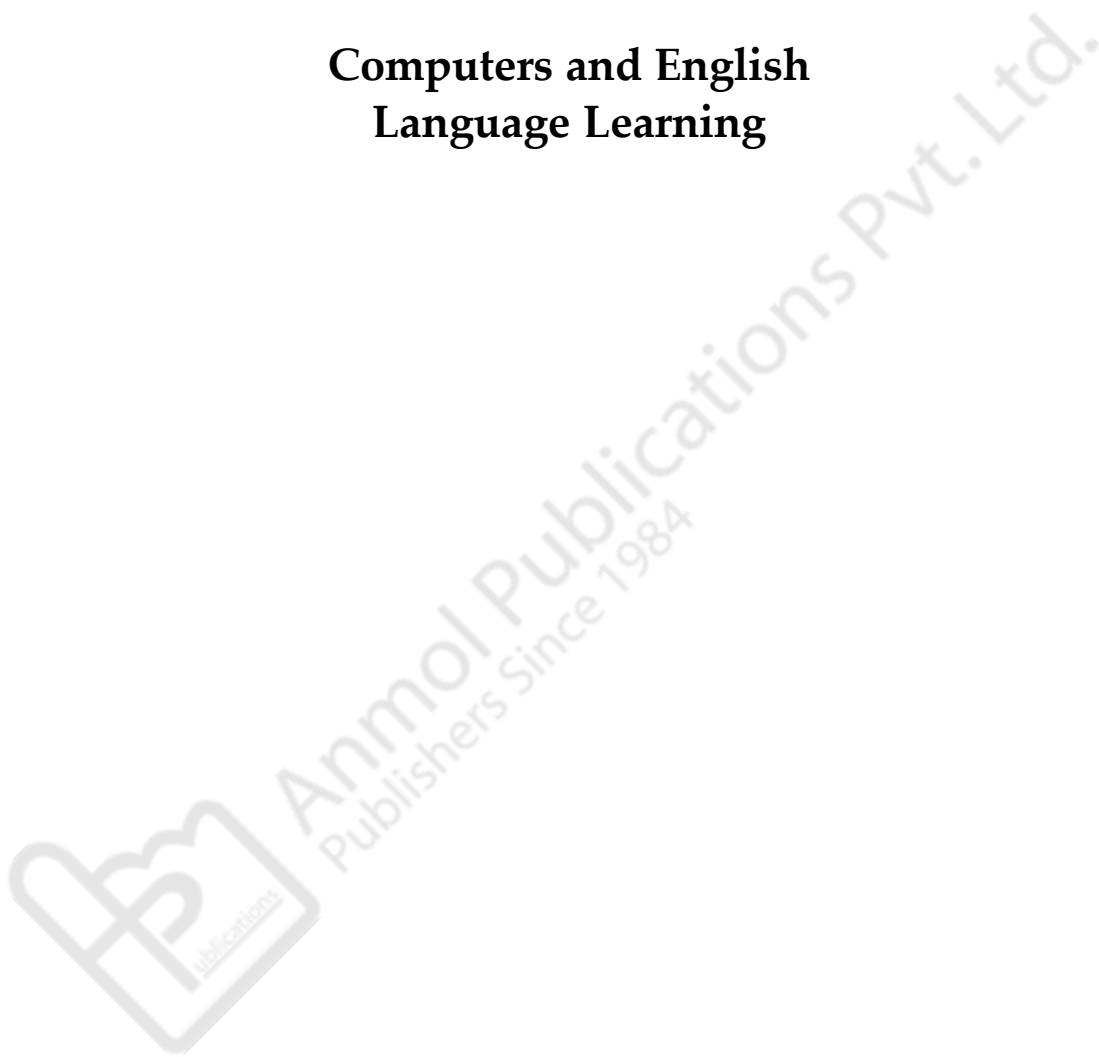
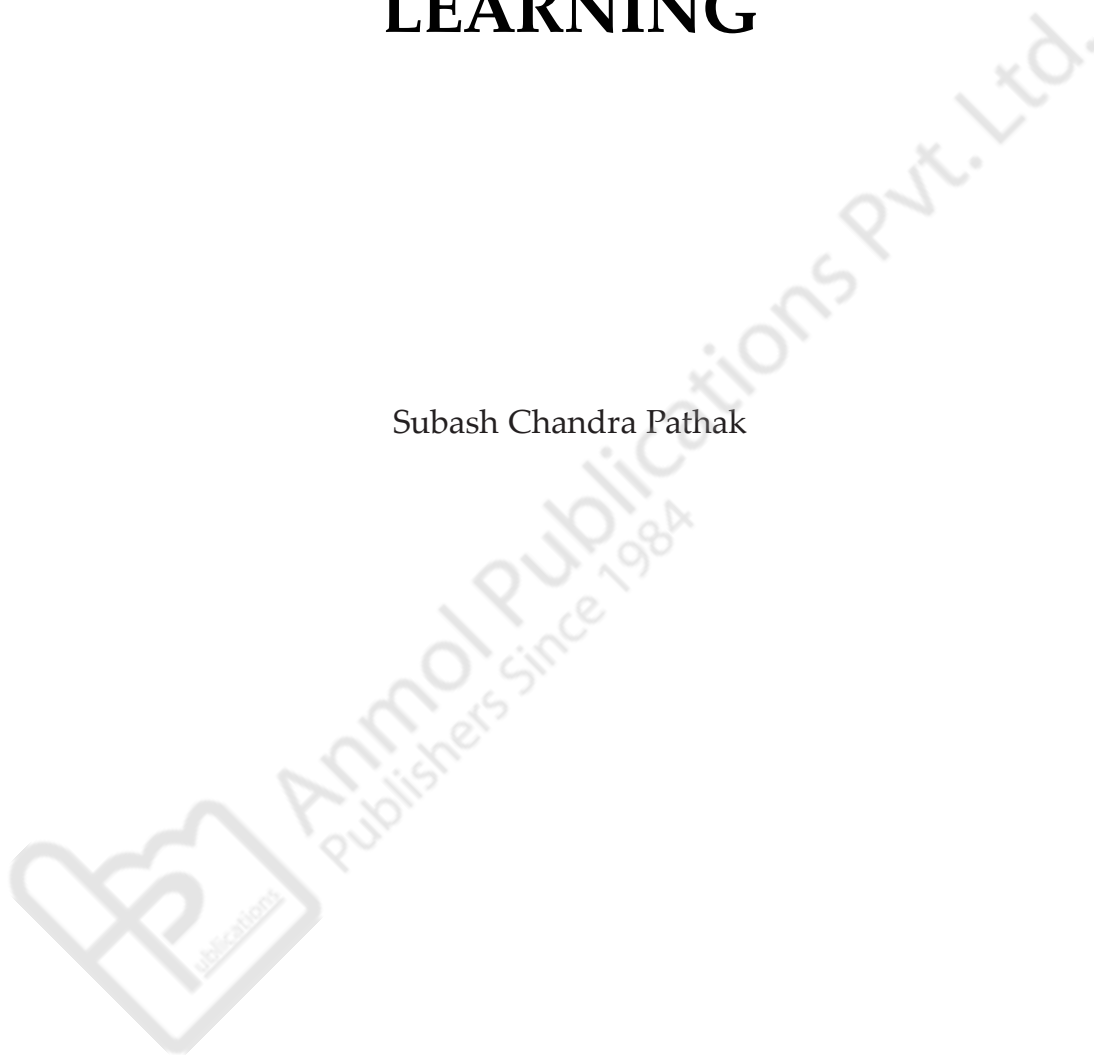


**Computers and English
Language Learning**



COMPUTERS AND ENGLISH LANGUAGE LEARNING

Subash Chandra Pathak



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Preface

English is a very important language in business. Many people study English as a foreign language, because they want a better job. English is also very important in education. Many pages on the internet are in English. English as a second language is the single most popular subject in the world, after mathematics. Many people who can not go to English language classes study on the internet, using websites like BBC Learning English. Many people study English in a country where the people speak English. This way, many students learn listening and speaking English better. Learning English is what people do when they want to learn how to speak and listen to the English language. People who want to learn English usually also learn to read and write at the same time. A lot of people learn English at school, where English is a common subject. A lot of people also want to spend their own personal time to learn English. They might know no English when they start, or they might have learned some English at school. There are some ways to learn English outside of school:

- *Institutional learning*: Many people join lessons like school lessons but at learning centers where any people can go, no matter their age. In such a centre they will join a class fitting their existing level of learning of English, so that they will be in a group for the teacher to help them learn.
- *Individual learning*: Other people try to learn English on their own, or in a less formal setting

than in a group of people with a teacher. People might meet with others who are trying to learn English, in order to practice their standard of English when speaking. People can also listen to radio broadcasts in English, or watch television programmes in English to help them improve their listening ability. A popular channel to listen to the radio on is broadcast by the BBC, called the BBC World Service. People can also study English by reading books, or listening to English courses on recorded CDs or cassettes.

- *Online learning:* A popular way to learn English in the modern world is to make use of the internet where there are many websites that can help learners. The BBC World Service has a free website for people who are learning English as a second or foreign language called BBC Learning English. There are many online community forums such as English forums, where many people meet to learn English. Questions are answered quickly even with help from volunteer teachers from all over the whole world.

This publication titled, “Computers and English Language Learning” provides readers with an introductory overview of English orthography, types and English as a foreign or second language. An introduction to computer-assisted language learning and e-learning is made. Focus lies on computer-based learning management systems. Besides, focus also lies on computer assisted language learning. The subject areas of communicative language teaching and educational programming languages are covered. This publication titled, “Computers and English Language Learning” is completely user-friendly as it also gives readers a glossary, bibliography and index.

—Editor

1

English Orthography, Types and English as a Foreign or Second Language

ENGLISH ORTHOGRAPHY

English orthography is the alphabetic spelling system used by the English language. English orthography, like other alphabetic orthographies, uses a set of habits to represent speech sounds in writing. In most other languages, these habits are regular enough so that they may be called *rules*. In standard English spelling, however, nearly every sound is spelled in more than one way, and most spellings and all letters can be pronounced in more than one way and often in many different ways. This is partly due to the complex history of the English language, but mainly because no systematic spelling reform has been implemented in English, contrary to the situation in most other languages.

In general, English spelling does not reflect the significant changes in the pronunciation of the language that have occurred since the late fifteenth century.

Function of the Letters

Phonemic Representation

Like most alphabetic systems, letters in English

orthography may represent a particular sound. For example, the word *cat* consists of three letters ⟨c⟩, ⟨a⟩, and ⟨t⟩, in which ⟨c⟩ represents the sound /k/, ⟨a⟩ the sound /æ/, and ⟨t⟩ the sound /t/.

Single letters or multiple sequences of letters may provide this function. Thus, the single letter ⟨c⟩ in the word *cat* represents the single sound /k/. In the word *ship*, the digraph ⟨sh⟩ (two letters) represents the sound /ʃ/. In the word *ditch*, the three letters ⟨tch⟩ represent the sound /tʃ/.

Less commonly, a single letter can represent multiple sounds voiced in succession. The most common example is the letter ⟨x⟩ which normally represents the consonant cluster /ks/ (for example, in the word *ex-wife*).

The same letter (or sequence of letters) may indicate different sounds when it occurs in different positions within a word. For instance, the digraph ⟨gh⟩ represents the sound /f/ at the end of some words, such as *rough*. At the beginning of syllables (i.e. the syllable onset), the digraph ⟨gh⟩ represents the sound /a/, such as in the word *ghost*. Conversely, the digraph ⟨gh⟩ never represents the sound /f/ in syllable onsets and almost never represents the sound /a/ in syllable codas (*Pittsburgh* is an exception). (Incidentally, this shows that *ghoti* does not follow English spelling rules to sound like *fish*.)

Word Origin

Another type of spelling characteristic is related to word origin. For example, when representing a vowel, the letter ⟨y⟩ in non-word-final positions, represents the sound /j/ in some words borrowed from Greek (reflecting an original upsilon), whereas the letter usually representing this sound in non-Greek words is the letter ⟨i⟩. Thus, the word *myth* is of Greek origin, while *pith* is a Germanic word. Other

examples include ⟨ph⟩ representing /f/ (which is usually represented by ⟨f⟩), and ⟨ch⟩ representing /k/ (which is usually represented by ⟨c⟩ or ⟨k⟩) — the use of these spellings for these sounds often mark words that have been borrowed from Greek.

Some researchers such as Brengelman (1970), have suggested that, in addition to this marking of word origin, these spellings indicate a more formal level of style or register in a given text, although Rollins (2004) finds this point to be exaggerated as there would be many exceptions where a word with one of these spellings, such as ⟨ph⟩ for /f/ (like *telephone*), could occur in an informal text.

Homophone Differentiation

Spelling may also be used to distinguish between homophones (words with the same pronunciation but different meanings). For example, the words *heir* and *air* are pronounced identically in most dialects. However, they are distinguished from each other orthographically by the addition of the letter ⟨h⟩. Another example is the pair of homophones *plain* and *plane*, but are marked with two different orthographic representations of the vowel /ej/.

In written language, this may help to resolve potential ambiguities that would arise otherwise (cf. *He's breaking the car* vs. *He's braking the car*). Nevertheless, homophones that are unresolved by spelling still exist (for example, the word *bay* has at least five fundamentally different meanings).

Some proponents of spelling reform view homophones as undesirable and would prefer that they be eliminated. Doing so, however, would increase orthographic ambiguities (such as the break/brake example above) that would need to be resolved via the linguistic context.

Marking Sound Changes in Other Letters

Another function of English letters is to provide

information about the pronunciation of *other* letters in the word. Rollins (2004) uses the term “markers” for letters with this function. Letters may mark different types of information. One type of marking is that of a different pronunciation of another letter within the word. An example of this is letter ⟨e⟩ in the word *cottage*. Here ⟨e⟩ indicates that the preceding ⟨g⟩ should represent the sound /dʒ/, rather than the more common value of ⟨g⟩ in word-final position as the sound /g/, such as in *tag*.

A particular letter may have more than one pronunciation-marking role. Besides the marking of word-final ⟨g⟩ as indicating /dʒ/ as in *cottage*, the letter ⟨e⟩ often marks an altered pronunciation for preceding vowels. In the pair *ban* and *bane*, the ⟨a⟩ of *ban* has the value /æ/, whereas the ⟨a⟩ of *bane* is marked by the ⟨e⟩ as having the value /ej/. In this context, the ⟨e⟩ is not pronounced, and is referred to as “silent e”.

A single letter may even fill multiple pronunciation-marking roles simultaneously. For example, in the word *wage* the ⟨e⟩ marks not only the change of the ⟨a⟩ from /æ/ to /ej/, but also of the ⟨g⟩ from /g/ to /dʒ/.

Multiple Functionality

A given letter or (letters) may have dual functions. For example, the letter ⟨i⟩ in the word *cinema* has a sound-representing function (representing the sound /j/) and a pronunciation-marking function (marking the ⟨c⟩ as having the value /s/ opposed to the value /k/).

Underlying Representation

Like many other alphabetic orthographies, English spelling does not represent non-contrastive phonetic sounds (that is, sub-phonemic sounds). The fact that the letter ⟨t⟩ is pronounced with aspiration [t^h] at the beginning of words

is never indicated in the spelling, and, indeed, this phonetic detail is probably not noticeable to the average native speaker not trained in phonetics. However, unlike some orthographies, English orthography often represents a very abstract underlying representation (or morphophonemic form) of English words.

[T]he postulated underlying forms are systematically related to the conventional orthography ... and are, as is well known, related to the underlying forms of a much earlier historical stage of the language. There has, in other words, been little change in lexical representation since Middle English, and, consequently, we would expect ... that lexical representation would differ very little from dialect to dialect in Modern English ... [and] that conventional orthography is probably fairly close to optimal for all modern English dialects, as well as for the attested dialects of the past several hundred years.

In these cases, a given morpheme (i.e. a component of a word) is represented with a single spelling despite the fact that it is pronounced differently (i.e. has different surface representations) in different environments.

Another example involves the vowel differences (with accompanying stress pattern changes) in several related words. For instance, the word *photographer* is derived from the word *photograph* by adding the derivational suffix *-er*. When this suffix is added, the vowel pronunciations change largely owing to the moveable stress.

It could be argued that the underlying representation of *photo* is a single phonological form. Since the (surface) pronunciation of the vowels can be largely predicted by phonological rules according to the different stress patterns, the orthography only needs to have one spelling that corresponds to the underlying form. Other examples of

this type include words with the *-ity* suffix (as in *agile* vs *agility*, *acid* vs *acidity*, *divine* vs *divinity*, *sane* vs *sanity*, etc.).

Another example includes words like. Here the vowel spelling *ea* is pronounced differently in the two related words. Thus, again the orthography uses only a single spelling that corresponds to the single morphemic form rather than to the surface phonological form.

English orthography does not always provide an underlying representation; sometimes it provides an intermediate representation between the underlying form and the surface pronunciation. This is the case with the spelling of the regular plural morpheme, which is written as either *-s* (as in *tick*, *ticks* and *mite*, *mites*) or *-es* (as in *box*, *boxes*). Here the spelling *-s* is pronounced either /s/ or /z/ (depending on the environment, e.g. *ticks* and *pigs*) while *-es* is usually pronounced /jz/. Thus, there are two different spellings that correspond to the single underlying representation |z| of the plural suffix and the three surface forms. The spelling indicates the insertion of /h/ before the /z/ in the spelling *-es*, but does not indicate the devoiced /s/ distinctly from the unaffected /z/ in the spelling *-s*.

The abstract representation of words as indicated by the orthography can be considered advantageous since it makes etymological relationships more apparent to English readers. This makes writing English more complex, but arguably makes reading English more efficient. However, very abstract underlying representations, such as that of Chomsky & Halle (1968) or of underspecification theories, are sometimes considered too abstract to accurately reflect the communicative competence of native speakers. Followers of these arguments believe the less abstract surface forms are more “psychologically real” and thus more useful in terms of pedagogy.

Diacritics

English includes some words that can be written with accent marks. These words have mostly been imported from other languages, usually French. As imported words become increasingly naturalised, there is an increasing tendency to omit the accent marks, even in formal writing. For example, words such as *rôle* and *hôtel* were first seen with accents when they were borrowed into English, but now the accent is almost never used. The words were originally considered French borrowings – even accused by some of being foreign phrases used where English alternatives would suffice – but today their French origin is largely forgotten.

The strongest tendency to retain the accent is in words that are atypical of English morphology and therefore still perceived as slightly foreign. For example, *café* and *pâté* both have a pronounced final *e*, which would otherwise be silent by the normal English pronunciation rules. Further examples of words often retaining diacritics when used in English are: *aplique*, *attache*, *blase*, *bric-a-brac*, *brotchen*, *cliche*, *creme*, *crepe*, *facade*, *fiance(e)*, *flambe*, *naïve*, *naïvete*, *ne(e)*, *papier-mache*, *passé*, *pinata*, *protege*, *resume*, *risque*, *uber-*, *voilà*. Italics, with appropriate accents, are generally applied to foreign terms that are uncommonly used in or have not been assimilated into English: for example, *adios*, *coup d'état*, *creme brulee*, *piece de resistance*, *raison d'être*, *uber (ubermensch)*, *vis-a-vis*.

Written accents are also used occasionally in poetry and scripts for dramatic performances to indicate that a certain normally unstressed syllable in a word should be stressed for dramatic effect, or to keep with the metre of the poetry. This use is frequently seen in archaic and pseudoarchaic writings with the *-ed* suffix, to indicate that the *e* should be fully pronounced, as with *cursed*.

