pelled by an original violent movement which was sustained by continuing disturbances in the air. Such an explanation could not withstand the simplest common-sense analysis. If two archers shot at each other, their arrows passing in flight would have to be propelled, according to the Aristotelians, by the movement of air in opposite directions. This was so palpably absurd that some mediaeval philosophers had introduced invisible spirits to help push the objects along when the Aristotelian rush of air failed.

To the Parisian nominalists this was an unacceptable solution and, to replace it, they developed a theory of “impetus.” Its principal exponent, John Buridan (ca. 1300–ca. 1358), held that an object was kept in motion by means of an “impetus” which was imprinted on it by the original moving force. This theory, it was soon realized, had startling implications for the then accepted explanations of the rotation of heavenly bodies. Aristotelian cosmologists, who could account for motion only by the continuous action of a mover, had argued that the heavenly bodies were imbedded in transparent spheres which were moved around the earth by means of “intelligences” or, in Christian terms, angels. With their concept of impetus, however, the Parisians could eliminate the need for such occult forces. God, they asserted, impressed an initial impetus on the heavenly bodies which set them turning in an uninterrupted and perpetual orbit. If this explanation did not fully encompass the mod-
ern law of inertia, it did anticipate it to some extent. More important, it eliminated the need for special, or divine, intervention to explain the working of the universe and thus prepared the way for the more sophisticated researches of Leonardo da Vinci and Galileo.

Another original and resourceful thinker in the Parisian group was Nicolas Oresme (ca. 1330–1382), a pupil of Buridan as well as a bishop and a friend and adviser of the French king Charles V. Nicolas went so far as to describe the universe as a mechanical clock, originally created and set in motion by God and then left to run by itself, thus foreshadowing the mechanistic thought of the eighteenth-century, post-Newtonian world. Nicolas’ book on cosmology, written like so many other important works of the century in the vernacular, further suggested the then radical theory that the earth rotates diurnally on its axis. Nor were Nicolas’ interests confined to cosmology; he was, in fact, one of the most versatile geniuses of the later Middle Ages. For example, in his efforts to clarify and communicate some highly abstract and characteristically mediaeval concepts concerning “forms” and “qualities,” he developed diagramatic visual aids that suggested later graphic techniques of representing mathematical relationships; these suggest to some modern scholars that he may have anticipated analytical geometry. He also wrote a tract on coinage which became one of
the earliest scientific studies of monetary and fiscal problems.

If the fourteenth-century school of Paris was so advanced, why, then, did its members not go ahead to draw what were later to seem the obvious practical conclusions from their theories? This is a perplexing problem, but the basic answer seems to be that the Parisian scholars were still very mediaeval in the sense that they were far more concerned with speculative philosophy than with demonstrable theories. They were not interested in performing experiments, let alone investigating the practical applications that might have derived from their speculations. It was this frame of mind which separated them furthest from the practical orientation of modern science. But their influence was still profound, and their theories continued to be taught until the sixteenth century. Moreover, by 1400, Europeans were the only men in the world who were working on science with constant interest and application, thus replacing such earlier leaders in scientific research as the Chinese, Hindus, and Moslems.

Technology

If the nominalist scholars of the fourteenth century were not interested in the possible practical applications of their theories, there were other men, usually anonymous, who were actively concerned with technology and who had a much greater immediate im-
pact on daily life in Europe. War has frequently stimulated technological development and the endless conflicts of the fourteenth century were no exception. We have already seen how the English longbow gave its masters a decisive superiority in the Hundred Years' War. Far more significant for the future, though less effective at the time, were the advances made in firearms. By 1300, Europeans had developed reasonably advanced methods of casting metals and had acquired formulae for gunpowder. The result was the cannon. The earliest European picture of this novel weapon dates from 1327 and shows it shooting an arrow rather than a ball. But Europeans learned fast. The English probably used cannon at the battle of Crécy in 1346 and certainly used it for sieges as early as 1339. Soon it was considered standard military equipment, and smaller guns were developed during the same period. Needless to say, it was often more dangerous to stand behind than in front of some of these primitive weapons. Even so, once the initial discoveries had been made, improvements were only a matter of time; and with the introduction of firearms, the nature of warfare was to be revolutionized.

