynn White, 1978, p. 286

⁴³ Ian Inkster, 1991, p. 14

arguments ignore that the rate of diffusion and the consequent improvements of new technologies highly depends on the distribution of information within a given territory which, in turn, depends on the efficiency of the predominant technology of communication. There are certainly other factors influencing the rate of diffusion and improvement, such as sectoral competitiveness, human and physical capital and a host of other factors, but at the origin lies the flow of information. If farmers in the Rhine valley do not know that farmers in the Seine valley are using a more productive heavy plough rather than the scratch plough, how can they adopt the new technology? As outlined above, most technologies were known in the Occident at the time of Charlemagne. However, their use was mostly limited to northern continental Europe. It would take roughly another 300 years until the plough, the three field system and the horse harness were utilized throughout the western world. It is therefore not surprising that already existing technologies started to be widely diffused, adopted and consequently adapted after the birth and the expanding use of the Carolingian minuscule. This new technology of communication was therefore the key element in the economic take-off in Europe. It permitted western civilization to move from a point such as C (figure 2) to D and subsequently to a point such as E. The isoquant Y_0 would therefore represent European output in 800 AD and Y_1 in 1300 AD.

As mentioned earlier, the improvement of the heavy plough was an important development for the European economy. Unlike the scratch-plough which was in use roughly up until that time and which was most suitable to the

light and dry soil of the Mediterranean regions, the new heavy plough handled the heavy moist soil of central and northern Europe very well. This, coupled with field drainage and the accession of new soils greatly improved agricultural productivity. However, the heavy plough demanded a higher number of oxen, eight to be precise. Since few peasants owned such a large amount of oxen, the pooling of resources became necessary. Therefore, the new heavy plough increased the need of teamwork which favoured the organization of society into small entities⁴⁴ which, in turn, gave rise to the medieval manorial system.⁴⁵ The change in the information network was paramount to this decentralization. Had it not become relatively cheaper to store information, small centres could never have developed.

VI. THE ROLE OF THE CHURCH:

The technological progress of the time is seemingly unrelated to the Church which, as discussed above, had monopolized the new technology of communication. This poses a fundamental question: What, if any, was the link between the Church and the diffusion of ideas which ultimately accelerated economic growth?

i) The book producer

The majority of the texts produced by clerical institutions were in fact the Bible and canon laws and also liturgical and service books.⁴⁶ However, in addition to religious toil, Carolingian and other scholars produced their own scientific

⁴⁴ Lynn White, 1966, pp. 43-4

⁴⁵ Joel Mokyr, 1990, p. 33

⁴⁶ Rosamund McKitterick, 1994, p. 224

works which circulated and were reproduced in monasteries.⁴⁷ A manuscript from Trier contains Bede's⁴⁸ works on time and other texts on scientific matters as well as annals and cosmographical treatises. The manuscript contains full-page diagrams and tables, a map of the world, tables of planets and the signs of the zodiac and tables for calendar calculations. These forms of explaining diagrams seems to have been a Carolingian innovation.⁴⁹ Contemporary scribes also copied works from the Antiquity onto parchment such as Cicero's *De Oratore* and *De Inventione*.⁵⁰ Most of these classical works would have been lost nowadays had it not been for Carolingian scribes. As noted above, literacy was confined to a small part of the population. However, books were not only commissioned by religious institutions, but also by individuals, such as members of the royal family, laymen and laywomen, monks and nuns. The books were practical manuals on estate management, warfare, medicine, mathematics, cosmography, music, building, geography, astronomy, law and agriculture.⁵¹ It is important to note that different centres specialized in the production of certain texts,⁵² therefore profiting from the gains of specialization. This put downward pressure on the cost of storing information causing the isocost to rotate around its point of intersection with the ordinate (not shown in figure 1). Consequently, this made a further increase in output possible. Books were produced not only to satisfy domestic demand but

⁴⁷ Rosamund McKitterick, 1994, p. 225

⁴⁸ Bede (672-735) was a English Benedictine scholar and is considered to be one of the greatest Anglo-Saxon scholars.