Ligatures

In certain older texts (typically British), the use of the ligatures æ and œ is common in words such as *archæology*, *diarrhæa*, and *encyclopædia*. Such words have Latin or Greek origin. Nowadays, the ligatures have been generally replaced in British English by the separated digraph *ae* and *oe* (*encyclopaedia*, *diarrhoea*; but usually *economy*, *ecology*) and in American English by *e* (*encyclopedia*, *diarrhea*; but usually *paeon*, *amoeba*, *oedipal*, *Caesar*). In some cases, usage may vary; for instance, both *encyclopedia* and *encyclopaedia* are current in the UK.

Irregularities - Phonic

The English spelling system, compared to the systems used in many other languages, is quite irregular and complex. Although French presents a similar degree of difficulty when *encoding* (writing), English is more difficult when *decoding* (reading). For example, in French the /u/ sound (as in 'food'), can be spelt 'ou', 'ous', 'out' and 'oux' (*ou*, *nous*, *tout*, *choux*) but the pronunciation of those graphemes is always the same. In English, the /u:/ sound can be spelt with 'oo' and with 'u', 'u-e', 'ui', 'ue', 'o', 'oe', 'o-e', 'o-b', 'ou', 'ough' and 'ew' (food - truth, rude, fruit, blue, to, shoe, move, tomb, group, through, flew), but 9 of the 11 alternative graphemes have other pronunciations as well: *rub*, *build*, *go*, *toe*, *drove*, *comb*, *out*, *rough*, *sew*.

English has never had any formal regulating authority for spelling, such as the Spanish Real Academia Espanola, Italian Accademia della Crusca or the French Academie francaise.

Spelling Irregularities

Attempts to regularize or reform the language, including spelling reform, have usually met with failure. The only significant exceptions were the reforms of Noah Webster

which resulted in many of the differences between British and American spelling, such as *center/centre*, and *dialog/dialogue*. (Other differences, such as *-ize/-ise* in *realize/realise* etc., came about separately; see American and British English spelling differences for details.) Besides the quirks the English spelling system has inherited from its past, there are other idiosyncrasies in spelling that make it tricky to learn. English contains 24–27 (depending on dialect) separate consonant phonemes and, depending on dialect, anywhere from fourteen to twenty vowels. However, there are only 26 letters in the modern English alphabet, so there cannot be a one-to-one correspondence between letters and sounds. Many sounds are spelled using different letters or multiple letters, and for those words whose pronunciation is predictable from the spelling, the sounds denoted by the letters depend on the surrounding letters. For example, the digraph *th* represents two different sounds (the voiced interdental fricative and the voiceless interdental fricative) (see Pronunciation of English *th*), and the voiceless alveolar fricative can be represented by the letters *s* and *c*.

It is, however, not the shortage of letters which makes English spelling irregular. Its irregularities are caused by the use of many different graphemes for some of its sounds, such as the long oo, ee and oe sounds (*too, true, shoe, flew, through; sleeve, leave, even, seize, siege; stole, coal, bowl, roll, old, mould*), and the use of identical graphemes for spelling different sounds (*over, oven, move*).

Furthermore, English makes no attempt to Anglicise the spellings of most recent loanwords, but preserves the foreign spellings, even when they employ exotic conventions like the Polish *cz* in *Czech* or the Old Norse *fj* in *fjord* (although New Zealand English exclusively spells it *fiord*). In fact, instead of loans being respelled to conform to English spelling standards, sometimes the pronunciation

changes as a result of pressure from the spelling. One example of this is the word *ski*, which was adopted from Norwegian in the mid-18th century, although it did not become common until 1900. It used to be pronounced *shee*, which is similar to the Norwegian pronunciation, but the increasing popularity of the sport after the middle of the 20th century helped the *sk* pronunciation replace it.

There was also a period when the spelling of words was altered in what is now regarded as a misguided attempt to make them conform to what were perceived to be the etymological origins of the words. For example, the letter *b* was added to *debt* (originally *dette*) in an attempt to link it to the Latin *debitum*, and the letter *s* in *island* is a misplaced attempt to link it to Latin *insula* instead of the Norse word *igland*, which is the true origin of the English word. The letter *p* in *ptarmigan* has no etymological justification whatsoever. The spelling of English continues to evolve. Many loanwords come from languages where the pronunciation of vowels corresponds to the way they were pronounced in Old English, which is similar to the Italian or Spanish pronunciation of the vowels, and is the value the vowel symbols [a], [e], [i], [o], and [u] have in the International Phonetic Alphabet. As a result, there is a somewhat regular system of pronouncing “foreign” words in English, and some borrowed words have had their spelling changed to conform to this system. For example, *Hindu* used to be spelled *Hindoo*, and the name *Maria* used to be pronounced like the name *Mariah*, but was changed to conform to this system.

Commercial advertisers have also had an effect on English spelling. In attempts to differentiate their products from others, they introduce new or simplified spellings like *lite* instead of *light*, *thru* instead of *through*, *smokey* instead of *smoky* (for “smokey bacon” flavour crisps), and

rucsac instead of *rucksack*. The spellings of personal names have also been a source of spelling innovations: affectionate versions of women's names that sound the same as men's names have been spelled differently: *Nikki* and *Nicky*, *Toni* and *Tony*, *Jo* and *Joe*.

Sometimes everyday speakers of English change a counterintuitive pronunciation simply because it is counterintuitive. Changes like this are not usually seen as "standard", but can become standard if used enough. An example is the word *miniscule*, which still competes with its original spelling of *minuscule*, though this might also be because of analogy with the word *mini*. A further example is the modern pronunciation of *tissue*.

History

Inconsistencies and irregularities in English spelling have gradually increased in number throughout the history of the English language. There are a number of contributing factors. First, gradual changes in pronunciation, such as the Great Vowel Shift, account for a tremendous number of irregularities. Second, relatively recent loan words from other languages generally carry their original spellings, which are often not phonetic in English. The Romanization of languages (e.g., Chinese) using alphabets derived from the Latin alphabet has further complicated this problem, for example when pronouncing Chinese place names. Third, some prescriptivists have had partial success in their attempts to normalize the English language, forcing a change in spelling but not in pronunciation.

The regular spelling system of Old English was swept away by the Norman Conquest, and English itself was eclipsed by Norman French for three centuries, eventually emerging with its spelling much influenced by French. English had also borrowed large numbers of words from

French, which for reasons of prestige and familiarity kept their French spellings. The spelling of Middle English, such as in the writings of Geoffrey Chaucer, is very irregular and inconsistent, with the same word being spelled differently, sometimes even in the same sentence. However, these were generally much better guides to pronunciation than modern English spelling can honestly claim.

For example, the sound /œ/, normally written *u*, is spelled with an *o* in *son*, *love*, *come*, etc., due to Norman spelling conventions which prohibited writing *u* before *v*, *m*, *n* due to the graphical confusion that would result. (*v*, *u*, *n* were identically written with two minims in Norman handwriting; *w* was written as two *u* letters; *m* was written with three minims, hence *mm* looked like *vun*, *nvu*, *uvu*, etc.) Similarly, spelling conventions also prohibited final *v*. Hence the identical spellings of the three different vowel sounds in *love*, *grove* and *prove* are due to ambiguity in the Middle English spelling system, not sound change.

There was also a series of linguistic sound changes towards the end of this period, including the Great Vowel Shift, which resulted in the *i* in *mine*, for example, changing from a pure vowel to a diphthong. These changes for the most part did not detract from the rule-governed nature of the spelling system; but in some cases they introduced confusing inconsistencies, like the well-known example of the many pronunciations of *ough* (*rough*, *through*, *though*, *trough*, *plough*, etc.). Most of these changes happened before the arrival of printing in England. However, the arrival of the printing press merely froze the current system, rather than providing the impetus for a realignment of spelling with pronunciation. Furthermore, it introduced further inconsistencies, partly because of the use of typesetters trained abroad, particularly in the Low Countries. For example, the *h* in *ghost* was influenced by Dutch. The

addition and deletion of a silent *e* at the ends of words was also sometimes used to make the right-hand margin line up more neatly.

By the time dictionaries were introduced in the mid 17th century, the spelling system of English started to stabilize. By the 19th century, most words had set spellings, though it took some time before they diffused throughout the English-speaking world. In *The Mill on the Floss* (1860), English novelist George Eliot satirized the attitude of the English rural gentry of the 1820s towards orthography:

Mr. Tulliver did not willingly write a letter, and found the relation between spoken and written language, briefly known as spelling, one of the most puzzling things in this puzzling world. Nevertheless, like all fervid writing, the task was done in less time than usual, and if the spelling differed from Mrs. Glegg's,—why, she belonged, like himself, to a generation with whom spelling was a matter of private judgment.

The modern English spelling system, with its national variants, spread together with the expansion of public education later in the nineteenth century.

“Ough” Words

The most notorious group of letters in the English language, *ough*, is commonly pronounced at least ten different ways, six of which are illustrated in the construct, *Though the tough cough and hiccough plough him through*, which is quoted by Robert A. Heinlein in *The Door into Summer* to illustrate the difficulties facing automated speech transcription and reading. *Ough* is in fact a word in its own right; it is an exclamation of disgust similar to *ugh*.

- *though*: /oʊ/ as in *toe*; (other examples: *dough*)
- *tough*: /tʃ/ as in *cuff*; (other examples: *rough*, *enough*)

- *cough*: /Rf/ as in *off*; (other examples: *Gough* (name, some pronunciations))
- *hiccough* (a now uncommon variant of *hiccup*): /Œp/ as in *up*; (unique)
- *plough*: /aS/ as in *cow*; (other examples: *sough*, *drought*, *bough*, and the name *Doughty*)
- *through*: /uD/ as in *blue*;
- *nought*: /TD/ as in *caught*. (other examples: *ought*, *sought*, *thought*, *brought*)
- *lough*: /Rx/ with a rough breathing sound like the *ch* in *loch*

Finally, there is the place name Loughborough, where the first ough has the sound as in *cuff* and the second rhymes either with *dough* or *thorough* - the latter being more common among locals.

Spelling Patterns

Spelling to Sound Correspondences

Vowels

In a generative approach to English spelling, Rollins (2004) identifies twenty main orthographic vowels of stressed syllables that are grouped into four main categories: “Lax”, “Tense”, “Heavy”, “Tense-R”. (As this classification is based on orthography, not all orthographic “lax” vowels are necessarily phonologically lax.) For instance, the letter *a* can represent the lax vowel /æ/, tense /ej/, heavy Q(D), or tense-r /[(Y)]. Heavy and tense-r vowels are the respective lax and tense counterparts followed by the letter *r*.

Tense vowels are distinguished from lax vowels with a “silent” *e* letter that is added at the end of words. Thus, the letter *a* in *hat* is lax /æ/, but when the letter *e* is added in the word *hate* the letter *a* is tense /ej/. Similarly, heavy and tense-r vowels pattern together: the letters *ar* in *car*

are heavy /Qr/, the letters *ar* followed by silent *e* in the word *care* are /[Yr/. The letter *u* represents two different vowel patterns, one being /Œ/, /juD/, /Y/, /jS/, the other /S/, /uD/, /S/. There is no distinction between heavy and tense-r vowels with the letter *o*, and the letter *u* in the /S-uD-S/ pattern does not have a heavy vowel member. Besides silent *e*, another strategy for indicating tense and tense-r vowels, is the addition of another orthographic vowel forming a digraph. In this case, the first vowel is usually the main vowel while the second vowel is the “marking” vowel. For example, the word *man* has a lax *a* pronounced /æ/, but with the addition of *i* (as the digraph *ai*) in the word *main* the *a* is marked as tense and pronounced /ej/. These two strategies produce words that are spelled differently but pronounced identically, as in *mane* (silent *e* strategy), *main* (digraph strategy) and *Maine* (both strategies). The use of two different strategies relates to the function of distinguishing between words that would otherwise be homonyms.

Besides the 20 basic vowel spellings, Rollins (2004) has a reduced vowel category (representing the sounds /Y, j/) and a miscellaneous category.

ENGLISH AS A FOREIGN OR SECOND LANGUAGE

ESL (English as a second language), ESOL (English for speakers of other languages), and EFL (English as a foreign language) all refer to the use or study of English by speakers with a different native language. The precise usage, including the different use of the terms ESL and ESOL in different countries, is described below. These terms are most commonly used in relation to teaching and learning English, but they may also be used in relation to demographic information.

ELT (English language teaching) is a widely-used

teacher-centred term, as in the English language teaching divisions of large publishing houses, ELT training, etc. The abbreviations TESL (teaching English as a second language), TESOL (teaching English to speakers of other languages) and TEFL (teaching English as a foreign language) are also used.

Other terms used in this field include EAL (English as an additional language), EIL (English as an international language), ELF (English as a lingua franca), ESP (English for special purposes, or English for specific purposes), EAP (English for academic purposes). Some terms that refer to those who are learning English are ELL (English language learner), LEP (limited English proficiency) and CLD (culturally and linguistically diverse).

Terminology and Types

The many acronyms and abbreviations used in the field of English teaching and learning may be confusing. English is a language with great reach and influence; it is taught all over the world under many different circumstances. In English-speaking countries, English language teaching has essentially evolved in two broad directions: instruction for people who intend to live in an English-speaking country and for those who don't. These divisions have grown firmer as the instructors of these two "industries" have used different terminology, followed distinct training qualifications, formed separate professional associations, and so on. Crucially, these two arms have very different funding structures, public in the former and private in the latter, and to some extent this influences the way schools are established and classes are held. Matters are further complicated by the fact that the United States and the United Kingdom, both major engines of the language, describe these categories in different terms: as many eloquent users of the language have observed, "England and America

are two countries divided by a common language.” (Attributed to Winston Churchill, George Bernard Shaw, and Oscar Wilde). The following technical definitions may therefore have their currency contested.

English Outside English-Speaking Countries

EFL, English as a foreign language, indicates the use of English in a non-English-speaking region. Study can occur either in the student’s home country, as part of the normal school curriculum or otherwise, or, for the more privileged minority, in an anglophone country that they visit as a sort of educational tourist, particularly immediately before or after graduating from university. *TEFL* is the teaching of English as a foreign language; note that this sort of instruction can take place in any country, English-speaking or not. Typically, EFL is learned either to pass exams as a necessary part of one’s education, or for career progression while working for an organisation or business with an international focus. EFL may be part of the state school curriculum in countries where English has no special status (what linguist Braj Kachru calls the “expanding circle countries”); it may also be supplemented by lessons paid for privately. Teachers of EFL generally assume that students are literate in their mother tongue. The Chinese *EFL Journal* and Iranian *EFL Journal* are examples of international journals dedicated to specifics of English language learning within countries where English is used as a foreign language.

English Within English-Speaking Countries

The other broad grouping is the use of English within the Anglosphere. In what theorist Braj Kachru calls “the inner circle”, i.e. countries such as the United Kingdom and the United States, this use of English is generally by refugees, immigrants and their children. It also includes

the use of English in “outer circle” countries, often former British colonies, where English is an official language even if it is not spoken as a mother tongue by the majority of the population.

In the US, Canada and Australia, this use of English is called *ESL* (English as a second language). This term has been criticized on the grounds that many learners already speak more than one language. A counter-argument says that the word “a” in the phrase “a second language” means there is no presumption that English is *the* second acquired language. *TESL* is the teaching of English as a second language.

In the UK, Ireland and New Zealand, the term *ESL* has been replaced by *ESOL* (English for speakers of other languages). In these countries *TESOL* (teaching English to speakers of other languages) is normally used to refer to teaching English only to this group. In the UK, the term *EAL* (English as an additional language), rather than *ESOL*, is usually used when talking about primary and secondary schools, in order to clarify English is not the students’ first language, but their second or third.

Other acronyms were created to describe the person rather than the language to be learned. The term *LEP* (Limited English proficiency) was created in 1975 by the Lau Remedies following a decision of the US Supreme Court. *ELL* (English Language Learner), used by United States governments and school systems, was created by James Crawford of the Institute for Language and Education Policy in an effort to label learners positively, rather than ascribing a deficiency to them. *LOTE* (Languages other than English) is a parallel term used in Canada, Australia, and New Zealand.

Typically, this sort of English (called ESL in the United States, Canada, and Australia, ESOL in the United Kingdom, Ireland and New Zealand) is learned to function in the new host country, e.g. within the school system (if a child), to find and hold down a job (if an adult), to perform the necessities of daily life. The teaching of it does not presuppose literacy in the mother tongue. It is usually paid for by the host government to help newcomers settle into their adopted country, sometimes as part of an explicit citizenship program. It is technically possible for ESL to be taught not in the host country, but in, for example, a refugee camp, as part of a pre-departure program sponsored by the government soon to receive new potential citizens. In practice, however, this is extremely rare.

Particularly in Canada and Australia, the term *ESD* (English as a second dialect) is used alongside ESL, usually in reference to programs for Canadian First Nations people or indigenous Australians, respectively. It refers to the use of standard English, which may need to be explicitly taught, by speakers of a creole or non-standard variety. It is often grouped with ESL as *ESL/ESD*.

Umbrella Terms

All these ways of denoting the teaching of English can be bundled together into an umbrella term. Unfortunately, all the English teachers in the world cannot agree on just one. The term *TESOL* (teaching English to speakers of other languages) is used in American English to include both TEFL and TESL. This is also the case in Canada. British English uses *ELT* (English language teaching), because TESOL has a different, more specific meaning; see above.

Systems of Simplified English

For international communication several models of

“simplified English” have been suggested or developed, among them:

- Basic English, developed by Charles Kay Ogden (and later also I.A. Richards) in the 1930s; a recent revival has been initiated by Bill Topley
- Threshold Level English, developed by van Ek and Alexander
- Globish, developed by Jean-Paul Nerrière
- Basic Global English, developed by Joachim Grzega
- Nuclear English, proposed by Randolph Quirk and Gabriele Stein but never fully developed
- The English collectively developed in the Simple English Wikipedia, primarily Basic English and Special English

Difficulties for Learners

Language teaching practice often assumes that most of the difficulties that learners face in the study of English are a consequence of the degree to which their native language differs from English (a contrastive analysis approach). A native speaker of Chinese, for example, may face many more difficulties than a native speaker of German, because German is closely related to English, whereas Chinese is not. This may be true for anyone of any mother tongue (also called first language, normally abbreviated L1) setting out to learn any other language (called a target language, second language or L2). See also second language acquisition (SLA) for mixed evidence from linguistic research.

Language learners often produce errors of syntax and pronunciation thought to result from the influence of their L1, such as mapping its grammatical patterns inappropriately onto the L2, pronouncing certain sounds incorrectly or with difficulty, and confusing items of vocabulary known as false friends. This is known as L1

transfer or “language interference”. However, these transfer effects are typically stronger for beginners’ language production, and SLA research has highlighted many errors which cannot be attributed to the L1, as they are attested in learners of many language backgrounds (for example, failure to apply 3rd person present singular -s to verbs, as in ‘he make’).

Some students may have very different cultural perceptions in the classroom as far as learning a second language is concerned. Also, cultural differences in communication styles and preferences are significant. For example, a study looked at Chinese ESL students and British teachers and found that the Chinese learners did not see classroom discussion and interaction as important but placed a heavy emphasis on teacher-directed lectures.

Pronunciation

Consonant Phonemes

English does not have more individual consonant sounds than most languages. However, the interdental, /θ/ and /ð/ (the sounds written with *th*), which are common in English (*thin, thing, etc.*; and *the, this, that, etc.*) are relatively rare in other languages, even others in the Germanic family (e.g., English *thousand* = German *tausend*), and these sounds are missing even in some English dialects. Some learners substitute a [t] or [d] sound, while others shift to [s] or [z], [f] or [v] and even [ts] or [dz].

Speakers of Japanese, Korean, Chinese and Thai may have difficulty distinguishing [y] and [l]. Speakers of Xiang Chinese may have a similar difficulty distinguishing [n] and [l]. The distinction between [b] and [v] can cause difficulty for native speakers of Spanish, Arabic, Japanese and Korean.