If the technology of destruction was of paramount importance to the men of the fourteenth century, they still did not neglect the possibilities of improving the instruments and techniques used in peaceful pursuits. One important area of innovation was in the construction and handling of ships. It was in this
period that Europeans began to build ships sturdy enough to take to the open ocean and manageable enough to work slightly into the wind. The ability to hold a general course at sea, made possible by the invention of the mariner's compass and the consequent development of accurate nautical charts and maps, produced a revolution in sailing. Navigators no longer needed to rely on clear skies in order to guide their voyages by means of the sun and the stars. With reliable charts and navigational instruments ships could sail in the winter long after the skies had become overcast. Nor were they forced to hug the shores for fear of getting lost. By the fourteenth century, Italian ships were beginning to break out of the Mediterranean. The famous Venetian galleys were passing the Straits of Gibraltar and making their way up the coast to England and Flanders. Others seem to have ventured out on the high seas to reach the Canary and Madeira islands. These bold forays into the Atlantic not only presaged the voyages of Columbus; they established the techniques which made them possible. Indeed, Columbus himself relied so heavily on sailing by compass that he really had no accurate idea of how to sail by the sun and stars.

The perfection of map and chart making was only one aspect of a widespread interest in the technology of measurement. In addition to developing methods for measuring space and distance, men of the fourteenth century also succeeded in making instru-
ments to measure time. In the early Middle Ages, men had relied on sundials for this purpose, and when the sun failed to shine they fell back on a variety of running-down devices. Alfred the Great, for example, in the ninth century, bothered by the problem of keeping time at night, had resorted to burning down knotted candles. It was not until late in the thirteenth century, however, that Europeans became sufficiently familiar with mechanical techniques to improve substantially upon this simple solution by devising a mechanical clock using geared wheels and escape mechanisms. In the fourteenth century, when craftsmen had mastered the art sufficiently to produce reliable mechanical clocks in some quantity, these became something of a fad. Elaborate clocks in public buildings became status symbols, and communities vied with each other in installing mechanisms which would not only tell time but also perform complicated tricks as they struck the hours, thus inaugurating a tradition that finds its modern expression in the baseball scoreboard that explodes with euphoria every time the home team scores a home run. With the perfection of clocks, Europeans began to divide the hour into sixty minutes and the minute into sixty seconds. Thus one of the most characteristic aspects of Western civilization—the preoccupation with exact time measurement—was born.

Other technological advances of the fourteenth century can only be mentioned in passing. Around
the year 1300, eyeglasses made their first appearance in western Europe. Students of optics also became more familiar with laws of perspective, which, as we will see, had a great influence on the history of art.

Practical medicine also progressed in the fourteenth century. Very slowly after the Black Death, techniques of sanitation, quarantine, and post-mortem dissection became more prevalent. Many men still regarded the dissection of a human body as tantamount to dissecting God, but Italian and French physicians pursued their investigations despite this prejudice and the opprobrium it engendered. Even so, the anatomical charts that resulted from their research were far inferior to the nautical charts used by mariners. But the need for exact observation and measurement in medicine was becoming evident.

Fine Arts

Not surprisingly, the age that recognized a need for exact observation and measurement was also the one that produced a revolution in art. This revolution clearly corresponded to the spectacular advances in technology, theoretical science, and philosophic outlook that occurred during the fourteenth century. The technology of measurement and the growing interest in anatomy helped to stimulate an artistic interest in human proportions; the study of optics and new departures in geometry led to the first awareness of the problem of perspective; and the nominalist
view of examining particular conditions, rather than
general types, helped to prepare the way for artistic
naturalism. Such powerful influences could hardly
have failed to affect the development of painting; but
acting through the genius of the great Italian painter
Giotto, they produced a major artistic revolution.

Giotto (ca. 1266–1336) is commonly regarded as
one of the most remarkable figures in the history of
culture. A shepherd who left his flocks to become the
first truly great painter of the postclassical world, he
liberated Italian art from the dominating influence of
Byzantine formalism and left it pre-eminent in Eu-
rope. Giotto’s contemporaries credited him with hav-
ing been the first to imitate nature in a realistic man-
ner. Previously, mediaeval artists were preoccupied
with abstractions, and their art, two-dimensional and
highly symbolic, was intended to capture the “ideas”
or “essences” of objects rather than their actual ap-
pearance. Giotto, in contrast, tried to represent space
in depth and became one of the first to take account
of the problem of perspective in painting. His work
also portrayed everyday subjects, running the gamut
from family scenes to dramatic situations, all fraught
with human emotions. His representations of St.
Francis, for example, reveal the humanity of his sub-
ject in a way that was entirely new to the Middle
Ages. This is not at all to say that Giotto strove for
photographic realism. Many of his finest works de-
picted allegorical figures and supernatural events, but
in the same natural manner he used for mundane subjects. So great was this gift that Boccaccio insisted Giotto’s painting could deceive the senses.