⁴⁹ Rosamund McKitterick, 1994, p. 225

⁵⁰ Rosamund McKitterick, 1983, p. 212

⁵¹ Rosamund McKitterick, 1994, pp. 243-4

⁵² Rosamund McKitterick, 1994, p. 242

also to be exported.⁵³ A para-European language, namely medieval Latin, greatly facilitated this international movement of books.⁵⁴ This vehicular language, henceforth, also decreased the cost of transmitting information causing a parallel shift of the isocost to the north-East (not shown in figure 1). Again, this movement provided the means to increase output.

ii) The land owner

The second point to be made about the role of the Church is a more pragmatic argument. During the Merovingian time and particularly during the reign of Charles Martel, the Church had experienced a great decline of power which resulted in the loss of lands. Charlemagne's father confiscated Church lands and distributed them to retainers in order to strengthen his armed forces.⁵⁵ Le Mans, for example, like many Carolingian bishoprics had lost most of its estate in the eighth century.⁵⁶ There were no surviving written documents to support the land claims.⁵⁷ The fear of losing land was therefore a valid concern for the Church and it had henceforth had a great interest in recording its possessions to secure the title of land for future generations.

With the arrival of the Carolingian Renaissance, patronage on a grand scale by the Carolingian rulers developed.⁵⁸ With increased landholdings, the

⁵³ Rosamund McKitterick, 1994, p. 242

⁵⁴ Latin remained the most used language of books up to the eighteenth century. John M. Lenhart, 1935, p. 36

⁵⁵ Lynn White, 1962, p. 4

⁵⁶ As noted above, the expropriation was mainly to finance warfare.

⁵⁷ However, faced with this dilemma, a local monk forged documents to support the claim. Brian Stock, 1983, p. 61

⁵⁸ The large donations of land from private individuals to the Church might only be comparable to donations in the times of the Black Death (the plague epidemic) in 14th century.

Church had a direct interest in the increase in agricultural production. It therefore had a great incentive to spread ideas that might enhance agricultural output. Therefore, the probability that relevant information was spreading to potential users was very high which greatly contributed to the speed and scope of diffusion of ideas and technology.⁵⁹

The monastery of Cluny, founded in September 910 AD by Duke William of Aquitaine,⁶⁰ led the great reform movement of the Church. The bond that kept the new decentralized system of communication together was the Christian religion since, as mentioned above, at the hub of the smaller centres was a religious institution. The Cluniacs promoted a strong papacy in order to reinforce the links between the multiple centres. Cluny and its affiliated houses were free from all secular interference and were only answerable to the Pope which constituted a clear break from earlier traditions when religious institutions were subordinate to local lords and kings. The common religion, therefore, ensured that Europe remained a cultural entity even though politically it had evolved into a system of semi-autonomous counties and duchies. Through the Church, a large territory with increasingly different tongues, customs and laws, could be more easily integrated and administered.⁶¹ Map 1 (Appendix) illustrates the vast array of Cluny's daughterhouses and affiliated monasteries in the first century after its foundation. Christianity was the lubricant of the new information network, which as discussed earlier permitted the ascent of Europe.

⁵⁹ Ian Inkster, 1991, p. 17

⁶⁰ Rosamund McKitterick, 1983, p. 281

⁶¹ Giles Brown in Rosamund McKitterick, 1994, p. 45

iii) The agricultural producer

The economy of the early Middle Ages was moving from a subsistence agriculture to one that produced surpluses which were subsequently sold. The Church was not immune to this commercialization. For example, in the early ninth century, the Abbot of St. Riquier acquired some seventy thousand silver coins annually.⁶² The great Benedictine monasteries, as Duby, 1974, p. 213, put it, represented medieval farming at its best. The Benedictines made an extensive use of writing. They recorded, from the late eleventh century on, the contents of their archives, the rights of the house, issued internal regulations and drafted manorial surveys (the *censarii* that recorded burdens on land and the *consuetudinarii* that established lists of banal exactions).⁶³ The ecclesiastical and economic activity of an abbot was clearly regulated. A good example for this new type of regulation was the abbey of Cluny which in *circa* 1150 drew up the *Constitution Expensae*, a project for a planned household economy.⁶⁴ Cluniac monks devoted their time almost entirely to the worship of God and it was henceforth necessary that the house was sufficiently supplied with foodstuff and cash. The estate was usually divided into manorial centres each being obligated to provide food and wine. The size of the "farm" they had to hand over every year could be increased if output from the manor was rising appreciably. Individual manors were administered by *firmarii* (lay people) fully entrusted with seigniorial powers rather than by

⁶² 70,000 silver coins roughly equaled the value of 150 horses.