Vowel Phonemes

The precise number of distinct vowel sounds depends on the variety of English: for example, Received Pronunciation has twelve monophthongs (single or “pure” vowels), eight diphthongs (double vowels) and two triphthongs (triple vowels); whereas General American has thirteen monophthongs and three diphthongs. Many learners, such as speakers of Spanish, Japanese or Arabic, have fewer vowels, or only pure ones, in their mother tongue and so may have problems both with hearing and with pronouncing these distinctions.

Syllable Structure

In its syllable structure, English allows for a cluster of up to three consonants before the vowel and four after it (e.g., *straw*, *desks*, *glimpsed*). The syllable structure causes problems for speakers of many other languages. Japanese, for example, broadly alternates consonant and vowel sounds so learners from Japan often try to force vowels in between the consonants (e.g., *desks* /desks/ becomes “desukusu” or *milk shake* /mjlk fejk/ becomes “mirukushcku”). Learners from languages where all words end in vowels sometimes tend to make all English words end in vowels, thus *make* /mejk/ can come out as [mejkY]. The learner’s task is further complicated by the fact that native speakers may drop consonants in the more complex blends (e.g., [mɔ̃ns] instead of [mɔ̃nes] for *months*).

Unstressed Vowels

Native English speakers frequently replace almost any vowel in an unstressed syllable with an unstressed vowel, often schwa. For example, *from* has a distinctly pronounced short ‘o’ sound when it is stressed (e.g., *Where are you from?*), but when it is unstressed, the short ‘o’ reduces to a schwa (e.g., *I’m from London.*). In some cases, unstressed

vowels may disappear altogether, in words such as chocolate (which has four syllables in Spanish, but only two as pronounced by Americans: “*choc-lit*”).

Stress in English more strongly determines vowel quality than it does in most other world languages (although there are notable exceptions such as Russian). For example, in some varieties the syllables *an*, *en*, *in*, *on* and *un* are pronounced as homophones, that is, exactly alike. Native speakers can usually distinguish *an able*, *enable*, and *unable* because of their position in a sentence, but this is more difficult for inexperienced English speakers. Moreover, learners tend to overpronounce these unstressed vowels, giving their speech an unnatural rhythm.

Stress Timing

English tends to be a stress-timed language - this means that stressed syllables are roughly equidistant in time, no matter how many syllables come in between. Although some other languages, e.g., German and Russian, are also stress-timed, most of the world's other major languages are syllable-timed, with each syllable coming at an equal time after the previous one. Learners from these languages often have a staccato rhythm when speaking English that is disconcerting to a native speaker.

“Stress for emphasis” - students' own languages may not use stress for emphasis as English does.

“Stress for contrast” - stressing the right word or expression. This may not come easily to some non-native speakers.

“Emphatic apologies” - the normally unstressed auxiliary is stressed (I really *am* very sorry)

In English there are quite a number of words - about fifty - that have two different pronunciations, depending

on whether they are stressed. They are “grammatical words”: pronouns, prepositions, auxiliary verbs and conjunctions. Most students tend to overuse the strong form, which is pronounced with the written vowel.

Connected Speech

Phonological processes such as assimilation, elision and epenthesis together with indistinct word boundaries can confuse learners when listening to natural spoken English, as well as making their speech sound too formal if they do not use them.

Grammar

- Tense, aspect, and mood - English has a relatively large number of tense-aspect-mood forms with some quite subtle differences, such as the difference between the simple past “I ate” and the present perfect “I have eaten.” Progressive and perfect progressive forms add complexity.
- Functions of auxiliaries - Learners of English tend to find it difficult to manipulate the various ways in which English uses auxiliary verbs. These include negation (e.g. *He hasn't been drinking.*), inversion with the subject to form a question (e.g. *Has he been drinking?*), short answers (e.g. *Yes, he has.*) and tag questions (*has he?*). A further complication is that the dummy auxiliary verb *do /does /did* is added to fulfil these functions in the simple present and simple past, but not for the verb *to be*.
- Modal verbs - English also has a significant number of modal auxiliary verbs which each have a number of uses. For example, the opposite of “You must be here at 8” (obligation) is usually “You don't have to be here at 8” (lack of obligation, choice), while “must” in “You must not drink the water”

(prohibition) has a different meaning from “must” in “You must not be a native speaker” (deduction). This complexity takes considerable work for most English language learners to master.

- Idiomatic usage - English is reputed to have a relatively high degree of idiomatic usage. For example, the use of different main verb forms in such apparently parallel constructions as “try to learn”, “help learn”, and “avoid learning” pose difficulty for learners. Another example is the idiomatic distinction between “make” and “do”: “make a mistake”, not “do a mistake”; and “do a favor”, not “make a favor”.
- Articles - English has an appreciable number of articles, including the “the” definite article and the “a, an” indefinite article. At times English nouns can or indeed must be used without an article; this is called the zero article. Some of the differences between definite, indefinite and zero article are fairly easy to learn, but others are not, particularly since a learner’s native language may lack articles or use them in different ways than English does. Although the information conveyed by articles is rarely essential for communication, English uses them frequently (several times in the average sentence), so that they require some effort from the learner.

Vocabulary

- Phrasal verbs - Phrasal verbs in English can cause difficulties for many learners because they have several meanings and different syntactic patterns. There are also a number of phrasal verb differences between American and British English.

- **Word derivation** - Word derivation in English requires a lot of rote learning. For example, an adjective can be negated by using the prefix *un-* (e.g. *unable*), *in-* (e.g. *inappropriate*), *dis-* (e.g. *dishonest*), or *a-* (e.g. *amoral*), or through the use of one of a myriad related but rarer prefixes, all modified versions of the first four.
- **Size of lexicon** - The history of English has resulted in a very large vocabulary, essentially one stream from Old English and one from the Norman infusion of Latin-derived terms. (Schmitt & Marsden claim that English has one of the largest vocabularies of any known language.) This inevitably requires more work for a learner to master the language.
- **Collocations** - Collocations in English refer to the tendency for words to occur regularly with others. For example, nouns and verbs that go together (ride a bike/ drive a car). Native speakers tend to use chunks of collocations and the ESL learners make mistakes with collocations in their writing/ speaking which sometimes results in awkwardness.
- **Slang and Colloquialisms** In most native English speaking countries, large numbers of slang and colloquial terms are used in everyday speech. Many learners may find that classroom based English is significantly different to how English is spoken in normal situations. This can often be difficult and confusing for learners with little experience of using English in Anglophone countries. Also, slang terms differ greatly between different regions and can change quickly in response to popular culture. Some phrases can become unintentionally rude if misused.

Differences Between Spoken and Written English

As with most languages, written language tends to

use a more formal register than spoken language. The acquisition of literacy takes significant effort in English.

- *spelling* - Because of the many changes in pronunciation which have occurred since a written standard developed, the retention of many historical idiosyncrasies in spelling, and the large influx of foreign words (mainly from Danish, Norman French, Classical Latin and Greek) with different and overlapping spelling patterns, English spelling is difficult even for native speakers to master. This difficulty is shown in such activities as spelling bees that generally require the memorization of words. English speakers may also rely on computer tools such as spell checkers more than speakers of other languages, as the users of these utilities may have forgotten, or never learned, the correct spelling of a word. The generalizations that exist are quite complex and there are many exceptions leading to a considerable amount of rote learning. The spelling system causes problems in both directions - a learner may know a word by sound but not be able to write it correctly (or indeed find it in a dictionary), or they may see a word written but not know how to pronounce it or mislearn the pronunciation. However, despite the variety of spelling patterns in English, there are dozens of rules that are 75% or more reliable.

Varieties of English

- The British Isles, historical home of English, has significant regional language differences in pronunciation, accent, vocabulary and grammar.
- The thriving communities of English native speakers in countries all over the world also have some

noticeable differences in pronunciation, vocabulary and grammar.

- English has no organisation that determines the most prestigious form of the language - unlike the French language which has the *Academie de la langue francaise*, Spanish language's *Real Academia Espanola*, or the Italian *Accademia della Crusca*.

Teaching English therefore involves not only helping the student to use the form of English most suitable for his purposes, but also exposure to regional forms and cultural styles so that the student will be able to discern meaning even when the words, grammar or pronunciation are different to the form of English he is being taught to speak.

Exams for Learners

Learners of English are often keen to get accreditation and a number of exams are known internationally:

- University of Cambridge ESOL Examinations offers a suite of eighteen globally available examinations including General English: Key English Test (KET), Preliminary English Test (PET), First Certificate in English (FCE), Certificate in Advanced English (CAE) and Certificate of Proficiency in English (CPE).
- Trinity College London ESOL offers Integrated Skills in English (ISE), series of 5 exams, which assesses Reading, Writing, Speaking and Listening accepted by academic institutions in the UK. They also offer Graded Examinations in Spoken English (GESE), series of 12 exams, which assesses Speaking and Listening and ESOL Skills for Life and ESOL for Work exams in the UK only.

- IELTS (International English Language Testing System), accepted by academic institutions in the UK, Australia, New Zealand and Canada, and by many in the USA.
- London Tests of English from Pearson Language Tests, a series of six exams each mapped to a level from the Common European Framework (CEFR-see below)
- Secondary Level English Proficiency test
- Pearson Test of English Academic (PTE Academic), a Pearson product, measure Reading, Writing, Speaking and Listening as well as Grammar, Oral Fluency, Pronunciation, Spelling, Vocubular and Written Discourse. The test is computer-based and is designed to reflect international English for academic admission into any university requiring English proficiency.
- TOEFL (Test of English as a Foreign Language), an Educational Testing Service product, developed and used primarily for academic institutions in the USA, and now widely accepted in tertiary institutions in Canada, New Zealand, Australia, the UK, and Ireland. The current test is an Internet-based test, and is thus known as the TOEFL iBT. Used as a proxy for English for Academic Purposes.
- TOEIC (Test of English for International Communication), an Educational Testing Service product for Business English used by 10,000 organizations in 120 countries. Includes a Listening & Reading test as well as a Speaking & Writing test introduced in selected countries beginning in 2006.

Many countries also have their own exams. ESOL learners in England, Wales and Northern Ireland usually

take the national Skills for Life qualifications, which are offered by several exam boards. EFL learners in China may take the College English Test. In Greece English students may take the PALS (PanHellenic Association of Language School Owners) exams.

The Common European Framework

Between 1998 and 2000, the Council of Europe's language policy division developed its Common European Framework of Reference for Languages. The aim of this framework was to have a common system for foreign language testing and certification, to cover all European languages and countries. The Common European Framework (CEF) divides language learners into three levels:

- A. Basic User
- B. Independent User
- C. Proficient User

Each of these levels is divided into two sections, resulting in a total of six levels for testing (A1, A2, B1, etc.).

Qualifications for Teachers

Non-Native Speakers

Most people who teach English are in fact not native speakers of that language. They are state school teachers in countries around the world, and as such they hold the relevant teaching qualification of their country, usually with a specialization in teaching English. For example, teachers in Hong Kong hold the Language Proficiency Assessment for Teachers. Those who work in private language schools may, from commercial pressures, have the same qualifications as native speakers. Widespread problems exist of minimal qualifications and poor quality providers of training, and as the industry becomes more professional, it is trying to self-regulate to eliminate these.

United States Qualifications

Most U.S. instructors at community colleges and universities qualify by taking a Master of Arts (MA) in TESOL. This degree also qualifies them to teach in most EFL contexts. In some areas of the United States, a growing number of elementary school teachers are involved in teaching ELLs (English Language Learners, that is, children who come to school speaking a home language other than English.) The qualifications for these classroom teachers vary from state to state but always include a state-issued teaching certificate for public instruction. This state licensing requires substantial practical experience as well as course work. The MA in TESOL typically includes both graduate work in English as one of the classical liberal arts (literature, linguistics, media studies) with a theoretical component in language pedagogy. Admission to the MA in TESOL typically requires at least a bachelor's degree with a minor in English or linguistics, or, sometimes, a degree in a foreign language instead.

It is important to note that the issuance of a teaching certificate or license is not automatic following completion of degree requirements. All teachers must complete a battery of exams (typically the Praxis subject and method exams or similar, state-sponsored exams) as well as supervised instruction as student teachers. Often, ESL certification can be obtained through extra college coursework. ESL certifications are usually only valid when paired with an already existing teaching certificate. Certification requirements for ESL teachers vary greatly from state to state; out-of-state teaching certificates are recognized if the two states have a reciprocity agreement.

British Qualifications

Common, respected qualifications for teachers within

the United Kingdom's sphere of influence include certificates and diplomas issued by Trinity College London ESOL and University of Cambridge ESOL (henceforth Trinity and Cambridge).

A certificate course is usually undertaken before starting to teach. This is sufficient for most EFL jobs and for some ESOL ones. CertTESOL (Certificate in Teaching English to Speakers of Other Languages), issued by Trinity, and CELTA (Certificate in English Language Teaching to Adults), issued by Cambridge, are the most widely taken and accepted qualifications for new teacher trainees. Courses are offered in the UK and in many countries around the world. It is usually taught full-time over a one-month period or part-time over a period up to a year.

Teachers with two or more years of teaching experience who want to stay in the profession and advance their career prospects (including school management and teacher training) can take a diploma course. Trinity offers the Trinity Licentiate Diploma in Teaching English to Speakers of Other Languages (DipTESOL) and Cambridge offers the Diploma in English Language Teaching to Adults (DELTA). These diplomas are considered to be equivalent and are both accredited at level 7 of the revised National Qualifications Framework. Some teachers who stay in the profession go on to do an MA in a relevant discipline such as applied linguistics or ELT. Many UK master's degrees require considerable experience in the field before a candidate is accepted onto the course.

The above qualifications are well-respected within the UK EFL sector, including private language schools and higher education language provision. However, in England and Wales, in order to meet the government's criteria for being a qualified teacher of ESOL in the Learning and Skills Sector (i.e. post-compulsory or further education),

teachers need to have the Certificate in Further Education Teaching Stage 3 at level 5 (of the revised NQF) and the Certificate for ESOL Subject Specialists at level 4. Recognised qualifications which confer one or both of these include a Postgraduate Certificate in Education (PGCE) in ESOL, the CELTA module 2 and City & Guilds 9488. Teachers of any subject within the British state sector are normally expected to hold a PGCE, and may choose to specialise in ELT.

South Korea Qualifications

To teach English in Republic of Korea as an ESL teacher, you must be a native speaker from an English-speaking country. This includes the United States of America, some areas of Canada, Australia, New Zealand, the United Kingdom, Nigeria, Jamaica, Ghana, South Africa, and Ireland.

You must have a Bachelor's or Master's degree in any field and must complete 10 years of education in one of the ten accepted countries (from grade 6 to university). You must have no criminal record (minor offenses such as traffic violations will be examined by the immigration office as well).

Teaching experience or language certificates (TESOL/TEFL/TESL/CELTA) are not required, but would be a major plus.

Professional Associations and Unions

- TESOL Inc. is Teachers of English to Speakers of Other Languages, a professional organization based in the United States. In addition, there are many large state-wide and regional affiliates, see below.
- IATEFL is the International Association of Teachers of English as a Foreign Language, a professional organization based in the United Kingdom.

- Professional organisations for teachers of English exist at national levels. Many contain phrases in their title such as the Japan Association for Language Teaching (JALT), TESOL Greece in Greece, or the Society of Pakistan English Language Teachers (SPELT). Some of these organisations may be bigger in structure (supra-national, such as TESOL Arabia in the Gulf states), or smaller (limited to one city, state, or province, such as CATESOL in California). Some are affiliated to TESOL or IATEFL.
- NATECLA is the National Association for Teaching English and other Community Languages to Adults, which focuses on teaching ESOL in the United Kingdom.
- National Union of General Workers is a Japanese union which includes English teachers.
- University and College Union is a British trade union which includes lecturers of ELT.

Types of English

- BE - Business English
- EAL - English as an additional language. The use of this term is restricted to certain countries. See the discussion in Terminology and types.
- EAP - English for academic purposes
- EFL - English as a foreign language. English for use in a non-English-speaking region, by someone whose first language is not English. See the discussion in Terminology and types.
- EIL - English as an international language
- ELF - English as a lingua franca
- ELL - English language learner. The use of this

term is restricted to certain countries. See the discussion in Terminology and types.

- ELT - English language teaching. The use of this term is restricted to certain countries. See the discussion in Terminology and types.
- ESL - English as a second language. English for use in an English-speaking region, by someone whose first language is not English. The use of this term is restricted to certain countries. See the discussion in Terminology and types.
- ESOL - English for speakers of other languages. This term is used differently in different countries. See the discussion in Terminology and types.
- ESP - English for specific purposes, or English for special purposes (e.g. technical English, scientific English, English for medical professionals, English for waiters).
- EST - English for science and technology (e.g. technical English, scientific English).
- TEFL - Teaching English as a foreign language. This link is to a page about a subset of TEFL, namely travel-teaching. More generally, see the discussion in Terminology and types.
- TESL - Teaching English as a second language. The use of this term is restricted to certain countries. See the discussion in Terminology and types.
- TESOL - Teaching English to speakers of other languages, or Teaching English as a second or other language. See the discussion in Terminology and types.
- TYLE - Teaching Young Learners English. Note that “Young Learners” can mean under 18, or much younger.

Other Abbreviations

- BULATS - Business Language Testing Services, a computer-based test of business English, produced by CambridgeEsol. The test also exists for French, German, and Spanish.
- CELT - Certificate in English Language Teaching, certified by the National Qualifications Authority of Ireland (ACELS).
- CELTA - Certificate in English Language Teaching to Adults
- CELTYL - Certificate in English Language Teaching to Young Learners
- DELTA - Diploma in English Language Teaching to Adults
- IELTS - International English Language Testing System
- LTE - London Tests of English by Pearson Language Tests
- TOEFL - Test of English as a Foreign Language
- TOEIC - Test of English for International Communication
- UCLES - University of Cambridge Local Examinations Syndicate, an exam board
- Trinity College London ESOL

HISTORY OF THE ENGLISH LANGUAGE

English is a West Germanic language that originated from the Anglo-Frisian dialects brought to Britain by Germanic invaders from various parts of what is now northwest Germany and the Netherlands. Initially, Old English was a diverse group of dialects, reflecting the varied origins of the Anglo-Saxon kingdoms of England. One of these dialects, Late West Saxon, eventually came to dominate.

The original Old English language was then influenced by two further waves of invasion: the first by speakers of the Scandinavian branch of the Germanic language family, who conquered and colonized parts of Britain in the 8th and 9th centuries; the second by the Normans in the 11th century, who spoke Old Norman and ultimately developed an English variety of this called Anglo-Norman. These two invasions caused English to become “mixed” to some degree.

Cohabitation with the Scandinavians resulted in a significant grammatical simplification and lexical enrichment of the Anglo-Frisian core of English; the later Norman occupation led to the grafting onto that Germanic core of a more elaborate layer of words from the Romance languages (Latin-based languages). This Norman influence entered English largely through the courts and government. Thus, English developed into a “borrowing” language of great flexibility, resulting in an enormous and varied vocabulary.

Proto-English

The languages of Germanic peoples gave rise to the English language (the Angles, Saxons, Frisians, Jutes and possibly the Franks, who traded and fought with the Latin-speaking Roman Empire in the centuries-long process of the Germanic peoples’ expansion into Western Europe during the Migration Period). Some Latin words for common objects entered the vocabulary of these Germanic peoples before their arrival in Britain and their subsequent formation of England.

The main source of information for the culture of the Germanic peoples (the ancestors of the English) in ancient times is Tacitus’ *Germania*, written around 100 AD. While remaining conversant with Roman civilisation and its economy, including serving in the Roman military, they

retained political independence. Some Germanic troops served in Britannia under the Romans. It is unlikely that Germanic settlement in Britain was intensified (except for Frisians) until the arrival of mercenaries in the 5th century as described by Gildas. As it was, the Angles, Saxons and Jutes arrived as Germanic pagans, independent of Roman control.