Giotto’s style was immediately copied in his native city of Florence and influenced important painters in the neighboring city of Siena, who, in elegance of line, rapidly surpassed even Giotto himself. By the middle of the century there was a temporary reaction in the form of a revival of symbolic and mystical themes, accompanied by a preoccupation with death and damnation most likely brought about by the Black Death and the other upheavals of the age. For a while this renewed preoccupation with abstractions replaced the simple naturalness of Giotto. Not long afterwards, Italian artists returned to his principles, which, in the fifteenth century, they were to perfect in one of the most spectacular periods of artistic creativity ever known to man.

Nor was Giotto’s influence limited to Italy. The Italian experiment with perspective spread rapidly to the North, where it was employed in the art of manuscript illumination. Interestingly, the new techniques were first adopted in Paris—the home of nominalism and theoretical science. About 1325, Jean Pucelle, a Frenchman who is sometimes called “the Giotto of the North,” began to use perspective and psychological expression in his manuscript illuminations. Pucelle also delighted in filling his pages with a profusion of natural objects. His own signature was the punning
device of a dragonfly, which in mediaeval French was called *pucelle*. Other French illuminators, following Pucelle’s initiative, began to illustrate the seasons through rudimentary but three-dimensional landscapes instead of conventional allegorical figures. By the end of the century, the painters of the North had so fully assimilated perspective and the other new techniques as to rival their Italian teachers. They soon began to teach them in turn, ultimately producing, through this exchange of influences, the so-called International Style.

Another highly significant innovation of fourteenth-century art was the development of the portrait. There were no portrait painters in the high Middle Ages because men were less interested in individual personality traits than they were in idealized representations of significant moral types. Sitting for a portrait would have been regarded as a cardinal example of the sin of pride. During the fourteenth century, however, the cult of fame became a dominant literary theme, just as the claims of the particular were slowly replacing the claims of the universal, providing an impetus as well as a favorable climate for the revival of the long-neglected portrait genre. Representations of distinctive facial features for the purpose of revealing character can first be discerned in sculpture. A life-size portrait bust of Pope Boniface VIII executed early in the century is recognized as the first representation of a pope that can be regarded
as an accurate personal likeness. The greater plasticity of the three-dimensional form undoubtedly lent itself more readily to portraiture, but painting was pressed into the same service later in the century. The earliest known example, dating from about 1360, is a striking portrait of the French king John the Good painted on canvas stretched over wood. Soon it became customary for important men to have painters fix their likenesses as a means of obtaining worldly immortality. As a result, it is in the fourteenth century that students of mediaeval history can identify notables as truly animated beings rather than mysterious figures shrouded by blurred effigies.

*Vernacular Literature*

Still another example of the breakdown of universal forms in the fourteenth century was the accelerated decline of the use of Latin in favor of the European vernaculars. Even though vernacular literature had made its appearance in Europe as early as the twelfth century, a strong predisposition toward Latin for professional or academic writing lingered on. Thus, in the thirteenth century, romances, histories, and lyric poems, in short those genres intended primarily to entertain, were increasingly written in the vernacular; but philosophy, theology, law, and politics, serious subjects treated by scholars and directed to an international professional audience, were still usually presented in Latin. In the fourteenth century, how-
ever, officials started to keep administrative records in the vernacular, and philosophers and scientists like Oresme used it for some of their most influential treatises. As the great religious controversies of the age became matters of general public concern, they too were conducted increasingly in the vernacular. The German mystics, as we have already seen, preached and wrote in it; and radical reformers like Wyclif advocated its use in translations.

At the same time, the development of vernacular literature reached a new stage with the appearance of writings that can take their place with the greatest masterworks of the world. Foremost among these is the *Divine Comedy* of Dante (1265–1321). This long allegorical poem describing the pilgrimage and salvation of the Christian soul was written as its author, a political exile from his native Florence, wandered through northern Italy seeking patronage and asylum. Considering these circumstances, one might expect the *Divine Comedy* to be morose and bitter. Instead, it rises above Dante’s immediate concerns to make one of the most elevated statements about man’s relation to the universe. It is still the universe of St. Thomas’s *Summa* (to which the *Comedy* has often been compared) but with the academic prose transmuted into soaring verse. But even if his work is mediaeval in its inspiration and orientation, as scholars of literature insist, Dante seems, like Giotto, to surpass the traditional limits
of the mediaeval world, an impression that may be due in part to his stupendous genius. In his hands, for example, as in Giotto’s, traditional allegorical abstractions became intensely human figures. In this and other ways Dante and Giotto were simply too great to be fitted completely into any category, even one so commodious as “mediaeval.”