Georges Duby, 1974, pp. 96-7

⁶³ Georges Duby, 1974, pp. 213-4

⁶⁴ Georges Duby, 1974, pp. 214

wardens chosen from the community.⁶⁵ How well the system worked can be illustrated by the rapid rise in wealth and power of the house of Cluny. By 937 AD, hence only twenty-seven years after its foundation, seventeen houses of monks were under the direction of Odo, abbot of Cluny and the number rose under the abbot Odilo in the 1030s to roughly sixty. Some estimates go as high as two thousand legally on Cluny dependent monasteries at the arrival of the twelfth century.⁶⁶ During the twelfth century, money was increasingly used since it facilitated the transfer of goods from dispersed properties to the monasteries, the centres of consumption. It was easier to sell agricultural products on local markets and then transfer the monetary proceeds which could, in turn, be exchanged for food, wine and other goods. The abbey of Cluny collected cash rents from its daughter houses, and received, for example, from its fifteen priorities in Provence alone, roughly fifty *librae* a year.⁶⁷ By 1122, no more than a quarter of the food consumed by Cluny originated from her own lands and labour services could readily be substituted by cash payments. In less than two hundred years, the Cluniacs amassed a huge amount of wealth whose most impressive witnesses are the major constructions, the largest anywhere in Latin Christendom, and the rebuilt and lavishly decorated sanctuaries.

⁶⁵ Georges Duby, 1974, pp. 215

⁶⁶ Uta-Renate Blumenthal, 1988, p. 14

⁶⁷ Georges Duby, 1974, pp. 216

VII. Concluding Remarks:

When Charlemagne died on January 28, 814,⁶⁸ the achievements of his time did not die with him. His era laid the bedrock for developments for centuries to come. Charlemagne had never learnt how to read and write. He had put great effort in acquiring these skills but the effort probably began too late in his life. It is almost symbolic that the death of the illiterate emperor marked the beginning of the rebirth of the written word. This increasing importance of the written word fundamentally changed the way information was exchanged. The information network was changing from a centralized to a decentralized system. The empire of Charlemagne did not survive two generations. The territory was divided between his three grand-sons Louis the German, Charles the Bald and Lothar the First. The efficiency and the importance of the Carolingian minuscule is probably best seen in the fact that writing of the XXth century resembles extraordinarily closely the script invented some twelve hundred years earlier.

This paper tried to develop an alternative to traditional economic growth theory by incorporating the importance of communications. It demonstrated this different approach by attempting to illustrate Europe's take-off in the Middle Ages. The latter phenomenon had remained largely unexplained by contemporary economists and historians alike. The modern world is said to have entered the communicational revolution and interest about the effects of communications on economic activity is growing. Economics ultimately is about understanding the

⁶⁸ Paul Edward Dutton. 1993, p. 40

past to know what lies in the future. This paper does not claim to have found the holy grail of economic growth and should be considered complementary to the existing body of knowledge. Further theoretical as well as empirical research is required to better comprehend the influences of communications technologies.

Appendix

Table 1: The population of cities in Latin Christendom

city	inhabitants in 800 AD (in thousands)	inhabitants in 1000 AD (in thousands)	inhabitants in 1300 AD (in thousands)
Brugge (Bruges)	...	12	40
Montpellier	...	1	35
Paris	25	20	150
Rouen	10	12	35
St. Omer	...	1	35
Aachen	5	10	21
Köln (Cologne)	15	21	54
Regensburg	25	40	11
London	...	25	35
L'Aquila	...	...	40
Bologna	...	...	40
Cremona	...	...	40
Ferrara	...	12	36
Florence	...	...	95
Genoa	...	15	100
Milan	...	...	100
Naples	50	30	60
Pisa	...	9	38
Rome	50	35	30
Salerno	...	50	10
Siena	...	...	50
Venice	...	45	110

Source: Bairoch et al. (1988) pp. 4-49

... Not available.