According to the *Anglo-Saxon Chronicle*, around the year 449, Vortigern, King of the Britons, invited the “Angle kin” (Angles allegedly led by the Germanic brothers Hengist and Horsa) to help him in conflicts with the Picts. In return, the Angles were granted lands in the southeast of Britain. Further aid was sought, and in response “came men of Ald Seaxum of Anglum of Iotum” (Saxons, Angles and Jutes). The *Chronicle* talks of a subsequent influx of settlers who eventually established seven kingdoms, known as the heptarchy. However, modern scholars view the figures of Hengist and Horsa as Euhemerized deities from Anglo-Saxon paganism, who ultimately stem from the religion of the Proto-Indo-Europeans.

Old English

The invaders’ Germanic language displaced the indigenous Brythonic languages in most of the areas of Great Britain that were later to become England. The original Celtic languages remained in parts of Scotland, Wales and Cornwall (where Cornish was spoken into the 19th century). The Germanic dialects combined to form what is now called Old English. The most famous surviving work from the Old English period is the epic poem *Beowulf* composed by an unknown poet.

Old English did not sound or look like the Standard English of today. Any native English speaker of today would find Old English unintelligible without studying it

as a separate language. Nevertheless, about half of the most commonly used words in Modern English have Old English roots. The words *be*, *strong* and *water*, for example, derive from Old English; and many non-standard dialects such as Scots and Northumbrian English have retained many features of Old English in vocabulary and pronunciation. Old English was spoken until sometime in the 12th or 13th century.

Later, English was strongly influenced by the North Germanic language Old Norse, spoken by the Norsemen who invaded and settled mainly in the north-east of England. The new and the earlier settlers spoke languages from different branches of the Germanic family; many of their lexical roots were the same or similar, although their grammars were more distinct.

The Germanic language of these Old English-speaking inhabitants was influenced by contact with Norse invaders, which might have been responsible for some of the morphological simplification of Old English, including the loss of grammatical gender and explicitly marked case (with the notable exception of the pronouns). English words of Old Norse origin include *anger*, *bag*, *both*, *hit*, *law*, *leg*, *same*, *skill*, *sky*, *take*, and many others, possibly even including the pronoun *they*.

The introduction of Christianity added another wave of Latin and some Greek words. The Old English period formally ended sometime after the Norman conquest (starting in 1066 AD), when the language was influenced to an even greater extent by the Norman-speaking Normans. The use of Anglo-Saxon to describe a merging of Anglian and Saxon languages and cultures is a relatively modern development.

Middle English

For about 300 years following the Norman Conquest in 1066, the Norman kings and their high nobility spoke only one of the *langues d'oïl* called Anglo-Norman, which was a variety of Old Norman used in England and to some extent elsewhere in the British Isles during the Anglo-Norman period and originating from a northern dialect of Old French, whilst English continued to be the language of the common people. Middle English was influenced by both Anglo-Norman and, later, Anglo-French.

Even after the decline of Norman, French retained the status of a formal or prestige language and had (with Norman) a significant influence on the language, which is visible in Modern English today. A tendency for Norman-derived words to have more formal connotations has continued to the present day; most modern English speakers would consider a “cordial reception” (from French) to be more formal than a “hearty welcome” (Germanic). Another example is the very unusual construction of the words for animals being separate from the words for their meat: *e.g.*, beef and pork (from the Norman *bœuf* and *porc*) being the products of ‘cows’ and ‘pigs’, animals with Germanic names.

English was also influenced by the Celtic languages it was displacing, especially the Brittonic substrate, most notably with the introduction of the continuous aspect—a feature found in many modern languages but developed earlier and more thoroughly in English.

While the *Anglo-Saxon Chronicle* continued until 1154, most other literature from this period was in Old Norman or Latin. A large number of Norman words were taken into Old English, with many doubling for Old English words. The Norman influence is the hallmark of the linguistic shifts in English over the period of time following the

invasion, producing what is now referred to as Middle English.

The most famous writer from the Middle English period was Geoffrey Chaucer, and *The Canterbury Tales* is his best-known work.

English literature started to reappear around 1200, when a changing political climate and the decline in Anglo-Norman made it more respectable. The Provisions of Oxford, released in 1258, was the first English government document to be published in the English language since the Conquest. In 1362, Edward III became the first king to address Parliament in English. By the end of that century, even the royal court had switched to English. Anglo-Norman remained in use in limited circles somewhat longer, but it had ceased to be a living language.

English spelling was also influenced by Norman in this period, with the /t/ and /d/ sounds being spelled *th* rather than with the Old English letters þ (thorn) and ð (eth), which did not exist in Norman. (These letters remain in the modern Icelandic alphabet, which is descended from the alphabet of Old Norse.)

Early Modern English

Modern English is often dated from the Great Vowel Shift, which took place mainly during the 15th century. English was further transformed by the spread of a standardised London-based dialect in government and administration and by the standardising effect of printing. By the time of William Shakespeare (mid-late 16th century), the language had become clearly recognizable as Modern English. In 1604, the first English dictionary was published, the *Table Alphabeticall*.

English has continuously adopted foreign words,

especially from Latin and Greek, since the Renaissance. (In the 17th century, Latin words were often used with the original inflections, but these eventually disappeared). As there are many words from different languages and English spelling is variable, the risk of mispronunciation is high, but remnants of the older forms remain in a few regional dialects, most notably in the West Country.

Modern English

In 1755, Samuel Johnson published the first significant English dictionary, his *Dictionary of the English Language*.

The main difference between Early Modern English and Late Modern English is vocabulary. Late Modern English has many more words, arising from two principal factors: firstly, the Industrial Revolution and technology created a need for new words; secondly, the British Empire at its height covered one quarter of the Earth's surface, and the English language adopted foreign words from many countries.

Historic English Text Samples

Old English

Beowulf lines 1 to 11, approximately AD 900

Which, as translated by Francis Gummere, reads:

Lo, praise of the prowess of people-kings
of spear-armed Danes, in days long sped,
we have heard, and what honor the athelings won!
Oft Scyld the Scefing from squadroned foes,
from many a tribe, the mead-bench tore,
awing the earls. Since erst he lay
friendless, a foundling, fate repaid him:
for he waxed under welkin, in wealth he throve,
till before him the folk, both far and near,
who house by the whale-path, heard his mandate,
gave him gifts: a good king he!

Here is a sample *prose* text, the beginning of *The Voyages of Ohthere and Wulfstan*. The full text can be found at [The Voyages of Ohthere and Wulfstan](#), at Wikisource.

King Alfred, that he of all Norsemen lived north-most. He quoth that he lived in the land northward along the North Sea. He said though that the land was very long from there, but it is all wasteland, except that in a few places here and there Finns [i.e. Sami] encamp, hunting in winter and in summer fishing by the sea. He said that at some time he wanted to find out how long the land lay northward or whether any man lived north of the wasteland. Then he traveled north by the land. All the way he kept the waste land on his starboard and the wide sea on his port three days. Then he was as far north as whale hunters furthest travel. Then he traveled still north as far as he might sail in another three days. Then the land bowed east (or the sea into the land — he did not know which). But he knew that he waited there for west winds (and somewhat north), and sailed east by the land so as he might sail in four days.

Then he had to wait for due-north winds, because the land bowed south (or the sea into the land — he did not know which). Then he sailed from there south by the land so as he might sail in five days. Then a large river lay there up into the land. Then they turned up into the river, because they dared not sail forth past the river for hostility, because the land was all settled on the other side of the river. He had not encountered earlier any settled land since he travelled from his own home, but all the way waste land was on his starboard (except fishers, fowlers and hunters, who were all Finns). And the wide sea was always on his port. The Bjarmians have cultivated their land very well, but they did not dare go in there. But the Terfinn's land was all waste except where hunters encamped, or fishers or fowlers.

Middle English

From *The Canterbury Tales* by Geoffrey Chaucer, 14th century:

Whan that Aprille with his shoures soote
 The droghte of March hath perced to the roote
 And bathed every veyne in swich licour,
 Of which vertu engendred is the flour;
 Whan Zephirus eek with his sweete breeth
 Inspired hath in every holt and heeth
 The tendre croppes, and the yonge sonne
 Hath in the Ram his halfe cours yronne,
 And smale foweles maken melodye,
 That slepen al the nyght with open yē
 (So priketh hem Nature in hir corages);
 Than longen folk to goon on pilgrimages

Early Modern English

Of man's first disobedience, and the fruit
 Of that forbidden tree, whose mortal taste
 Brought death into the world, and all our woe,
 With loss of Eden, till one greater Man
 Restore us, and regain the blissful seat,
 Sing, Heavenly Muse, that on the secret top
 Of Oreb, or of Sinai, didst inspire
 That shepherd, who first taught the chosen seed,
 In the beginning how the Heavens and Earth
 Rose out of chaos: or if Sion hill
 Delight thee more, and Siloa's brook that flowed
 Fast by the oracle of God, I thence
 Invoke thy aid to my adventurous song,
 That with no middle Flight intends to soar
 Above the Aonian mount, while it pursues
 Things unattempted yet in prose or rhyme.

Modern English

The evening arrived: the boys took their places; the master
 in his cook's uniform stationed himself at the copper; his
 pauper assistants ranged themselves behind him; the gruel
 was served out, and a long grace was said over the short

commons. The gruel disappeared, the boys whispered each other and winked at Oliver, while his next neighbours nudged him. Child as he was, he was desperate with hunger and reckless with misery. He rose from the table, and advancing, basin and spoon in hand, to the master, said, somewhat alarmed at his own temerity—

“Please, sir, I want some more.”

The master was a fat, healthy man, but he turned very pale. He gazed in stupefied astonishment on the small rebel for some seconds, and then clung for support to the copper. The assistants were paralysed with wonder, and the boys with fear.

“What!” said the master at length, in a faint voice.

“Please, sir,” replied Oliver, “I want some more.”

The master aimed a blow at Oliver’s head with the ladle, pinioned him in his arms, and shrieked aloud for the beadle.

BASIC ENGLISH

Basic English, also known as Simple English, is an English-based controlled language created (in essence as a simplified subset of English) by linguist and philosopher Charles Kay Ogden as an international auxiliary language, and as an aid for teaching English as a Second Language. It was presented in Ogden’s book *Basic English: A General Introduction with Rules and Grammar* (1930). Capitalised, *BASIC* is sometimes taken as an acronym that stands for *British American Scientific International Commercial*.

Ogden’s Basic, and the concept of a simplified English, gained its greatest publicity just after the Allied victory in the Second World War as a means for world peace. Although Basic English was not built into a program, similar simplifications have been devised for various international uses. Ogden’s associate I.A. Richards promoted its use in schools in China. More recently, it has influenced the creation of Voice of America’s Special English for news broadcasting,

and Simplified English, another English-based controlled language designed to write technical manuals.

What survives today of Ogden's Basic English is the basic 850-word list used as the beginner's vocabulary of the English language taught worldwide, especially in Asia.

Design Principles

Ogden tried to simplify English while keeping it normal for native speakers, by specifying grammar restrictions and a controlled small vocabulary which makes an extensive use of paraphrasing. Most notably, Ogden allowed only 18 verbs, which he called "operators". His *General Introduction* says "There are no 'verbs' in Basic English", with the underlying assumption that, as noun use in English is very straightforward but verb use/conjugation is not, the elimination of verbs would be a welcome simplification.

Word Lists

Ogden's word lists include only word *roots*, which in practice are extended with the defined set of affixes and the full set of forms allowed for any available word (noun, pronoun, or the limited set of verbs). The 850 core words of Basic English are found in Wiktionary's *Appendix: Basic English word list*. This core is theoretically enough for everyday life. However, Ogden prescribed that any student should learn an additional 150 word list for everyday work in some particular field, by adding a word list of 100 words particularly useful in a general field (e.g., science, verse, business, etc.), along with a 50-word list from a more specialised subset of that general field, to make a basic 1000 word vocabulary for everyday work and life.

Moreover, Ogden assumed that any student already should be familiar with (and thus may only review) a core subset of around 350 "international" words. Therefore, a first level student should graduate with a core vocabulary

of around 1350 words. A realistic general core vocabulary could contain 1500 words (the core 850 words, plus 350 international words, and 300 words for the general fields of trade, economics, and science). A sample 1500 word vocabulary is included in the Simple English Wikipedia.

Ogden provided lists to extend the general 1500 vocabulary to make a 2000 word list, enough for a “standard” English level. This 2000 word vocabulary represents “what any learner should know”. At this level students could start to move on their own.

Rules

The word use of Basic English is similar to full English, but the rules are much simpler, and there are fewer exceptions. Not all meanings of each word are allowed.

Ogden’s rules of grammar for Basic English help people use the 850 words to talk about things and events in a normal way.

1. Make plurals with an “S” on the end of the word. If there are special ways to make a plural word, such as “ES” and “IES”, use them.
2. There are two word endings to change each of the 150 adjectives: -”ER” and -”EST”
3. There are two word endings to change the verb word endings, -”ING” and -”ED”.
4. Make qualifiers from adverbs by adding -”LY”.
5. Talk about amounts with “MORE” and “MOST.” Use and know -”ER” and -”EST.”
6. Make opposite adjectives with “UN”-
7. Make questions with the opposite word order, and with “DO”.
8. Operators and pronouns conjugate as in normal English.

9. Make combined words (compounds) from two nouns (for example “milkman”) or a noun and a directive (sundown).
10. Measures, numbers, money, days, months, years, clock time, and international words are in English forms. E.g. Date/Time: 20 May 1972 at 21:00
11. Use the words of an industry or science. For example, in this grammar, some special words are for teaching languages, and not part of Basic English: plural, conjugate, noun, adjective, adverb, qualifier, operator, pronoun, and directive.

Criticism

Like all international auxiliary languages (or IALs), Basic English may be criticised as unavoidably based on personal preferences, and thus, paradoxically, inherently divisive. Moreover, like all natural language based IALs, Basic is subject to criticism as unfairly biased towards the native speaker community. As a teaching aid for English as a Second Language, Basic English has been criticised for the choice of the core vocabulary and for its grammatical constraints.

In 1944, readability expert Rudolf Flesch published an article in *Harpers*, “How Basic is Basic English?” in which he claimed, “It’s not basic, and it’s not English.” The basic complaint was that the vocabulary is too restricted, and, as a result, the text ends up being awkward and more difficult than necessary. He also notes that the words in the Basic vocabulary were arbitrarily selected, and there have been no empirical studies showing that it makes language simpler. For example, take this Basic English passage from the Simple Wikipedia Main Page:

“The Epping Ongar Railway is a preserved railway. It runs along the last section of the old Great Eastern Railway and

London Underground Central line branch line. The line runs between Epping and Ongar. There is also an intermediate stop at North Weald. The line was reopened in late 2004 after 10 years of being closed. It runs a Sunday and Bank Holiday service using a Class 117 diesel multiple unit. The service runs between Ongar and Coopersale. The service is provided by volunteers who take care for the line as well as run the trains. The land and infrastructure are owned by Epping Ongar Railway Ltd.

“The branch line to Ongar was built in 1865 by the Eastern Counties/Great Eastern Railway. The eastern section of the line, between Epping and Ongar, was single track. There was one passing loop at North Weald station. Around 14 trains went as far as Ongar station each day. The rest finished at Epping or Loughton. The trains continued to finish at Epping or Loughton until 1949. At this time the London Passenger Transport Board’s New Works project extended the Central line to Epping using electric trains. The Central Line would take over the railway from British Rail. As part of this change, the Epping-Ongar branch line had its through trains to London removed. Instead, a shuttle service between Epping (to connect with trains to London) and Ongar was used.”

The passage has a Flesch-Kincaid readability score of 6.8, but it is not well-written 6th-grade text. It is choppy and disjointed. It is repetitious, badly organized, and has too many passive constructions, lacks required connectives, and keeps changing the subject. Writing for a class of readers other than one’s own is very difficult to do and there are no simple one-size-fits all solutions like Basic English.

Literary References

In the novel *The Shape of Things to Come*, published in 1933, H.G. Wells depicted Basic English as the lingua franca of a new elite which after a prolonged struggle succeeds in uniting the world and establishing a totalitarian

world government. In the future world of Wells' vision, virtually all members of humanity know this language.

From 1942 to 1944 George Orwell was a proponent of Basic English, but in 1945 he became critical of universal languages. Basic English later inspired his use of Newspeak in *Nineteen Eighty-Four*.

In his story "Gulf", science fiction writer Robert A. Heinlein used a constructed language, in which every Basic English word is replaced with a single phoneme, as an appropriate means of communication for a race of genius supermen.

OLD ENGLISH

Old English is an early form of the English language that was spoken and written by the Anglo-Saxons and their descendants in parts of what are now England and southeastern Scotland between at least the mid-5th century and the mid-12th century. What survives through writing represents primarily the literary register of Anglo-Saxon.

It is a West Germanic language and is closely related to Old Frisian. Old English was fully inflected with five grammatical cases (nominative, accusative, genitive, dative, and instrumental, though the instrumental was very rare), which had dual forms for referring to groups of two objects (but only in the personal pronouns) in addition to the usual singular and plural forms. It also assigned gender to all nouns, including those that describe inanimate objects: for example, *sco sunne* (the Sun) was feminine, while *se môna* (the Moon) was masculine (cf. modern German *die Sonne* and *der Mond*). From the 9th century, Old English experienced heavy influence from Old Norse, a member of the related North Germanic group of languages.

History

Old English was not static, and its usage covered a period of approximately 700 years, from the Anglo-Saxon invasion of Britain in the 5th century to the late 11th century, some time after the Norman invasion.

Old English is a West Germanic language, developing out of common Ingvaemonic or “North-Sea Germanic” from the 5th century. Anglo-Saxon literacy develops after Christianisation in the late 7th century. The oldest surviving text of Old English literature is *Cædmon’s Hymn*, composed between 658 and 680. There is a limited corpus of runic inscriptions from the 5th to 7th centuries, but the oldest coherent runic texts (notably Franks Casket) date to the 8th century.

The history of Old English can be subdivided in:

Prehistoric Old English (c. 450 to 650); for this period, Old English is mostly a reconstructed language as no literary witnesses survive (with the exception of limited epigraphic evidence).

Early Old English (ca. 650 to 900), the period of the oldest manuscript traditions, with authors such as Cædmon, Bede, Cynewulf and Aldhelm.

Late Old English (c. 900 to 1066), the final stage of the language leading up to the Norman conquest of England and the subsequent transition to Early Middle English.

The Old English period is followed by Middle English (12th to 15th century), Early Modern English (ca. 1480 to 1650) and finally Modern English (after 1650).

Influence of Other Languages

In the course of the Early Middle Ages, Old English assimilated some aspects of a few languages with which it came in contact, such as the two dialects of Old Norse from

the contact with the Norsemen or “Danes” who by the late 9th century controlled large tracts of land in northern and eastern England which came to be known as the Danelaw.

Latin Influence

A large percentage of the educated and literate population of the time were competent in Latin, which was the scholarly and diplomatic *lingua franca* of Europe at the time. It is sometimes possible to give approximate dates for the entry of individual Latin words into Old English based on which patterns of linguistic change they have undergone. There were at least three notable periods of Latin influence. The first occurred before the ancestral Angles and Saxons left continental Europe for Britain. The second began when the Anglo-Saxons were converted to Christianity and Latin-speaking priests became widespread. See Latin influence in English: Dark Ages for details.

The third and largest single transfer of Latin-based words happened after the Norman Conquest of 1066, when an enormous number of Norman words began to influence the language. Most of these Old language words were themselves derived from Old French and ultimately from classical Latin, although a notable stock of Norse words were introduced or re-introduced in Norman form. The Norman Conquest approximately marks the end of Old English and the advent of Middle English.