Further, even if Dante’s basic assumptions were mediaeval, his judgments frequently revealed a concern with humanity different from that found in traditional theology. In contrast to the Summa of St. Thomas, Dante’s poem appeals more to the emotions than to the intellect. Where St. Thomas attempted to reconcile faith and reason, Dante evoked hope and fear, and stressed conduct more than belief, as shown by the presence of a controversial mediaeval prophet and a heretic in his Paradise. Thus Dante repeatedly veers away from the logical dogmatism found in scholastic philosophy toward the humane and ethical interest in man that was to characterize and illuminate the literature of the Renaissance. Finally, of course, Dante’s style is so original and powerful that it left a lasting imprint on Italian as a literary language.

In the development of Italian literature, Dante is followed by Petrarch (1304–1374) and Boccaccio (1313–1375), who with him comprise the so-called “three crowns of Tuscany.” All were products of the mediaeval tradition, but each in turn looks further away from the cultural synthesis of the thir-
teenth century which had been their common heri-
tage. Petrarch like Dante was a wanderer. Born in
Tuscany but forced to spend even more of his life
than Dante in travels, he wrote in nearly every liter-
ary and philosophical genre during his long career.
His huge output is at once the delight and despair of
scholars because he had the engaging but exasperating
habit of frequently changing his point of view. But if
his beliefs are elusive, many of his traits of character
are clear. Even more than Dante, he subordinated
questions of theological dogma to considerations of
human morality. This preoccupation drove him to
denounce the—to him—arid philosophy of the me-
dieval schools and to study and attempt to emulate
the great classical moralists such as Cicero. Petrarch’s
profound knowledge of, and love for, Cicero and his
sentimental attachment to Plato (whom he could not
read because he knew no Greek) helped to initiate
the great Italian cult of antiquity which reached its
climax in the next century.

Petrarch did not, as is often thought, turn to the
classics as an alternative to Christianity. Instead he
believed that Ciceronian ethics were essentially Chris-
tian, and he loved the moral writings of St. Augustine
as much as those of Cicero. Nonetheless, Petrarch’s
concern for moral philosophy led him to stress the
role of man in the world. He was, as a result, a con-
vert to the new cult of fame to the extent of having
himself crowned with laurel on the Capitoline Hill
at Rome in 1342—a gesture that his favorite, St. Augustine, could hardly have condoned. Petrarch wrote beautiful sonnets and songs in the vernacular and thus enriched the Italian language, but he thought less of these than of his own works in Latin and considered his vernacular compositions to have been trifling. His is a fascinating character and he emerges from his numerous writings and letters as a genuine personality. Indeed, he is one of the earliest literary figures to step out of the shadows and reveal his inner self. For this reason Petrarch, despite all his mediaeval residues, has been called the first modern man.

Boccaccio, the last of the three great Italian writers of the fourteenth century, was also a Tuscan. A close friend of Petrarch and an admirer of Dante, on whom he lectured in his native city, Boccaccio wrote in a manner quite foreign to the tastes of either of his predecessors. Eschewing their elevated tone, Boccaccio developed his own worldly style carefully attuned to the rhythms of colloquial speech and suited to the description of commonplace events. His greatest work, the Decameron, is, as the title suggests, a collection of ten units of ten stories each. The object is the elegant entertainment of his well-born and well-bred contemporaries. The language is therefore their own vernacular and the style is lucid and charming. The subjects are diverse—ranging from tragedy to farce—but each tale bears witness to the author's passion to please as well as to his great literary talent,
so that in both purpose and style the *Decameron* is a fresh departure from tradition as well as a model for all future storytellers.

Italian writers, like Italian painters, were pre-eminent throughout the fourteenth century, but the emergence and growth of vernacular literatures was a phenomenon as wide as Europe. France, which had led in the development of the mediaeval Gothic style, was slow in accepting Italian literary models and, in fact, during the fourteenth century French literature languished. Nonetheless the vernacular gained in currency and force in unlikely places. Professors at the University of Orléans, for example, began to lecture in French instead of Latin, and one of the greatest works of French history—the *Chronicle* of Jean Froissart (ca. 1337–1404)—was written in a vernacular style unparalleled for its clarity and grace.