Bold face indicates numbers mentioned in the text.

Table 2: Surviving Latin manuscripts of continental origin, by period of production, AD 0-900

Period	Number of manuscripts	Production per decade
0-700	750	25
700-750	5	1
750-800	50	10
800-900	7,000	700

Source: Dudley and Claus (1997), p. 34

Figure 1: Information and output

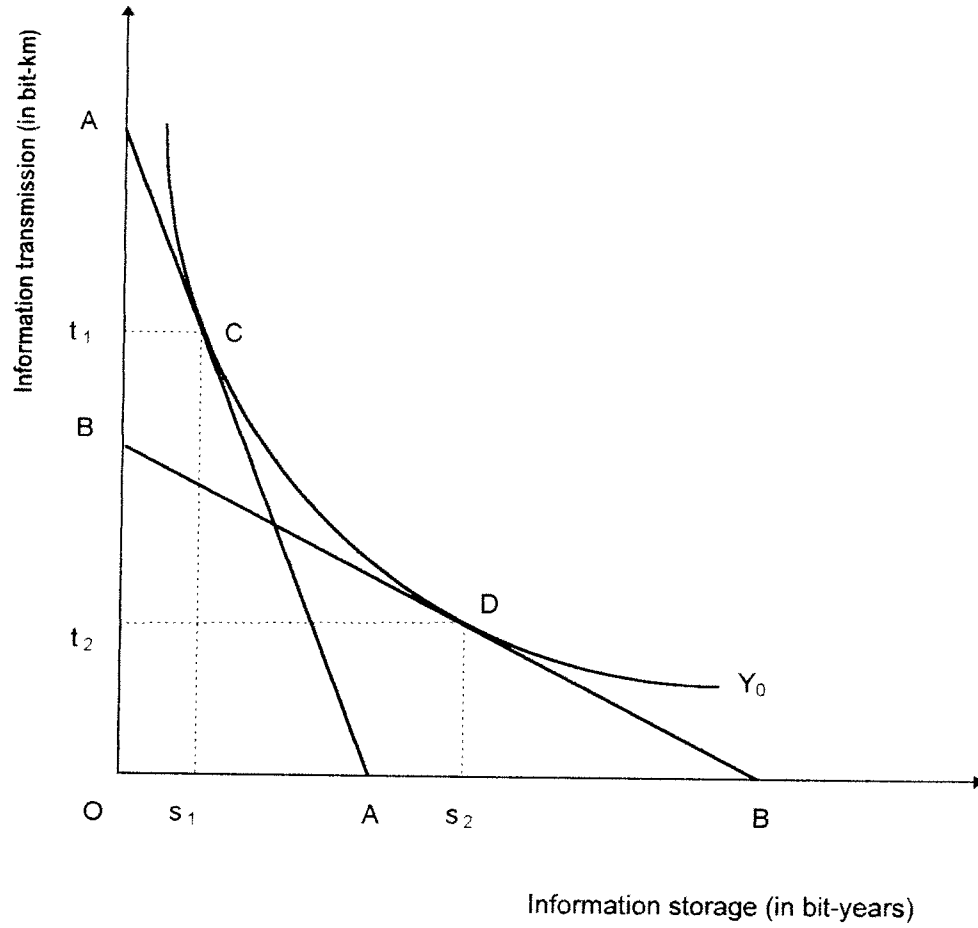


Figure 2: Information and output

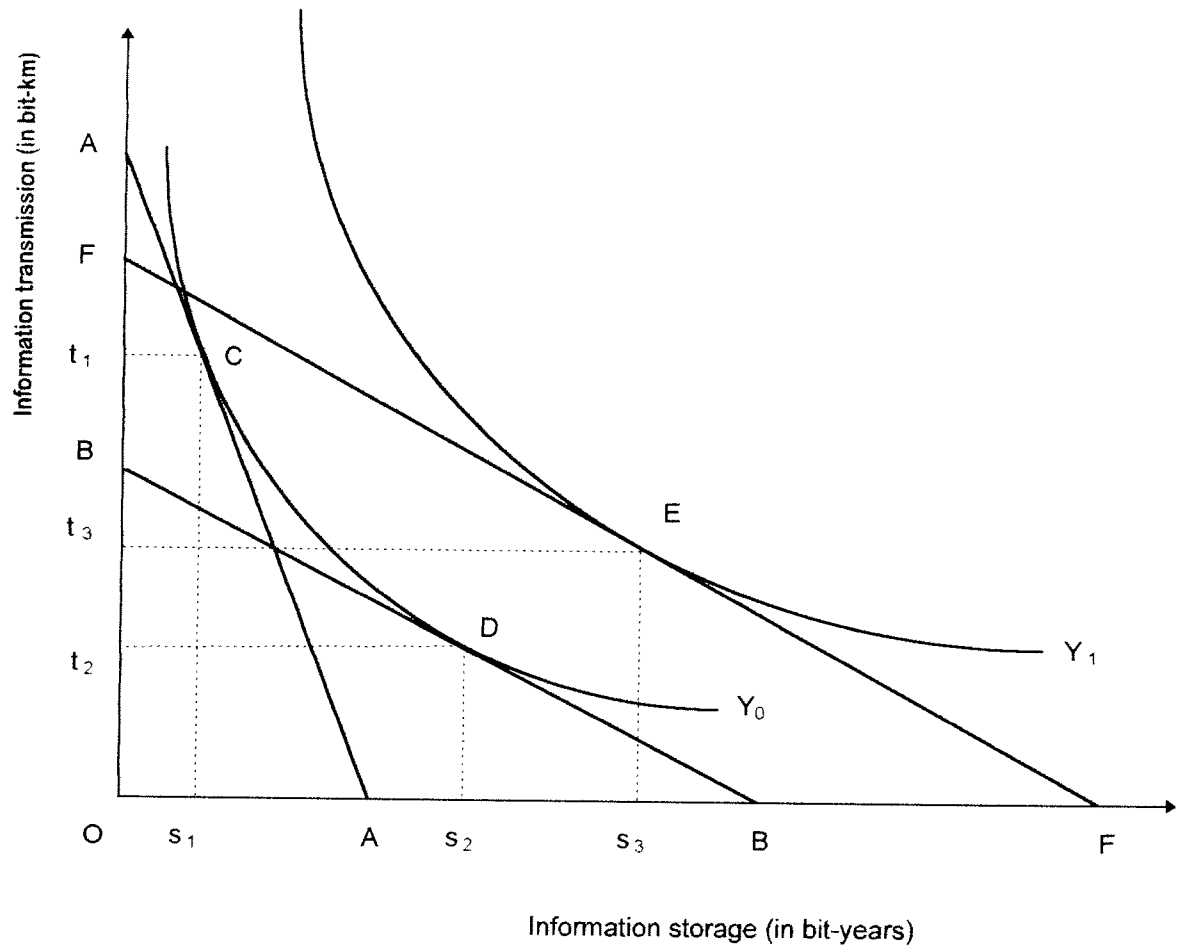
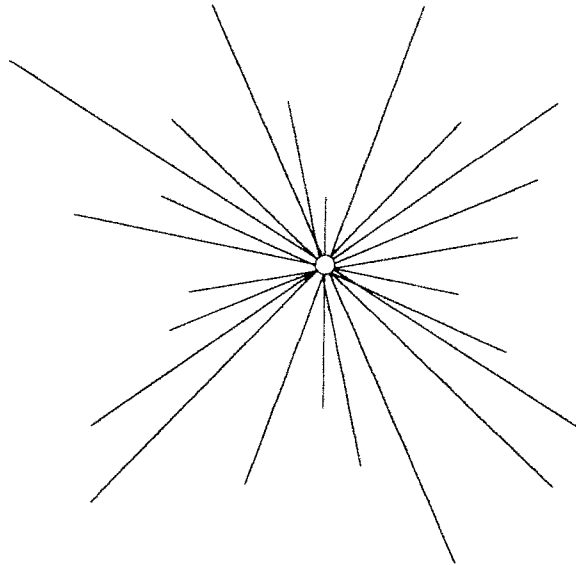
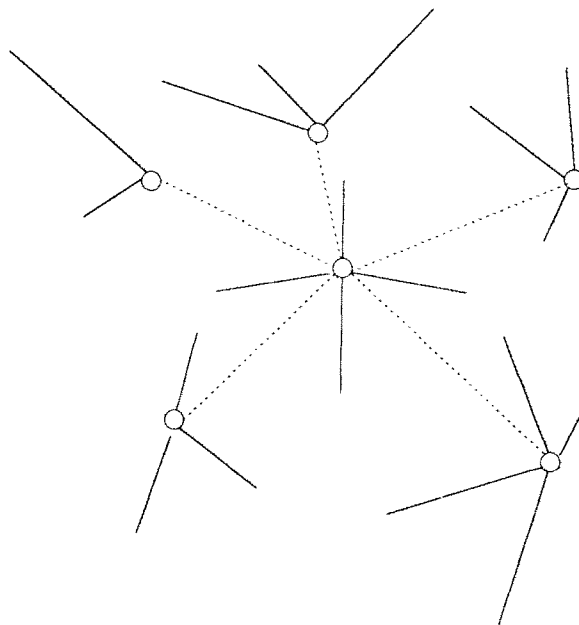