One of the ways the influence of Latin can be seen is that many Latin words for activities came to also be used to refer to the people engaged in those activities, an idiom carried over from Anglo-Saxon but using Latin words. This can be seen in words like *militia*, *assembly*, *movement*, and *service*.

The language was further altered by the transition away from the runic alphabet (also known as *futhorc* or *futhorc*) to the Latin alphabet, which was also a significant factor in the developmental pressures brought to bear on the language. Old English words were spelled, more or less, as they were pronounced. Often, the Latin alphabet fell short of being able to adequately represent Anglo-Saxon phonetics. Spellings, therefore, can be thought of as best-attempt approximations of how the language actually sounded. The “silent” letters in many Modern English words were pronounced in Old English: for example, the *c* and *h* in *cniht*, the Old English ancestor of the modern *knight*, were pronounced. Another side-effect of spelling Old English words phonetically using the Latin alphabet was that spelling was extremely variable. A word’s spelling could also reflect differences in the phonetics of the writer’s regional dialect. Words also endured idiosyncratic spelling choices of individual authors, some of whom varied spellings between works. Thus, for example, the word *and* could be spelt either *and* or *ond*.

Norse Influence

The second major source of loanwords to Old English were the Scandinavian words introduced during the Viking invasions of the 9th and 10th centuries. In addition to a great many place names, these consist mainly of items of basic vocabulary, and words concerned with particular administrative aspects of the Danelaw (that is, the area of land under Viking control, which included extensive holdings all along the eastern coast of England and Scotland).

The Vikings spoke Old Norse, a language related to Old English in that both derived from the same ancestral Proto-Germanic language. It is very common for the intermixing of speakers of different dialects, such as those

that occur during times of political unrest, to result in a mixed language, and one theory holds that exactly such a mixture of Old Norse and Old English helped accelerate the decline of case endings in Old English.

Apparent confirmation of this is the fact that simplification of the case endings occurred earliest in the north and latest in the southwest, the area farthest away from Viking influence. Regardless of the truth of this theory, the influence of Old Norse on the English language has been profound: responsible for such basic vocabulary items as *sky*, *leg*, the pronoun *they*, the verb form *are*, and hundreds of other words.

Celtic Influence

Traditionally, many maintain that the influence of Celtic on English has been small, citing the small number of Celtic loanwords taken into the language. The number of Celtic loanwords is of a lower order than either Latin or Scandinavian. However, a minority view is that distinctive Celtic traits can be discerned in syntax from the post-Old English period. Why these traits appear to be restricted to syntax and do not include vocabulary is not clear.

Dialects

Old English should not be regarded as a single monolithic entity just as Modern English is also not monolithic. Within Old English, there was language variation. Thus it is misleading, for example, to consider Old English as having a single sound system. Rather, there were multiple Old English sound systems. Old English has variation along regional lines as well as variation across different times. For example, the language attested in Wessex during the time of Æthelwold of Winchester, which is named Late West Saxon (or Æthelwoldian Saxon), is considerably different from the language attested in Wessex during the

time of Alfred the Great's court, which is named Early West Saxon (or Classical West Saxon or Alfredian Saxon). Furthermore, the difference between Early West Saxon and Late West Saxon is of such a nature that Late West Saxon is not directly descended from Early West Saxon (despite what the similarity in name implies).

The four main dialectal forms of Old English were Mercian, Northumbrian, Kentish, and West Saxon. Each of those dialects was associated with an independent kingdom on the island. Of these, all of Northumbria and most of Mercia were overrun by the Vikings during the 9th century. The portion of Mercia and all of Kent that were successfully defended were then integrated into Wessex.

After the process of unification of the diverse Anglo-Saxon kingdoms in 878 by Alfred the Great, there is a marked decline in the importance of regional dialects. This is not because they stopped existing; regional dialects continued even after that time to this day, as evidenced both by the existence of Middle and Modern English dialects later on, and by common sense—people do not spontaneously adopt another dialect when there is a sudden change of political power.

However, the bulk of the surviving documents from the Anglo-Saxon period are written in the dialect of Wessex, Alfred's kingdom. It seems likely that with consolidation of power, it became necessary to standardize the language of government to reduce the difficulty of administering the more remote areas of the kingdom. As a result, documents were written in the West Saxon dialect. Not only this, but Alfred was passionate about the spread of the vernacular, and brought many scribes to his region from Mercia to record previously unwritten texts.

The Church was affected likewise, especially since Alfred

initiated an ambitious program to translate religious materials into English. To retain his patronage and ensure the widest circulation of the translated materials, the monks and priests engaged in the program worked in his dialect. Alfred himself seems to have translated books out of Latin and into English, notably Pope Gregory I's treatise on administration, *Pastoral Care*.

Because of the centralization of power and the Viking invasions, there is little or no written evidence for the development of non-Wessex dialects after Alfred's

Phonology

The inventory of classical Old English (i.e. Late West Saxon) surface phones, as usually reconstructed.

The sounds marked in parentheses in the chart above are allophones:

- [d'] is an allophone of /j/ occurring after /n/ and when geminated
- [K] is an allophone of /n/ occurring before /k/ and /a/
- [v, D, z] are allophones of /f, ʃ, s/ respectively, occurring between vowels or voiced consonants
- [c, x] are allophones of /h/ occurring in coda position after front and back vowels respectively
- [ç] is an allophone of /a/ occurring after a vowel, and, at an earlier stage of the language, in the syllable onset.

Grammar

Morphology

Unlike modern English, Old English is a language rich with morphological diversity. It maintains several distinct cases: the nominative, accusative, genitive, dative

and (vestigially) instrumental, remnants of which survive only in a few pronouns in modern English.

Syntax

Word Order

The word order of Old English is widely believed to be subject-verb-object (SVO) as in modern English and most Germanic languages. The word order of Old English, however, was not overly important because of the aforementioned morphology of the language. As long as declension was correct, it did not matter whether you said, "My name is..." as "Mîn nama is..." or "Nama mîn is..."

Questions: Because of its similarity with Old Norse, it is believed that most of the time the word order of Old English changed when asking a question, from SVO to VSO; i.e. swapping the verb and the subject. Therefore, since there are very few rules on syntax, Old English has a free word order.

"I am..." becomes "Am I..."

"Ic eom..." becomes "Eom ic..."

Orthography

Old English was first written in runes (*futhorc*) but shifted to a (minuscule) half-uncial script of the Latin alphabet introduced by Irish Christian missionaries from around the 9th century. This was replaced by insular script, a cursive and pointed version of the half-uncial script. This was used until the end of the 12th century when continental Carolingian minuscule (also known as *Caroline*) replaced the insular.

The letter Daet D (called *eth* or *edh* in modern English) was an alteration of Latin <d>, and the runic letters thorn p and wynn are borrowings from *futhorc*. Also used was a symbol for the conjunction *and*, a character similar to the

number seven (J, called a Tironian note), and a symbol for the relative pronoun *pæt*, a thorn with a crossbar through the ascender. Macrons over vowels were rarely used to indicate long vowels. Also used occasionally were abbreviations for following *m*'s or *n*'s. All of the sound descriptions below are given using IPA symbols.

Conventions of Modern Editions

A number of changes are traditionally made in published modern editions of the original Old English manuscripts. Some of these conventions include the introduction of punctuation and the substitutions of symbols. The symbols e, f, g, r, s are used in modern editions, although their shapes in the insular script are considerably different. The long s (ſ) is substituted by its modern counterpart s. Insular y is usually substituted with its modern counterpart g (which is ultimately a Carolingian symbol).

Additionally, modern manuscripts often distinguish between a velar and palatal <c> and <g> with diacritic dots above the putative palatals: <ç>, <ǰ>. The *wynn* symbol <ƿ> is usually substituted with <w>. Macrons are usually found in modern editions to indicate putative long vowels, while they are usually lacking in the originals. In older printed editions of Old English works, an acute accent mark was used to maintain cohesion between Old English and Old Norse printing.

Literature

Old English literature, though more abundant than literature of the continent before AD 1000, is nonetheless scant. In his supplementary article to the 1935 posthumous edition of Bright's *Anglo-Saxon Reader*, Dr. James Hulbert writes:

In such historical conditions, an incalculable amount of the writings of the Anglo-Saxon period perished. What

they contained, how important they were for an understanding of literature before the Conquest, we have no means of knowing: the scant catalogs of monastic libraries do not help us, and there are no references in extant works to other compositions....How incomplete our materials are can be illustrated by the well-known fact that, with few and relatively unimportant exceptions, all extant Anglo-Saxon poetry is preserved in four manuscripts.

Some of the most important surviving works of Old English literature are *Beowulf*, an epic poem; the *Anglo-Saxon Chronicle*, a record of early English history; the Franks Casket, an early whalebone artifact; and Caedmon's Hymn, a Christian religious poem. There are also a number of extant prose works, such as sermons and saints' lives, biblical translations, and translated Latin works of the early Church Fathers, legal documents, such as laws and wills, and practical works on grammar, medicine, and geography. Still, poetry is considered the heart of Old English literature. Nearly all Anglo-Saxon authors are anonymous, with a few exceptions, such as Bede and Caedmon.

MIDDLE ENGLISH

Middle English is the stage in the history of the English language during the High and Late Middle Ages, or roughly during the four centuries between the late 11th and the late 15th century.

Middle English develops out of Late Old English in Norman England (1066–1154) and is spoken throughout the Plantagenet era (1154–1485). The end of the Middle English period is set at about 1470, when the Chancery Standard, a form of London-based English, began to become widespread, a process aided by the introduction of the printing press to England by William Caxton in the late

1470s. By that time the variant of the Northumbrian dialect (prevalent in Northern England) spoken in southeast Scotland was developing into the Scots language. The language of England as used after 1470 and up to 1650 is known as Early Modern English.

Unlike Old English, which tended largely to adopt Late West Saxon scribal conventions in the period immediately before the Norman conquest of England, written Middle English displays a wide variety of scribal (and presumably dialectal) forms. This diversity suggests the gradual end of the role of Wessex as a focal point and trend-setter for writers and scribes, the emergence of more distinct local scribal styles and written dialects, and a general pattern of transition of activity over the centuries that followed, as Northumbria, East Anglia, and London successively emerged as major centres of literature, each with their own particular interests.

Middle English literature of the 12th and 13th century is comparatively rare, as written communication was usually in Anglo-Norman or in Latin. Middle English becomes much more important as a literary language during the 14th century, with poets such as Chaucer and Langland.

History

Important texts for the reconstruction of the evolution of Middle English out of Old English are the *Ormulum* (12th century), the *Ancrene Wisse* and the Katherine Group (early 13th century, see AB language) and *Ayenbite of Inwyrt* (ca. 1340).

The second half of the 11th century is the transitional period from Late Old English to Early Middle English. Early Middle English is the language of the 12th and 13th centuries. Middle English is fully developed as a literary language by the second half of the 14th century. Late

Middle English and the transition to Early Modern English takes place from the early 15th century and is taken to have been complete by the beginning of the Tudor period in 1485.

Transition from Old English

Norman in the Kingdom of England.

The transfer of power in 1066 resulted in only limited culture shock; however, the top levels of English-speaking political and ecclesiastical hierarchies were removed. Their replacements spoke Norman and used Latin for administrative purposes. Thus Norman came into use as a language of polite discourse and literature, and this fundamentally altered the role of Old English in education and administration, even though many Normans of the early period were illiterate and depended on the clergy for written communication and record-keeping. Although Old English was by no means as standardised as modern English, its written forms were less subject to broad dialect variations than was post-Conquest English. Even now, after nearly a thousand years, the Norman influence on the English language is still apparent, though it did not begin to affect Middle English until somewhat later.

Consider these pairs of Modern English words. The first of each pair is derived from Old English and the second is of Anglo-Norman origin: pig/pork, chicken/poultry, calf/veal, cow/beef, wood/forest, sheep/mutton, house/mansion, worthy/honourable, bold/courageous, freedom/liberty.

The role of Anglo-Norman as the language of government and law can be seen in the abundance of Modern English words for the mechanisms of government which derive from Anglo-Norman: *court, judge, jury, appeal, parliament*. Also prevalent in Modern English are terms relating to

the chivalric cultures which arose in the 12th century, an era of feudalism and crusading. Early on, this vocabulary of refined behaviour began to work its way into English: the word 'debonaire' appears in the 1137 Peterborough Chronicle; so too does 'castel' (castle) which appears in the above Biblical quotation, another import of the Normans, who made their mark on the English language as much as on the territory of England itself. This period of trilingual activity developed much of the flexible triplicate *synonymy* of modern English. For instance, English has three words meaning roughly "of or relating to a king":

- *kingly* from Old English,
- *royal* from French and
- *regal* from Latin.

Likewise, Norman and — later — French influences led to some interesting word pairs in English, such as the following, which both mean "someone who defends":

- *Warden* from Norman, and
- *Guardian* from French (itself of Germanic origin).

Old and Middle English

The end of Anglo-Saxon rule did not of course change the language immediately. Although the most senior offices in the church were filled by Normans, Old English would continue to be used in chronicles such as the Peterborough Chronicle until the middle of the 12th century. The non-literate would have spoken the same dialects as before the Conquest, although these would be changing slowly until written records of them became available for study, which varies in different regions. Once the writing of Old English comes to an end, Middle English has no standard language, only dialects which derive from the dialects of the same regions in the Anglo-Saxon period.

Early Middle English

Early Middle English (1100–1300) has a largely Anglo-Saxon vocabulary (with many Norse borrowings in the northern parts of the country), but a greatly simplified inflectional system. The grammatical relations that were expressed in Old English by the dative and locative cases are replaced in Early Middle English with constructions using prepositions. This replacement is incomplete. We still today have the Old English genitive “-es” in many words—we now call it the “possessive”: e.g., the form “dog’s” for the longer “of the dog”. But most of the other case endings disappear in the Early ME period, including most of the roughly one dozen forms of the definite article (“the”). The dual grammatical number (expressing exactly two persons performing a task) also disappears from English during the Early ME period (apart from personal pronouns), further simplifying the language.

Deeper changes occurred in the grammar. Bit by bit, the wealthy and the government anglicised again, although Norman (and subsequently French) remained the dominant language of literature and law for a few centuries, even after the loss of the majority of the continental possessions of the English monarchy. The new English language did not sound the same as the old; for, as well as undergoing changes in vocabulary, the complex system of inflected endings which Old English had was gradually lost or simplified in the dialects of spoken Middle English. This change was gradually reflected in its increasingly diverse written forms as well. The loss of case endings was part of a general trend from inflections to fixed word order that also occurred in other Germanic languages, and therefore cannot be attributed simply to the influence of French-speaking sections of the population: English did, after all, remain the language of the vast majority. It is also argued

that Norse immigrants to England had a great impact on the loss of inflectional endings due to their semi-mutually comprehensible (to the native English speakers) vocabulary, but lack of capability to reproduce their endings.

14th Century

In the later 14th century, Chancery Standard (or London English) — a phenomenon produced by the increase of bureaucracy in London, and the concomitant increase in London literary output — introduced a greater conformity in English spelling. Many loanwords of French origin entered Middle English during the 14th century, especially in learned fields (e.g. *theology, zodiac*) and poetry (*paramour, romance*), but also military terminology (e.g. *retreat, esquire*).

The fame of Middle English literature tends to derive principally from the later 14th century, with the works of Geoffrey Chaucer and of John Gower. The ruling class began to use Middle English increasingly around this time. The Parliament of England used English from about the 1360s, and the king's court used mainly English from the time of King Henry V (who acceded in 1413). The oldest surviving correspondence in English, by Sir John Hawkwood, dates from the 1390s.

By the end of the 14th century, with some standardisation of the language, English began to exhibit the more recognisable forms of grammar and syntax that would form the basis of future standard dialects. English had become standard for oral argument (replacing Law French, from Anglo-Norman) 50 years earlier, in the Pleading in English Act 1362, but Latin continued in written legal use for another 300 years, until the Proceedings in Courts of Justice Act 1730.

Late Middle English

The Late Middle English period was a time of upheaval

in England. After the deposition of Richard II of England in 1399, the House of Plantagenet split into the House of Lancaster and the House of York, whose antagonism culminated in the Wars of the Roses (1455–1487). Stability came only gradually with the Tudor dynasty under Henry VII.

During this period, societal change, men coming into positions of power, some of them from other parts of the country or from lower levels in society, resulted also in linguistic change. Towards the end of the 15th century a more modern English was starting to emerge. Printing began in England in the 1470s, which tended to stabilise the language. With a standardised, printed English Bible and Prayer Book being read to church congregations from the 1540s onward, a wider public became familiar with a standard language, and the era of Modern English was under way.

Chancery Standard

Chancery Standard was a written form of English used by government bureaucracy and for other official purposes during the 15th century. It is transitional between Late Middle English and Early Modern English.

The Chancery Standard was developed during the reign of King Henry V (1413 to 1422) in response to his order for his chancery (government officials) to use, like himself, English rather than Anglo-Norman or Latin. It had become broadly standardised by about the 1430s, and it served as a widely intelligible form of English for the first English printers, from the 1470s onwards. As a result, it has contributed significantly to the form of Standard English as it developed during the Elizabethan Era, and by extension to the Standard English of today.

Chancery Standard was largely based on the London

and East Midland dialects, for those areas were the political and demographic centres of gravity. However, it used other dialect forms where they made meanings clearer; for example, the northern “they”, “their” and “them” (derived from Scandinavian forms) were used rather than the London “hi/they”, “hir” and “hem.” This was perhaps because the London forms could be confused with words such as he, her, and him. (However, the colloquial form written as “em”, as in “up and at ‘em”, may well represent a spoken survival of “hem” rather than a shortening of the Norse-derived “them”.)

In its early stages of development, the clerks who used Chancery Standard would have been familiar with French and Latin. The strict grammars of those languages influenced the construction of the standard. It was not the only influence on later forms of English — its level of influence is disputed and a variety of spoken dialects continued to exist — but it provided a core around which Early Modern English could crystallise.

By the mid-15th century, Chancery Standard was used for most official purposes except by the Church (which used Latin) and for some legal purposes (for which Law French and some Latin were used). It was disseminated around England by bureaucrats on official business, and slowly gained prestige.

Construction

With its simplified case-ending system, the grammar of Middle English is much closer to that of modern English than that of Old English. Compared to other Germanic languages, it is probably most similar to that of modern West Frisian, a language related to Dutch.

Nouns

Main article: Middle English declension

Middle English retains only two distinct noun-ending patterns from the more complex system of inflection in Old English. The early Modern English words *engel* (angel) and *name* (name) demonstrate the two patterns:

	<i>strong</i>		<i>weak</i>	
	<i>singular</i>	<i>plural</i>	<i>singular</i>	<i>plural</i>
nom/acc	engel	engles	name	namen
gen	engles	engle(ne)	name	namen
dat	engle	engle(s)	name	namen

The strong *-(e)s* plural form has survived into Modern English. The weak *-(e)n* form is now rare in the standard language, used only in *oxen*, *children*, *brethren*; and it is slightly less rare in some dialects, used in *eyen* for *eyes*, *shoon* for *shoes*, *hosen* for *hose(s)* and *kine* for *cows*.

Verbs

As a general rule (and all these rules are general), the first person singular of verbs in the present tense ends in *-e* (“*ich here*” - “*I hear*”), the second person in *-(e)st* (“*pou spekest*” - “*thou speakest*”), and the third person in *-ep* (“*he comeþ*” - “*he cometh/he comes*”). (*p* is pronounced like the unvoiced *th* in “*think*”).

In the past tense, weak verbs are formed by adding an *-ed(e)*, *-d(e)* or *-t(e)* ending. These, without their personal endings, also form past participles, together with past-participle prefixes derived from Old English: *i-*, *y-* and sometimes *bi-*.