More striking developments occurred in England, where English began to replace French as the principal literary language for the first time since the Norman Conquest. In the early fourteenth century, the English nobility spoke French, and French replaced Latin as the language of law and government; but as the Hundred Years' War progressed English slowly replaced French as both the written and spoken language of the entire country. Even so, in the period of transition people frequently wrote a curious mixture of the two languages. The following
extract of a letter dating from the early part of Richard II's reign offers a sample:

Treschere cosyn, ieo vous pry bryng a wryt of trespas en ver Richard forde of Sulhyul, Wyliam of Noryng of Yzerdeley, Wilyam Ducey of Northfield, the wheche trespas hu duden the waley of twenty mark touching to me and my tenante.¹

(My dear cousin, I beg you to bring a writ of trespass against Richard Ford of Solihull, William Noring of Yardley, William Ducy of Northfield, the said trespass they did to the value of twenty marks against me and my tenant.)

Such curious and halting attempts were to be expected in an age of transition. At the same time, however, several poets were using English most effectively as a literary vehicle. The greatest among them, Geoffrey Chaucer (ca. 1340–1400), was probably the only writer of the century who could take his place beside Dante, Petrarch, and Boccaccio. Chaucer borrowed heavily from Petrarch and Boccaccio for some of his plots, and his most familiar work, the Canterbury Tales, is in some ways strikingly similar to the Decameron. Yet Chaucer apparently never read Boccaccio’s masterpiece and can by no means be considered a mere imitator. His characters have a life of

¹ Letter from Rose Montefort to her cousin, quoted by H. S. Bennett, Chaucer and the Fifteenth Century (Oxford, 1947), pp. 177–178.
their own, and the English setting of the Canterbury Tales is quite as authentic and original as the Italian setting of the Decameron. Chaucer's language, too, although taken from the common speech of London, was transformed by his verse in a way that did as much to shape the literary development of English as did that of the three great Tuscans to shape Italian. Nor is Chaucer a mere figure of literary history. College students faced with an assignment from the Canterbury Tales are often surprised to find that Chaucer is one of the most entertaining writers of all time.

History

A book devoted to the history of the fourteenth century might well end with a glance at the fourteenth-century view of history. The first thing to notice is that it was in no sense a period of innovation in form; its greatest histories are notable either for their vivid style, as in Froissart's Chronicle, or for their careful attention to detail, as in Villani's History of Florence. But they remain characteristically mediaeval, copying traditional models and displaying the most obvious of established prejudices. It is thus not to the historians but rather to men of letters, and particularly Petrarch, that one must look for a fresh view of history. Indeed it was just because his passionate interest in the classical past was focused on literature, rather than conventional history, that he arrived at such original and significant conclusions.
Mediaeval men, it has been said with justice, had a very strong sense of historical continuity but a very weak sense of historical perspective. They did not consider classical times to have been remote or different; indeed most of them believed that the Roman Empire had never really fallen but continued on into their own day. Such a view led to considerable confusion. One manuscript, for example, shows the god Mercury dressed as a fourteenth-century bishop. Mediaeval thinkers, that is, simply did not recognize the fact that they lived in what we now call the “Middle Ages.” It was Petrarch who, in his love for the classical spirit, first insisted that with the fall of Rome an age of darkness had descended upon the world and had lasted until his own century. He thus implicitly divided history into the three familiar categories of ancient, mediaeval, and modern.

This new approach to history had a tremendous impact. Following Petrarch’s lead, scholars began to study classical antiquity with fewer preconceptions and strictly as a discrete phenomenon of the past. Even more important, the division of history into three distinct ages made possible an optimistic view of man’s destiny. Where their mediaeval predecessors had been convinced that the world was growing old and was about to end, the Italian writers of the fourteenth century spoke incessantly about rejuvenation and rebirth. They believed that Giotto had rediscovered the art of painting and Dante and Petrarch
had rediscovered the art of writing. No doubt this view was limited to Italy and no doubt even there it was held only by a small elite. No doubt, too, most Europeans throughout the fourteenth century were pessimistic and preoccupied with death. Yet as time went on, the conviction that they were living on the threshold of a great revival began to spread among an increasing number of educated Italians. These men believed that they were the harbingers of a Golden Age. Considering the many achievements snatched from the all but overwhelming adversities of the fourteenth century, perhaps they were right.