Figure 3: Two information network structures

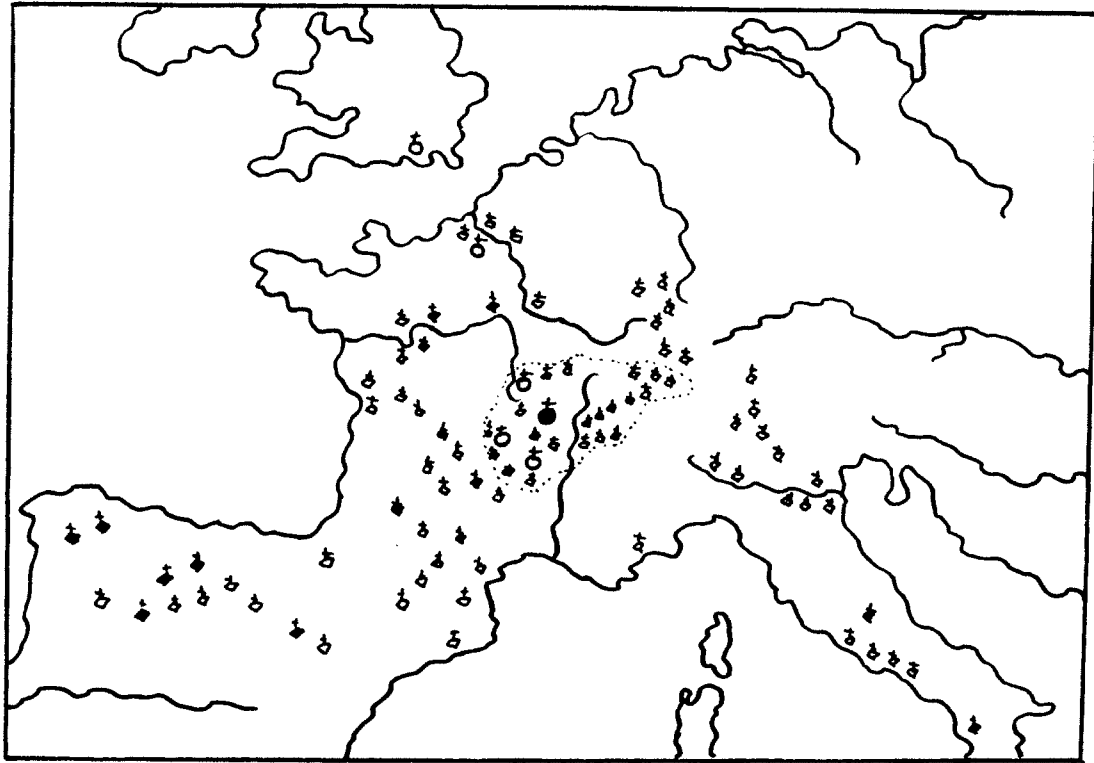


(a) Centralized



(b) Decentralized

Map 1: Cluny and its monasteries



- Cluny
- daughter houses of Cluny
- ✦ Major Cluniac monasteries
- ✧ Other Cluniac monasteries

source: Littell, 1976, p. 36

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