Strong verbs, by contrast, form their past tense by changing their stem vowel (e.g. *binden* -> *bound*), as in Modern English.

Pronouns

Post-Conquest English inherits its pronouns from Old

English, with the exception of the third person plural, a borrowing from Old Norse (the original Old English form clashed with the third person singular and was eventually dropped):

Personal Pronouns in Middle English

	<i>Singular</i>			<i>Plural</i>			
	<i>Subject</i>	<i>Object</i>	<i>Possessive</i>	<i>Subject</i>	<i>Object</i>	<i>Possessive</i>	
First	I	me	mi(n)	we	us	oure	
Second	pou/thou	pee/thee	py/thy	ye	you	your	
	Impersonal	hit	it/him	his			
Third	Masculine	he	him	his	he	hem	hir
	Feminine	sche	hire	hir	pay/ they	pem/ them	peir/ their

Here are the Old English pronouns. Most Middle English pronouns derived from these, but some came from Old Norse.

The first and second person pronouns in Old English survived into Middle English largely unchanged, with only minor spelling variations. In the fourth person, the masculine vocative singular became 'him'. The neuter form was replaced by a form of the demonstrative that developed into 'sche', but unsteadily—'heyr' remained in some areas for a long time. The lack of a strong standard written form between the thirteenth and the fifteenth century makes these changes hard to map.

The overall trend was the gradual reduction in the number of different case endings: the locative case disappeared, but the six other cases were partly retained in personal pronouns, as in *he*, *him*, *his*.

Orthography

Pronunciation

Generally, all letters in Middle English words were

pronounced. (Silent letters in Modern English come from pronunciation shifts, which means that pronunciation is no longer closely reflected by the written form because of fixed spelling constraints imposed by the invention of dictionaries and printing.) Therefore 'knight' was pronounced [Eknict] (with a pronounced <k> and the <gh> as the <ch> in German 'Knecht'), not [Enajt] as in Modern English.

In earlier Middle English all written vowels were pronounced. By Chaucer's time, however, the final <e> had become silent in normal speech, but could optionally be pronounced in verse as the meter required (but was normally silent when the next word began with a vowel). Chaucer followed these conventions: -e is silent in 'kowthe' and 'Thanne', but is pronounced in 'straunge', 'ferne', 'ende', etc. (Presumably, the final <y> is partly or completely dropped in 'Caunterbury', so as to make the meter flow.)

An additional rule in speech, and often in poetry as well, was that a non-final unstressed <e> was dropped when adjacent to only a single consonant on either side if there was another short 'e' in an adjoining syllable. Thus, 'every' sounds like "evry" and 'palmeres' like "palmers".

Sample Texts

Ormulum, 12th Century

This passage explains the background to the Nativity:

*Forrprihht anan se time comm patt ure Drihhtin wolldeben
borenn i piss middellærd forr all mankinne nedehe chæs
himm sone kinnessmenn all swillke summ he wollde& whær
he wollde borenn ben he chæs all att hiss wille. As soon as
the time camethat our Lord wantedto be born in this middle-
earthfor the sake of all mankind,at once he chose kinsmen
for himself,all just as he wanted,and he decided that he
would be bornexactly where he wished. (3494–501)*

Wycliffe's Bible, 1384

And it is don, aftirward Jesus made iourne bi cites & castelis prechende & euangelisende pe rewme of god, & twelue wip hym & summe wymmen pat weren helid of wicke spiritis & sicnesses, marie pat is clepid maudeleyn, of whom seune deuelis wenten out & Jone pe wif off chusi procuratour of eroude, & susanne & manye opere pat mynystreden to hym of her facultes

—*Luke ch.8, v.1-3*

And it came to pass afterward, that he went throughout every city and village, preaching and showing the glad tidings of the kingdom of God: and the twelve were with him, and certain women, which had been healed of evil spirits and infirmities, Mary called Magdalene, out of whom went seven devils, and Joanna the wife of Chuza Herod's steward, and Susanna, and many others, which ministered unto him of their substance.

—*Translation of Luke ch.8 v.1-3,*

Chaucer, 1390s

The following is the beginning of the general Prologue from *The Canterbury Tales* by Geoffrey Chaucer. The text was written in a dialect associated with London and spellings associated with the then emergent chancery standard.

Original in Middle English

Whan that Aprill, with his shoures
soote The droghte of March hath perced
to the roote And bathed every veyne in
swich licour, Of which vertu engendred
is the flour; Whan Zephirus eek with
his sweete breeth Inspired hath in
every holt and heeth The tendre crop-
pes, and the yonge sonne Hath in the

*Translation into Modern English:
(by Nevill Coghill)*

When in April the sweet showers fall
And pierce the drought of March to
the
root, and all The veins are bathed in
liquor of such power As brings about
the engendering of the flower, When
also Zephyrus with his sweet breath
Exhales an air in every grove and
heath
Upon the tender shoots, and the young

Ram his halfe cours yronne, And smale foweles maken melodye, That slepen al the nyght with open ye (So priketh hem Nature in hir corages); Thanne longen folk to goon on pilgrimages And palmeres for to seken straunge strondes To ferne halwes, kowthe in sondry londes; And specially from every shires ende Of Engelond, to Caunterbury they wende, The hooly blisful martir for to seke That hem hath holpen, whan that they were seeke.	sun His half course in the sign of the <i>Ram</i> has run And the small fowl are making melody That sleep away the night with open eye, (So nature pricks them and their heart engages) Then folk long to go on pilgrimages, And palmeres long to seek the stranger strands Of far off saints, hallowed in sundry lands, And specially from every shires' end Of England, down to Canterbury they wend The holy blissful martyr, quick To give his help to them when they were sick
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EARLY MODERN ENGLISH

Early Modern English is the stage of the English language used from about the end of the Middle English period (the latter half of the 15th century) to 1650. Thus, the first edition of the King James Bible and the works of William Shakespeare both belong to the late phase of Early Modern English. Prior to and following the accession of James I to the English throne in 1603 the emerging English standard began to influence the spoken and written Middle Scots of Scotland. Current readers of English are generally able to understand Early Modern English, though occasionally with difficulties arising from grammar changes, changes in the meanings of some words, and spelling differences.

The standardisation of English spelling falls within the Early Modern English period and is influenced by conventions predating the Great Vowel Shift, which is the reason for much of the non-phonetic spelling of contemporary Modern English.

Pronouns

In Early Modern English, there were two second-person personal pronouns: *thou*, the informal singular pronoun, and *ye*, which was both the plural pronoun and the formal singular pronoun. (This usage is analogous to the modern French *tu* and *vous* and modern southern German *du* and *Ihr*). *Thou* was already falling out of use in the Early Modern English period, but remained customary for addressing God and certain other solemn occasions, and sometimes for addressing inferiors.

Like other personal pronouns, *thou* and *ye* had different forms depending on their grammatical case; specifically, the objective form of *thou* was *thee*, its possessive forms were *thy* and *thine*, and its reflexive or emphatic form was *thysel*; while the objective form of *ye* was *you*, its possessive forms were *your* and *yours*, and its reflexive or emphatic forms were *yourself* and *yourselves*. In other respects, the pronouns were much the same as today.

One difference is that *my* and *thy* became *mine* and *thine* before words beginning with a vowel or the letter *h* (or, more accurately, the older forms “mine” and “thine” had become “my” and “thy” before words beginning with a consonant other than “h,” while “mine” and “thine” were retained before words beginning with a vowel or “h”); thus, *mine eyes*, *thine hand*, and so on.

Orthographic Conventions

The orthography of Early Modern English was fairly similar to that of today, but spelling was unphonetic and unstable. For example, the word *acuity* could be spelled either <acuity> or <acuitie>. Furthermore, there were a number of features of spelling that have not been retained:

- The letter <S> had two distinct lowercase forms: <s> (*short s*) as used today, and <n> (*long s*). The

short s was used at the end of a word, and the long s everywhere else, except that the double lowercase S was variously written <nn> or <ns>. This is similar to the alternation between medial (o) and final lower case sigma (ð) in Greek.

- <u> and <v> were not yet considered two distinct letters, but different forms of the same letter. Typographically, <v> was used at the start of a word and <u> elsewhere; hence *unmoued* (for modern *unmoved*) and *loue* (for *love*).
- <i> and <j> were also not yet considered two distinct letters, but different forms of the same letter, hence “ioy” for “joy” and “iust” for “just”.
- The letter <p> (thorn) was still in use during the Early Modern English period, though increasingly limited to hand-written texts. In print, <p> was often represented by <Y>.
- A silent <e> was often appended to words. The last consonant was sometimes doubled when this <e> was appended; hence *npeake*, *cowarde*, *manne* (for *man*), *runne* (for *run*).
- The sound /œ/ was often written <o> (as in *son*); hence *nommer*, *plombe* (for modern *summer*, *plumb*).

Nothing was standard, however. For example, “Julius Caesar” could be spelled “Julius Cænar”, “Ivlivs Cænar”, “Jvlivs Cænar”, or “Iulius Cænar” and the word “he” could be spelled “he” or “hee” in the same sentence, as it is found in Shakespeare’s plays.

Verbs

Marking Tense and Number

During the Early Modern period, English verb inflections became simplified as they evolved towards their modern forms:

- The third person singular present lost its alternate inflections; ‘-(e)th’ became obsolete while *-s* survived. (The alternate forms’ coexistence can be seen in Shakespeare’s phrase, “With her, that *hateth* thee and *hates* vs all”).
- The plural present form became uninflected. Present plurals had been marked with *-en*, *-th*, or *-s* (*-th* and *-s* survived the longest, especially with the plural use of *is*, *hath*, and *doth*). Marked present plurals were rare throughout the Early Modern period, though, and *-en* was probably only used as a stylistic affectation to indicate rural or old-fashioned speech.
- The second person singular was marked in both the present and past tenses with *-st* or *-est* (for example, in the past tense, *walkedst* or *gav’st*). Since the indicative past was not (and is not) otherwise marked for person or number, the loss of *thou* made the past subjunctive indistinguishable from the indicative past for all verbs except *to be*.

Modal Auxiliaries

The modal auxiliaries cemented their distinctive syntactical characteristics during the Early Modern period. Thus, modals’ use without an infinitive became rare (as in “I must to Coventry”; “I’ll none of that”). Use of modals’ present participles to indicate aspect (from 1556: “Maeyinge suffer no more the loue & deathe of Aurelio”), and of their preterite forms to indicate tense (“He follow’d Horace so very close, that of necessity he must fall with him”) also became uncommon.

Some verbs ceased to function as modals during the Early Modern period. The present form of *must*, *mot*, became obsolete. *Dare* also lost the syntactical characteristics of a

modal auxiliary, evolving a new past form (*dared*) distinct from the modal *durst*.

Perfect and Progressive Forms

The perfect of the verbs had not yet been standardized to use uniformly the auxiliary verb “to have”. Some took as their auxiliary verb “to be”, as in this example from the King James Bible, “But which of you ... will say unto him ... when he is come from the field, Go and sit down...” [Luke XVII:7]. The rules that determined which verbs took which auxiliaries were similar to those still observed in German and French.

The modern syntax used for the progressive aspect (“I am walking”) became dominant by the end of the Early Modern period, but other forms were also common. These included the prefix a- (“I am a-walking”) and the infinitive paired with “do” (“I do walk”). Moreover, the *to be* + *-ing verb* form could be used to express a passive meaning without any additional markers: “The house is building” could mean “The house is being built.”

Vocabulary

Although the language is otherwise very similar to that current, there have in time developed a few “false friends” within the English language itself, rendering difficulty in understanding even the still-prestigious phrasing of the King James Bible. An example is the passage, “Suffer the little children”; meaning, “Permit ...” (this usage of the word “suffer” is still found in some dialects in formal circumstances; it is also the source of the words “sufferance” and “suffrage”).

Development from Middle English

The change from Middle English to Early Modern English was not just a matter of vocabulary or pronunciation

changing: it was the beginning of a new era in the history of English.

An era of linguistic change in a language with large variations in dialect was replaced by a new era of a more standardized language with a richer lexicon and an established (and lasting) literature. Shakespeare's plays are familiar and comprehensible today, 400 years after they were written, but the works of Geoffrey Chaucer and William Langland, written only 200 years earlier, are considerably more difficult for the average reader.

Timeline

- 1476 – William Caxton starts printing in Westminster; however, the language he uses reflects the variety of styles and dialects used by the authors who work the prints.
- 1485 – Tudor dynasty established; start of period of (relative) political and social stability. Caxton publishes Thomas Malory's *Le Morte d'Arthur*, the first print bestseller in English. Malory's language, while archaic in some respects, is clearly Early Modern, possibly a Yorkshire or Midlands dialect.
- 1491 or 1492 – Richard Pynson starts printing in London; his style tends to prefer Chancery Standard, the form of English used by government.
- c. 1509 – Pynson becomes the king's official printer.
- From 1525 – Publication of William Tyndale's Bible translation (which was initially banned).
- 1539 – Publication of the *Great Bible*, the first officially authorised Bible in English, edited by Myles Coverdale, largely from the work of Tyndale. This Bible is read to congregations regularly in churches, familiarising much of the population of England with a standard form of the language.

- 1549 – Publication of the first *Book of Common Prayer* in English under the supervision of Thomas Cranmer. This book standardises much of the wording of church services. Some have argued that, since attendance at prayer book services was required by law for many years, the repetitive use of the language of the prayer book helped to standardize modern English.
- 1557 – Publication of *Tottel's Miscellany*.
- c. 1590 to c. 1612 – William Shakespeare's plays written; they are still widely read and familiar in the 21st century.
- 1607 - The first successful permanent English colony in the New World, Jamestown, is established in Virginia. The beginnings of American English.
- 1611 – The *King James Bible* is published, largely based on Tyndale's translation. It remains the standard Bible in the Church of England for many years.
- c. 1640–1660 – Period of social upheaval in England (the English Civil War and the era of Oliver Cromwell).
- 1651 – Publication of *Leviathan* by Thomas Hobbes.
- 1662 – New edition of the *Book of Common Prayer*, largely based on the 1549 and subsequent editions. This also long remains a standard work in English.
- 1667 – Publication of *Paradise Lost* by John Milton.

Development to Modern English

The 17th century port towns (and their forms of speech) would have gained in influence over the old county towns. England experienced a new period of internal peace and relative stability, encouraging the arts including literature, from around the 1690s onwards. Another important episode

in the development of the English language started around 1607: the English settlement of America. By 1750 a distinct American dialect of English had developed.

There are still elements of Early Modern English in some dialects. For example, *thee* and *thou* can still be heard in the Black Country, some parts of Yorkshire and Dawley, Telford. The pronunciation of *book*, *cook*, *look*, etc. with a long [u:] can be heard in some areas of the North and the West Country. However, these are becoming less frequent with each generation.

MODERN ENGLISH

Modern English is the form of the English language spoken since the Great Vowel Shift in England, completed in roughly 1550.

Despite some differences in vocabulary, texts from the early 17th century, such as the works of William Shakespeare and the King James Bible, are considered to be in Modern English, or more specifically, are referred to as using Early Modern English or Elizabethan English. English was adopted in regions around the world, such as North America, India, Africa, Australia and New Zealand through colonisation by the British Empire.

Modern English has a large number of dialects spoken in diverse countries throughout the world. This includes American English, Australian English, British English, Canadian English, Caribbean English, Hiberno-English, Indo-Pakistani English, Nigerian English, New Zealand English, Philippine English, Singaporean English, and South African English.

According to the Ethnologue, there are over 1 billion speakers of English as a first or second language as of 1999. English is spoken in a vast number of territories

including the United Kingdom, Ireland, Canada, the United States of America, Australia, New Zealand, India, Pakistan, Singapore and Southern Africa. Its large number of speakers, plus its worldwide presence, have made English a common language for use in such diverse applications as controlling aircraft, developing software, conducting international diplomacy, and business relations.

Influences

Early Modern English lacked uniformity in spelling, but Samuel Johnson's dictionary, published in 1755 in England, was influential in establishing a standard form of spelling. Noah Webster did the same in America, publishing his dictionary in 1828; see American and British English spelling differences.

Public education increased literacy, and more people had access to books (and therefore to a standard language) with the spread of public libraries in the 19th century. Many words entered English from other languages as a result of contact with other cultures through trade and settlement and from the migration of large numbers of people to the United States from other countries. World War I and World War II threw together people from different backgrounds, and the greater social mobility afterwards helped to lessen the differences between social accents, at least in the UK. The development of radio broadcasting in the early 20th century familiarised the population with accents and vocabulary from outside their own localities, often for the first time, and this phenomenon continued with film and television.

Outline of Changes

The following is an outline of the major changes in Modern English compared to its previous form (Middle

English). Note, however, that these are generalizations, and some of these may not be true for specific dialects:

Syntax

- disuse of the T-V distinction (thou, ye).
- use of auxiliary verbs becomes mandatory in interrogative sentences.
- rise and fall of prescriptive grammarians.

Alphabet

Changes in alphabet and spelling were heavily influenced by the advent of printing and continental printing practices.

- The letter thorn (*þ*), which was already being replaced by *th* in Middle English, finally fell into disuse. The last vestige of the letter was writing *the* as *þe*, which was still seen occasionally in the King James Bible of 1611.
- The letters *i* and *j*, previously written as a single letter, began to be distinguished; likewise for *u* and *v*. This was a common development of the Latin alphabet during this period.

Consequently, Modern English came to use a purely Latin alphabet of 26 letters.

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2

Introduction to Computer-Assisted Language Learning and E-Learning

COMPUTER-ASSISTED LANGUAGE LEARNING

Computer-assisted language learning (CALL) is succinctly defined in a seminal work by Levy (1997: p. 1) as “the search for and study of applications of the computer in language teaching and learning”. CALL embraces a wide range of ICT applications and approaches to teaching and learning foreign languages, from the “traditional” drill-and-practice programs that characterised CALL in the 1960s and 1970s to more recent manifestations of CALL, e.g. as used in a virtual learning environment and Web-based distance learning. It also extends to the use of corpora and concordancers, interactive whiteboards, Computer-mediated communication (CMC), language learning in virtual worlds and Mobile-assisted language learning (MALL).

The term CALI (Computer-assisted language instruction) was in use before CALL, reflecting its origins as a subset of the general term CAI (Computer-assisted instruction). CALI fell out of favour among language teachers, however, as it appeared to imply a teacher-centred approach (instructional), whereas language teachers are

more inclined to prefer a student-centred approach, focusing on learning rather than instruction. CALL began to replace CALI in the early 1980s (Davies & Higgins 1982: p. 3) and it is now incorporated into the names of the growing number of professional associations worldwide. An alternative term, Technology-enhanced language learning (TELL), also emerged around the early 1990s: e.g. the TELL Consortium project, University of Hull. The current philosophy of CALL puts a strong emphasis on student-centred materials that allow learners to work on their own.

Such materials may be structured or unstructured, but they normally embody two important features: interactive learning and individualised learning. CALL is essentially a tool that helps teachers to facilitate the language learning process. It can be used to reinforce what has been already been learned in the classroom or as a remedial tool to help learners who require additional support. The design of CALL materials generally takes into consideration principles of language pedagogy and methodology, which may be derived from different learning theories (e.g. behaviourist, cognitive, constructivist) and second language learning theories such as Stephen Krashen's monitor hypothesis.

History

CALL dates back to the 1960s, when it was first introduced on university mainframe computers. The PLATO project, initiated at the University of Illinois in 1960, is an important landmark in the early development of CALL (Marty 1981). The advent of the microcomputer in the late 1970s brought computing within the range of a wider audience, resulting in a boom in the development of CALL programs and a flurry of publications of books on CALL in the early 1980s. There have been several attempts to document the history of CALL.

Sanders (1995) covers the period from the mid-1960s to the mid-1990s, focusing on CALL in North America. Delcloque (2000) documents the history of CALL worldwide, from its beginnings in the 1960s to the dawning of the new millennium. Davies (2005) takes a look back at CALL's past and attempts to predict where it is going. Hubbard (2009) offers a compilation of 74 key articles and book excerpts, originally published in the years 1988-2007, that give a comprehensive overview of the wide range of leading ideas and research results that have exerted an influence on the development of CALL or that show promise in doing so in the future. A published review of Hubbard's collection can be found in *Language Learning & Technology* 14, 3 (2010).

Butler-Pascoe (2011) looks at the history of CALL from a different point of view, namely the evolution of CALL in the dual fields of educational technology and second/foreign language acquisition and the paradigm shifts experienced along the way.

Typology and Phases

During the 1980s and 1990s several attempts were made to establish a CALL typology. A wide range of different types of CALL programs was identified by Davies & Higgins (1985), Jones & Fortescue (1987), Hardisty & Windeatt (1989) and Levy (1997: pp. 118ff.). These included gap-filling and Cloze programs, multiple-choice programs, free-format (text-entry) programs, adventures and simulations, action mazes, sentence-reordering programs, exploratory programs - and "total Cloze", a type of program in which the learner has to reconstruct a whole text. Most of these early programs still exist in modernised versions.

Since the 1990s it has become increasingly difficult to categorise CALL as it now extends to the use of blogs,

wikis, social networking, podcasting, Web 2.0 applications, language learning in virtual worlds and interactive whiteboards (Davies et al. 2010: Section 3.7).

Warschauer (1996) and Warschauer & Healey (1998) took a different approach. Rather than focusing on the typology of CALL, they identified three historical phases of CALL, classified according to their underlying pedagogical and methodological approaches:

- Behavioristic CALL: conceived in the 1950s and implemented in the 1960s and 1970s.
- Communicative CALL: 1970s to 1980s.
- Integrative CALL: embracing Multimedia and the Internet: 1990s.

Most CALL programs in Warschauer & Healey's first phase, Behavioristic CALL (1960s to 1970s), consisted of drill-and-practice materials in which the computer presented a stimulus and the learner provided a response. At first, both could be done only through text. The computer would analyse students' input and give feedback, and more sophisticated programs would react to students' mistakes by branching to help screens and remedial activities. While such programs and their underlying pedagogy still exist today, behavioristic approaches to language learning have been rejected by most language teachers, and the increasing sophistication of computer technology has led CALL to other possibilities.

The second phase described by Warschauer & Healey, Communicative CALL, is based on the communicative approach that became prominent in the late 1970s and 1980s (Underwood 1984). In the communicative approach the focus is on using the language rather than analysis of the language, and grammar is taught implicitly rather than explicitly. It also allows for originality and flexibility

in student output of language. The communicative approach coincided with the arrival of the PC, which made computing much more widely available and resulted in a boom in the development of software for language learning. The first CALL software in this phase continued to provide skill practice but not in a drill format, for example: paced reading, text reconstruction and language games, but the computer remained the tutor. In this phase computers provided context for students to use the language, such as asking for directions to a place, and programs not designed for language learning such as *Sim City*, *Sleuth* and *Where in the World is Carmen Sandiego?* were used for language learning. Criticisms of this approach include using the computer in an ad hoc and disconnected manner for more marginal aims rather than the central aims of language teaching.

The third phase of CALL described by Warschauer & Healey, Integrative CALL, starting from the 1990s, tried to address criticisms of the communicative approach by integrating the teaching of language skills into tasks or projects to provide direction and coherence. It also coincided with the development of multimedia technology (providing text, graphics, sound and animation) as well as Computer-mediated communication (CMC). CALL in this period saw a definitive shift of the use of the computer for drill and tutorial purposes (the computer as a finite, authoritative base for a specific task) to a medium for extending education beyond the classroom. Multimedia CALL started with interactive laser videodiscs such as *Montevidisco* (Schneider & Bennion 1984) and *A la rencontre de Philippe* (Fuerstenberg 1993), both of which were simulations of situations where the learner played a key role. These programs later were transferred to CD-ROMs, and new role-playing games (RPGs) such as *Who is Oscar Lake?* made their appearance in a range of different languages.

In a later publication Warschauer changed the name of the first phase of CALL from Behavioristic CALL to Structural CALL and also revised the dates of the three phases (Warschauer 2000):

- Structural CALL: 1970s to 1980s.
- Communicative CALL: 1980s to 1990s.
- Integrative CALL: 2000 onwards.

Bax (2003) took issue with Warschauer & Healey (1998) and Warschauer (2000) and proposed these three phases:

- Restricted CALL - mainly behaviouristic: 1960s to 1980s.
- Open CALL - i.e. open in terms of feedback given to students, software types and the role of the teacher, and including simulations and games: 1980s to 2003 (i.e. the date of Bax's article).
- Integrated CALL - still to be achieved. Bax argued that at the time of writing language teachers were still in the Open CALL phase as true integration could only be said to have been achieved when using CALL had reached a state of "normalisation" – e.g. when it was as normal as using a pen.

Software Design and Pedagogy

Above all, careful consideration must be given to pedagogy in designing CALL software, but publishers of CALL software tend to follow the latest trend, regardless of its desirability. Moreover, approaches to teaching foreign languages are constantly changing, dating back to grammar-translation, through the direct method, audio-lingualism and a variety of other approaches, to the more recent communicative approach and constructivism (Decoo 2001).

Designing and creating CALL software is an extremely demanding task, calling upon a range of skills. Major CALL

development projects are usually managed by a team of people:

- A subject specialist (also known as a content provider) - usually a language teacher - who is responsible for providing the content and pedagogical input. More than one subject specialist is required for larger CALL projects.
- A programmer who is familiar with the chosen programming language or authoring tool.
- A graphic designer, to produce pictures and icons, and to advise on fonts, colour, screen layout, etc.
- A professional photographer or, at the very least, a very good amateur photographer. Graphic designers often have a background in photography too.
- A sound engineer and a video technician will be required if the package is to contain substantial amounts of sound and video.
- An instructional designer. Developing a CALL package is more than just putting a text book into a computer. An instructional designer will probably have a background in cognitive psychology and media technology, and will be able to advise the subject specialists in the team on the appropriate use of the chosen technology (Gimeno & Davies 2010).

It is all too easy when designing CALL software to take the comfortable route and produce a set of multiple-choice and gap-filling exercises, using a simple authoring tool (Bangs 2011), but CALL is much more than this; Stepp-Greany (2002), for example, describes the creation and management of an environment incorporating a constructivist and whole language philosophy. According to constructivist theory, learners are active participants

in tasks in which they “construct” new knowledge derived from their prior experience. Learners also assume responsibility for their learning, and the teacher is a facilitator rather than a purveyor of knowledge. Whole language theory embraces constructivism and postulates that language learning moves from the whole to the part, rather than building sub-skills to lead towards the higher abilities of comprehension, speaking and writing. It also emphasises that comprehending, speaking, reading, and writing skills are interrelated, reinforcing each other in complex ways. Language acquisition is, therefore, an active process in which the learner focuses on cues and meaning and makes intelligent guesses. Additional demands are placed upon teachers working in a technological environment incorporating constructivist and whole language theories. The development of teachers’ professional skills must include new pedagogical as well as technical and management skills. Regarding the issue of teacher facilitation in such an environment, the teacher has a key role to play, but there could be a conflict between the aim to create an atmosphere for learner independence and the teacher’s natural feelings of responsibility. In order to avoid learners’ negative perceptions, Stepp-Greany points out that it is especially important for the teacher to continue to address their needs, especially those of low-ability learners.

Multimedia

Language teachers have been avid users of technology for a very long time. Gramophone records were among the first technological aids to be used by language teachers in order to present students with recordings of native speakers’ voices, and broadcasts from foreign radio stations were used to make recordings on reel-to-reel tape recorders. Other examples of technological aids that have been used in the foreign language classroom include slide projectors,

film-strip projectors, film projectors, videocassette recorders and DVD players. In the early 1960s, integrated courses (which were often described as multimedia courses) began to appear. Examples of such courses are *Ecouter et Parler* (consisting of a coursebook and tape recordings) and *Deutsch durch die audiovisuelle Methode* (consisting of an illustrated coursebook, tape recordings and a film-strip - based on the Structuro-Global Audio-Visual method).

During the 1970s and 1980s standard microcomputers were incapable of producing sound and they had poor graphics capability. This represented a step backwards for language teachers, who by this time had become accustomed to using a range of different media in the foreign language classroom. The arrival of the multimedia computer in the early 1990s was therefore a major breakthrough as it enabled text, images, sound and video to be combined in one device and the integration of the four basic skills of listening, speaking, reading and writing (Davies 2011: Section 1).

Examples of CALL programs for multimedia computers that were published for multimedia computers on CD-ROM and DVD from the mid-1990s onwards are described by Davies (2010: Section 3). CALL programs are still being published on CD-ROM and DVD, but Web-based multimedia CALL has now virtually supplanted these media.

Following the arrival of multimedia CALL, multimedia language centres began to appear in educational institutions. While multimedia facilities offer many opportunities for language learning with the integration of text, images, sound and video, these opportunities have often not been fully utilised. One of the main promises of CALL is the ability to individualise learning but, as with the language labs that were introduced into educational institutions in

the 1960s and 1970s, the use of the facilities of multimedia centres has often devolved into rows of students all doing the same drills (Davies 2010: Section 3.1). There is therefore a danger that multimedia centres may go the same way as the language labs. Following a boom period in the 1970s, language labs went rapidly into decline. Davies (1997: p. 28) lays the blame mainly on the failure to train teachers to use language labs, both in terms of operation and in terms of developing new methodologies, but there were other factors such as poor reliability, lack of materials and a lack of good ideas.

Managing a multimedia language centre requires not only staff who have a knowledge of foreign languages and language teaching methodology but also staff with technical know-how and budget management ability, as well as the ability to combine all these into creative ways of taking advantage of what the technology can offer. A centre manager usually needs assistants for technical support, for managing resources and even the tutoring of students. Multimedia centres lend themselves to self-study and potentially self-directed learning, but this is often misunderstood. The simple existence of a multimedia centre does not automatically lead to students learning independently. Significant investment of time is essential for materials development and creating an atmosphere conducive to self-study. Unfortunately, administrators often have the mistaken belief that buying hardware by itself will meet the needs of the centre, allocating 90% of its budget to hardware and virtually ignoring software and staff training needs (Davies et al. 2011: *Foreword*). Self-access language learning centres or independent learning centres have emerged partially independently and partially in response to these issues. In self-access learning, the focus is on developing learner autonomy through varying degrees of

self-directed learning, as opposed to (or as a complement to) classroom learning. In many centres learners access materials and manage their learning independently, but they also have access to staff for help. Many self-access centres are heavy users of technology and an increasing number of them are now offering online self-access learning opportunities. Some centres have developed novel ways of supporting language learning outside the context of the language classroom (also called 'language support') by developing software to monitor students' self-directed learning and by offering online support from teachers. Centre managers and support staff may need to have new roles defined for them to support students' efforts at self-directed learning: v. Mozzon-McPherson & Vismans (2001), who refer to a new job description, namely that of the "language adviser".

Internet

The emergence of the World Wide Web (now known simply as "the Web") in the early 1990s marked a significant change in the use of communications technology for all computer users. Email and other forms of electronic communication had been in existence for many years, but the launch of the first graphical Web browser, Mosaic, in 1993 brought about a radical change in the ways in which we communicate electronically. The launch of the Web in the public arena immediately began to attract the attention of language teachers. Many language teachers were already familiar with the concept of hypertext on stand-alone computers, which made it possible to set up non-sequential structured reading activities for language learners in which they could point to items of text or images on a page displayed on the computer screen and branch to any other pages, e.g. in a so-called "stack" as implemented in the HyperCard program on Apple Mac computers. The Web

took this one stage further by creating a world-wide hypertext system that enabled the user to branch to different pages on computers anywhere in the world simply by pointing and clicking at a piece of text or an image. This opened up access to thousands of authentic foreign-language websites to teachers and students that could be used in a variety of ways. A problem that arose, however, was that this could lead to a good deal of time-wasting if Web browsing was used in an unstructured way (Davies 1997: pp. 42–43), and language teachers responded by developing more structured activities and online exercises (Leloup & Ponterio 2003). Davies (2010) lists over 500 websites, where links to online exercises can be found, along with links to online dictionaries and encyclopaedias, concordancers, translation aids and other miscellaneous resources of interest to the language teacher and learner.

The launch of the (free) *Hot Potatoes* (Holmes & Arneil) authoring tool, which was first demonstrated publicly at the EUROCALL 1998 conference, made it possible for language teachers to create their own online interactive exercises. Other useful tools are produced by the same authors.

In its early days the Web could not compete seriously with multimedia CALL on CD-ROM and DVD. Sound and video quality was often poor, and interaction was slow. But now the Web has caught up. Sound and video are of high quality and interaction has improved tremendously, although this does depend on sufficient bandwidth being available, which is not always the case, especially in remote rural areas and developing countries. One area in which CD-ROMs and DVDs are still superior is in the presentation of listen/respond/playback activities, although such activities on the Web are continually improving.

Since the early 2000s there has been a boom in the

development of so-called Web 2.0 applications. Contrary to popular opinion, Web 2.0 is not a new version of the Web, rather it implies a shift in emphasis from Web browsing, which is essentially a one-way process (from the Web to the end-user), to making use of Web applications in the same way as one uses applications on a desktop computer. It also implies more interaction and sharing. Walker, Davies & Hewer (2011: Section 2.1) list the following examples of Web 2.0 applications that language teachers are using:

- Image storage and sharing
- Social bookmarking
- Discussion lists, blogs, wikis, social networking
- Chat rooms, MUDs, MOOs and MUVES (virtual worlds)
- Podcasting
- Audio tools
- Video sharing applications and screen capture tools
- Animation tools - comic strips, movies, etc.
- Mashups

There is no doubt that the Web has proved to be a main focus for language teachers, who are making increasingly imaginative use of its wide range of facilities: see Dudeney (2007) and Thomas (2008).

Corpora and Concordancers

Corpora have been used for many years as the basis of linguistic research and also for the compilation of dictionaries and reference works such as the Collins Cobuild series, published by HarperCollins. Tribble & Barlow (2001), Sinclair (2004) and McEnery & Wilson (2011) describe a variety of ways in which corpora can be used in language teaching.

An early reference to the use of electronic concordancers in language teaching can be found in Higgins & Johns (1984: pp. 88–94), and many examples of their practical use in the classroom are described by Lamy & Klarskov Mortensen (2010).

It was Tim Johns (1991), however, who raised the profile of the use of concordancers in the language classroom with his concept of Data-driven learning (DDL). DDL encourages learners to work out their own rules about the meaning of words and their usage by using a concordancer to locate examples in a corpus of authentic texts. It is also possible for the teacher to use a concordancer to find examples of authentic usage to demonstrate a point of grammar or typical collocations, and to generate exercises based on the examples found. Various types of concordancers and where they can be obtained are described by Lamy & Klarskov Mortensen (2011).

Robb (2003) shows how it is possible to use Google as a concordancer, but he also points out a number of drawbacks, for instance there is no control over the educational level, nationality, or other characteristics of the creators of the texts that are found, and the presentation of the examples is not as easy to read as the output of a dedicated concordancer that places the key words (i.e. the search terms) in context.

Virtual Worlds

Virtual worlds date back to the adventure games and simulations of the 1970s, for example Colossal Cave Adventure, a text-only simulation in which the user communicated with the computer by typing commands at the keyboard. Language teachers discovered that it was possible to exploit these text-only programs by using them as the basis for discussion. Jones G. (1986) describes an

experiment based on the Kingdom simulation, in which learners played roles as members of a council governing an imaginary kingdom. A single computer in the classroom was used to provide the stimulus for discussion, namely simulating events taking place in the kingdom: crop planting time, harvest time, unforeseen catastrophes, etc. The early adventure games and simulations led on to multi-user variants, which were known as MUDs (Multi-user domains). Like their predecessors, MUDs were text-only, with the difference that they were available to a wider online audience.

MUDs then led on to MOOs (Multi-user domains object-oriented), which language teachers were able to exploit for teaching foreign languages and intercultural understanding: see Donaldson & Kotter (1999) and (Shield 2003). The next major breakthrough in the history of virtual worlds was the graphical user interface. Lucasfilm's Habitat (1986), was one of the first virtual worlds that was graphically based, albeit only in a two-dimensional environment. Each participant was represented by a visual avatar who could interact with other avatars using text chat. Three-dimensional virtual worlds such as Traveler and Active Worlds, both of which appeared in the 1990s, were the next important development.

Traveler included the possibility of audio communication (but not text chat) between avatars who were represented as disembodied heads in a three-dimensional abstract landscape. Svensson (2003) describes the Virtual Wedding Project, in which advanced students of English made use of Active Worlds as an arena for constructivist learning.

The 3D world of Second Life was launched in 2003. Initially perceived as another role-playing game (RPG), it began to attract the interest of language teachers with the launch of the first of the series of SLanguages conferences

in 2007. Walker, Davies & Hewer (2011: Section 14.2.1) and Molka-Danielsen & Deutschmann (2010) describe a number of experiments and projects that focus on language learning in Second Life.

To what extent Second Life and other virtual worlds will become established as important tools for teachers of foreign languages remains to be seen. It has been argued by Dudeney (2010) in his *That's Life* blog that Second Life is “too demanding and too unreliable for most educators”. The subsequent discussion shows that this view is shared by many teachers, but many others completely disagree.

Regardless of the pros and cons of Second Life, language teachers' interest in virtual worlds continues to grow. The joint EUROCALL/CALICO Virtual Worlds Special Interest Group was set up in 2009, and there are now many areas in Second Life that are dedicated to language learning and teaching, for example the commercial area for learners of English, which is managed by Language Lab, and free areas such as the region maintained by the Goethe-Institut and the EduNation Islands. There are also examples of simulations created specifically for language education, such as those produced by the EC-funded NIFLAR and AVALON projects. NIFLAR is implemented both in Second Life and in Opensim.

Human Language Technologies

Human Language Technologies (HLT) comprise a number of areas of research and development that focus on the use of technology to facilitate communication in a multilingual information society. Human language technologies are areas of activity in departments of the European Commission that were formerly grouped under the heading Language Engineering (Gupta & Schulze 2011: Section 1.1).

The subset of HLT that is of greatest interest to the language teacher is Natural Language Processing (NLP), especially the areas of speech synthesis, speech recognition and parsing.

Speech synthesis has improved immeasurably in recent years. It is often used in electronic dictionaries to enable learners to find out how words are pronounced. At word level, speech synthesis is quite effective, the artificial voice often closely resembling a human voice. At phrase level and sentence level, however, there are often problems of intonation, resulting in speech production that sounds unnatural even though it may be intelligible. Speech synthesis as embodied in Text To Speech (TTS) applications is invaluable as a tool for unsighted or partially sighted people. Gupta & Schulze (2010: Section 4.1) list several examples of speech synthesis applications.

Speech recognition is less advanced than speech synthesis. It has been used in a number of CALL programs, in which it is usually described as Automatic Speech Recognition (ASR). ASR is not easy to implement. Ehsani & Knodt (1998) summarise the core problem as follows:

“Complex cognitive processes account for the human ability to associate acoustic signals with meanings and intentions. For a computer, on the other hand, speech is essentially a series of digital values. However, despite these differences, the core problem of speech recognition is the same for both humans and machines: namely, of finding the best match between a given speech sound and its corresponding word string. Automatic speech recognition technology attempts to simulate and optimize this process computationally.”

Programs embodying ASR normally provide a native speaker model that the learner is requested to imitate, but

the matching process is not 100% reliable and may result in a learner's perfectly intelligible attempt to pronounce a word or phrase being rejected (Davies 2010: Section 3.4.6 and Section 3.4.7).

Parsing is used in a number of ways in CALL. Gupta & Schulze (2010: Section 5) describe how parsing may be used to analyse sentences, presenting the learner with a tree diagram that labels the constituent parts of speech of a sentence and shows the learner how the sentence is structured.

Parsing is also used in CALL programs to analyse the learner's input and diagnose errors. Davies (2002) writes:

“Discrete error analysis and feedback were a common feature of traditional CALL, and the more sophisticated programs would attempt to analyse the learner's response, pinpoint errors, and branch to help and remedial activities. [...] Error analysis in CALL is, however, a matter of controversy. Practitioners who come into CALL via the disciplines of computational linguistics, e.g. Natural Language Processing (NLP) and Human Language Technologies (HLT), tend to be more optimistic about the potential of error analysis by computer than those who come into CALL via language teaching. [...] An alternative approach is the use of Artificial Intelligence (AI) techniques to parse the learner's response - so-called *intelligent CALL* (ICALL) - but there is a gulf between those who favour the use of AI to develop CALL programs (Matthews 1994) and, at the other extreme, those who perceive this approach as a threat to humanity (Last 1989:153)”.

Underwood (1989) and Heift & Schulze (2007) present a more positive picture of AI.

Research into speech synthesis, speech recognition and parsing and how these areas of NLP can be used in CALL are the main focus of the NLP Special Interest Group within the EUROCALL professional association and the

ICALL Special Interest Group within the CALICO professional association. The EUROCALL NLP SIG also maintains a Ning.

Impact

The question of the impact of CALL in language learning and teaching has been raised at regular intervals ever since computers first appeared in educational institutions (Davies & Hewer 2011: Section 3). Recent large-scale impact studies include the study edited by Fitzpatrick & Davies (2003) and the EACEA (2009) study, both of which were produced for the European Commission.

A distinction needs to be made between the impact and the effectiveness of CALL. Impact may be measured quantitatively and qualitatively in terms of the uptake and use of ICT in teaching foreign languages, issues of availability of hardware and software, budgetary considerations, Internet access, teachers' and learners' attitudes to the use of CALL, changes in the ways in which languages are learnt and taught, and paradigm shifts in teachers' and learners' roles. Effectiveness, on the other hand, usually focuses on assessing to what extent ICT is a more effective way of teaching foreign languages compared to using traditional methods - and this is more problematic as so many variables come into play. Worldwide, the picture of the impact of CALL is extremely varied. Most developed nations work comfortably with the new technologies, but developing nations are often beset with problems of costs and broadband connectivity. Evidence on the effectiveness of CALL - as with the impact of CALL - is extremely varied and many research questions still need to be addressed and answered. Hubbard (2002) presents the results of a CALL research survey that was sent to 120 CALL professionals from around the world asking them to articulate a CALL research question they would like to see

answered. Some of the questions have been answered but many more remain open. Leakey (2011) offers an overview of current and past research in CALL and proposes a comprehensive model for evaluating the effectiveness of CALL platforms, programs and pedagogy.

A crucial issue is the extent to which the computer is perceived as taking over the teacher's role. Warschauer (1996: p. 6) perceived the computer as playing an "intelligent" role, and claimed that a computer program "should ideally be able to understand a user's spoken input and evaluate it not just for correctness but also or appropriateness. It should be able to diagnose a student's problems with pronunciation, syntax, or usage and then intelligently decide among a range of options (e.g. repeating, paraphrasing, slowing down, correcting, or directing the student to background explanations)." Jones C. (1986), on the other hand, rejected the idea of the computer being "some kind of inferior teacher-substitute" and proposed a methodology that focused more on what teachers could do with computer programs rather than what computer programs could do on their own: "in other words, treating the computer as they would any other classroom aid". Warschauer's high expectations in 1996 have still not been fulfilled, and currently there is an increasing tendency for teachers to go down the route proposed by Jones, making use of a variety of new tools such as concordancers, interactive whiteboards and applications for online communication.

Since the advent of the Web there has been an explosion in online learning, but to what extent it is effective is open to criticism. Felix (2003) takes a critical look at popular myths attached to online learning from three perspectives, namely administrators, teachers and students. She concludes: "That costs can be saved in this ambitious

enterprise is clearly a myth, as are expectations of saving time or replacing staff with machines.”

As for the effectiveness of CALL in promoting the four skills, Felix (2008) claims that there is “enough data in CALL to suggest positive effects on spelling, reading and writing”, but more research is needed in order to determine its effectiveness in other areas, especially speaking online. She claims that students’ perceptions of CALL are positive, but she qualifies this claim by stating that the technologies need to be stable and well supported, drawing attention to concerns that technical problems may interfere with the learning process. She also points out that older students may not feel comfortable with computers and younger students may not possess the necessary metaskills for coping effectively in the challenging new environments. Training in computer literacy for both students and teachers is essential, and time constraints may pose additional problems. In order to achieve meaningful results she recommends “time-series analysis in which the same group of students is involved in experimental and control treatment for a certain amount of time and then switched - more than once if possible”.

Professional Associations

The following professional associations are dedicated to the promulgation of innovative research, development and practice relating to the use of new technologies in language learning and teaching. Most of them organise conferences and publish journals on CALL.

APACALL: The Asia-Pacific Association for CALL: Organises the Globalization and Localization in Computer-Assisted Language Learning (GLoCALL) conference jointly with PacCALL.

AsiaCALL: The Asia Association of Computer Assisted Language Learning, Korea. AsiaCALL publishes the *AsiaCALL Online Journal*.

Association of University Language Centres (AULC) in the UK and Ireland.

CALICO: Established in 1982. Currently based at the University of South West Texas, USA. CALICO publishes the *CALICO Journal*.

EUROCALL: Founded by a group of enthusiasts in 1986 and established with the aid of European Commission funding as a formal professional association in 1993. Currently based at the University of Ulster, Northern Ireland. EUROCALL's journal, *ReCALL*, is published by Cambridge University Press. EUROCALL also publishes the *EUROCALL Review*.

IALLT: The US-based International Association for Language Learning Technology, originally known as IALL (International Association for Learning Labs). IALLT is a professional organisation dedicated to promoting effective uses of media centres for language teaching, learning, and research. IALLT publishes the *IALLT Journal*.

IATEFL: The UK-based International Association of Teachers of English as a Foreign Language. IATEFL embraces the Learning Technologies Special Interest Group (LTSIG) and publishes the *CALL Review* newsletter.

JALTCALL: Japan. JALT publishes the *JALTCALL Journal*.

LET: The Japan Association for Language Education and Technology (LET), formerly known as the Language Laboratory Association (LLA), and now embraces a wider range of language learning technologies.

PacCALL: The Pacific Association for Computer Assisted Language Learning, promoting CALL in the Pacific, from East to Southeast Asia, Oceania, across to the Americas. Organises the Globalization and Localization in Computer-Assisted Language Learning (GLoCALL) conference jointly with APACALL.

WorldCALL: A worldwide umbrella association of CALL associations. The first WorldCALL conference was held at the University of Melbourne in 1998. The second WorldCALL conference took place in Banff, Canada, 2003. The third WorldCALL took place in Japan in 2008. The fourth WorldCALL conference will take place in Glasgow, Scotland, 2013.

VIRTUAL WORLD LANGUAGE LEARNING

Virtual worlds are playing an increasingly important role in education, especially in language learning. According to Linden Lab Vice President of Platform and Technology Development, Joe Miller (20 May 2009), “Language learning is the most common education-based activity in Second Life”. Many universities, mainstream language institutes and private language schools are now using 3D virtual environments to support language learning.

History

Virtual worlds date back to the adventure games and simulations of the 1970s, for example Colossal Cave Adventure, a text-only simulation in which the user communicated with the computer by typing commands at the keyboard. These early adventure games and simulations led on to MUDs (Multi-user domains) and MOOs (Multi-user domains object-oriented), which language teachers were able to exploit for teaching foreign languages and intercultural understanding (Shield 2003).

Three-dimensional virtual worlds such as *Traveler* and *Active Worlds*, both of which appeared in the 1990s, were the next important development. *Traveler* included the possibility of audio communication (but not text chat) between avatars represented as disembodied heads in a three-dimensional abstract landscape. Svensson (2003) describes the Virtual Wedding Project, in which advanced students of English made use of *Active Worlds* as an arena for constructivist learning. The Adobe Atmosphere software platform was also used to promote language learning in the Babel-M project (Williams & Weetman 2003).

The 3D world of *Second Life* was launched in 2003. Initially perceived as another role-playing game (RPG), it began to attract the attention of language teachers. 2005 saw the first large-scale language school, *Languagelab.com*, open its doors in *Second Life*. By 2007, *Languagelab* was able to use VoIP (audio communication). Prior to that, teachers and students could only communicate via text chat.

Many universities, such as Monash University, and language institutes, such as The British Council, Confucius Institute, Instituto Cervantes and the Goethe-Institut, have islands in *Second Life* specifically for language learning. Many professional and research organisations support virtual world language learning through their activities in *Second Life*. EUROCALL and CALICO, two leading professional associations that promote language learning with the aid of new technologies, maintain a joint Virtual Worlds Special Interest Group (VW SIG) and a headquarters in *Second Life*.

Recent examples of creating sims in virtual worlds specifically for language education include the EU-funded NIFLAR project, the EU-funded AVALON project, and the EduNation Islands, which have been set up as a community

of educators aiming to provide information about and facilities for language learning and teaching. NIFLAR is implemented both in Second Life and in OpenSim. Numerous other examples are described by Molka-Danielsen & Deutschmann (2009), and Walker, Davies & Hewer (2011).

Since 2007 a series of conferences known as SLanguages have taken place, bringing together practitioners and researchers in the field of language education in Second Life for a 24-hour event to celebrate languages and cultures within the 3D virtual world.

Approaches to Language Education in Virtual Worlds

Almost all virtual world educational projects envisage a blended learning approach whereby the language learners are exposed to a 3D virtual environment for a specific activity or time period. Such approaches combine the use of virtual worlds with other online and offline tools, such as 2D virtual learning environments (e.g. Moodle) or physical classrooms. Other virtual world based language learning is intended to offer a complete language learning environment through a virtual world.

Virtual worlds such as Second Life are used for the immersive, collaborative and game-like opportunities they offer language learners. As such, virtual world language learning can be considered to offer distinct (although combinable) learning experiences.

- **Immersive:** Immersive experiences draw on the ability to be surrounded by a certain (real or fictitious) environment that can stimulate language learning.
- **Social:** Almost all 3D virtual spaces are inherently social environments where language learners can

meet others, either to informally practice a language or to participate in more formal classes.

- Creative: A lesser-developed approach to language learning in virtual worlds is that of constructing objects as part of a language learning activity. There is currently little documentation of such activities.

Six Learnings Framework

The “Six learnings framework” is a pedagogical outline developed for virtual world education in general. It sets out six possible ways to view an educational activity.

- Exploring: learners explore a virtual world’s locations and communities as fieldwork for class.
- Collaborating: learners work together within a virtual world on collaborative tasks.
- Being: learners explore themselves and their identity through their presence in a virtual world, such as through role-play.
- Building: learners construct objects within a virtual world.
- Championing: learners promote real life causes through activities and presentations in a virtual world.
- Expressing: learners represent activities within a virtual world to the outside world, through blogs, podcasts, presentations and videos.

How do People Learn in 3D Worlds?

- *The 7 Sensibilities of Virtual Worlds for Learning* presentation by Karl Kapp and Tony O’Driscoll illustrates how a 3D environment makes learning fundamentally different.
- *The 3D Virtual Worlds Learning Archetypes*

presentation by Karl Kapp and Tony O'Driscoll describes 14 archetypes of how people learn in virtual worlds.

Constructivist Approaches

3D virtual worlds are often used for constructivist learning because of the opportunities for learners to explore, collaborate and be immersed within an environment of their choice. Some virtual worlds allow users to build objects and to change the appearance of their avatar and of their surroundings. Constructivist approaches such as task-based language learning and Dogme are applied to virtual world language learning because of the scope for learners to socially co-construct knowledge, in spheres of particular relevance to the learner.

Task-Based Language Learning

Task-based language learning (TBLL) has been commonly applied to virtual world language education. Task-based language learning focuses on the use of authentic language and encourages students to do real life tasks using the language being learned. Tasks can be highly transactional, where the student is carrying out everyday tasks such as visiting the doctor at the Chinese Island of Monash University in Second Life. Incidental knowledge about the medical system in China and cultural information can also be gained at the same time.

Other tasks may focus on more interactional language, such as those that involve more social activities or interviews within a virtual world.

Dogme Language Teaching

Dogme language teaching is an approach that is essentially communicative, focusing mainly on conversation between learners and teacher rather than conventional

textbooks. Although Dogme is perceived by some teachers as being anti-technology, it nevertheless appears to be particularly relevant to virtual world language learning because of the social, immersive and creative experiences offered by virtual worlds and the opportunities they offer for authentic communication and a learner-centred approach.

WebQuests

Virtual world WebQuests (also referred to as SurReal Quests) combine the concept of 2D WebQuests with the immersive and social experiences of 3D virtual worlds. Learners develop texts, audios or podcasts based on their research, part of which is within a virtual world.

Language Villages

The concept of real-life language villages has been replicated within virtual worlds to create a language immersion environment for language learners in their own country.

Virtual Classrooms

Hundsberger (2009, p. 18) defines a virtual classroom thus:

“A virtual classroom in SL sets itself apart from other virtual classrooms in that an ordinary classroom is the place to learn a language whereas the SL virtual classroom is the place to practise a language. The connection to the outside world from a language lab is a 2D connection, but increasingly people enjoy rich and dynamic 3D environments such as SL as can be concluded from the high number of UK universities active in SL.”

To what extent a virtual classroom should offer only language practice rather than teaching a language as in a real-life classroom is a matter for debate. Hundsberger's view (p. 18) is that “[...] SL classrooms are not viewed as

a replacement for real life classrooms. SL classrooms are an additional tool to be used by the teacher/learner.”

Virtual Tourism

Language learning can take place in public spaces within virtual worlds. This offers greater flexibility with locations and students can choose the locations themselves, which enables a more constructivist approach.

The wide variety of replica places in Second Life, e.g. Barcelona, Berlin, London and Paris, offers opportunities for language learning through virtual tourism. Students can engage in conversation with native speakers who people these places, take part in conducted tours in different languages and even learn how to use Second Life in a language other than English.

The Hypergrid Adventurers Club is an open group of explorers who discuss and visit many different OpenSim virtual worlds. By using Hypergrid connectivity, avatars can jump between completely different OpenSim grids while maintaining a singular identity and inventory.

The TAFE Western Institute Virtual Tourism Project commenced in 2010 and was funded by the Australian Flexible Learning Framework's eLearning Innovations Project. It is focused on developing virtual worlds learning experiences for TVET Tourism students and is currently located at jokaydiaGRID, an OpenSim grid which supports a community of educators and artists.

The following tours of virtual worlds were presented at Virtual Worlds Best Practice in Education 2011 Conference:

- The Future will be Connected: John Lester
- World of Warcraft in the Classroom

- SpotOn3D: Bill Krebs
- Jibe and Unity3D: John Lester

Autonomous Learning

Virtual worlds offer exceptional opportunities for autonomous learning. The video *Language learning in Second Life: an Introduction* by Helen Myers (Karelia Kondor in SL) is a good illustration of an adult learner's experiences of her introduction to SL and in learning Italian.

Tandem Learning (Buddy Learning)

Tandem learning, or buddy learning, takes autonomous learning one step further. This form of learning involves two people with different native languages working together as a pair in order to help one another to improve their language skills. Each partner helps the other through explanations in the foreign language. As this form of learning is based on communication between members of different language communities and cultures, it also facilitates intercultural learning. A tandem learning group, Teach You Teach Me (Language Buddies), can be found in Second Life.

Holodecks

The term holodeck derives from the *Star Trek* TV series and feature films, in which a holodeck is depicted as an enclosed room in which simulations can be created for training or entertainment. Holodecks offer exciting possibilities of calling up a range of instantly available simulations that can be used for entertainment, presentations, conferencing and, of course, teaching and learning. For example, if students of hospitality studies are being introduced to the language used in checking in at a hotel a simulation of a hotel reception area can be generated instantly by selecting the chosen simulation

from a holodeck *rezzor*, a device that stores and generates different scenarios. Holodecks can also be used to encourage students to describe a scene or to even build a scene. Holodecks are commonly used for a range of role-plays.

CAVE Technology

A Cave Automatic Virtual Environment (CAVE) is an immersive virtual reality environment where projectors are directed to three, four, five or six of the walls of a room-sized cube, e.g. Sneak Peek: iED CAVE at South Park Elementary School in Colorado. The name is also a reference to the allegory of the Cave in Plato's Republic where a philosopher contemplates perception, reality and illusion.

The CAVE is a large theatre that sits in a larger room. The walls of the CAVE are made up of rear-projection screens, and the floor is made of a down-projection screen. High-resolution projectors display images on each of the screens by projecting the images onto mirrors which reflect the images onto the projection screens. The user will go inside the CAVE wearing special glasses to allow the 3D graphics that are generated by the CAVE to be seen. With these glasses, people using the CAVE can actually see objects floating in the air, and can walk around them, getting a realistic view of what the object would look like when they walk around it.

Voice Chat

Earlier virtual worlds, with the exception of *Traveler* (1996), offered only text chat. Voice chat was a later addition. Second Life did not introduce voice capabilities until 2007. Prior to this independent VoIP systems were used. Second Life's internal voice system has the added ability to reproduce the effect of distance on voice loudness, so that there is an auditive sense of space amongst users.

Other virtual worlds, such as Twinity, also offer internal voice systems. Browser-based 3D virtual environments tend to only offer text-chat communication, although this seems likely to become more widespread. Vivox is the leading integrated voice platform for the social web, providing a Voice Toolbar for developers of virtual worlds and multiplayer games. Vivox is now spreading into OpenSim at an impressive growth rate, e.g. Avination will be offering in-world Vivox voice at no charge to its residents and region renters, as well as to customers who host private grids with the company.

The advent of voice chat in Second Life in 2007 was a major breakthrough. Communicating with one's voice is the *sine qua non* of language learning and teaching, but voice chat is not without its problems. Many Second Life users report on problems using voice chat. This may be due to problems within the Second Life software itself, but it is often due to individual users' poor understanding of how to set up audio on their computers and/or of inadequate bandwidth. A separate voice chat channel outside Second Life, e.g. Skype, may in such cases offer a solution.

Owning and Renting Land in Virtual Worlds

Owning or renting land in a virtual world is necessary for educators who wish to create learning environments for their students. Educators can then use the land to create permanent structures or temporary structures embedded within holodecks. The land can also be used for students undertaking building activities. Students may also use public sandboxes, but they may prefer to exhibit their creations more permanently on owned or rented land.

Most language educators own or rent land in a virtual world, or they may implement a standalone Sim-on-a-Stick. Use of Extended UPnP Hypergrid Services now allows

virtual world visitors to access PC-based OpenSim standalones. This approach offers control over who is allowed to have access to the venue and the visitor permissions.

The Immersive Education Initiative iED revealed that it will provide free permanent virtual world land in OpenSim for one year to every school and non-profit organization that has at least one teacher, administrator, or student in attendance of any Immersive Education Initiative Summit.

Alternative 3D Worlds

Many islands in Second Life have language- or culture-specific communities that offer language learners easy ways to practise a foreign language (Berry 2009). Second Life is the widest-used 3D world among members of the language teaching community, but there are many alternatives. General-purpose virtual environments such as Hangout, Avatar Hangout and browser-based 3D environments such as ExitReality and 3DXplorer offer 3D spaces for social learning, which may also include language learning. Google Street View and Google Earth also have a role to play in language learning and teaching.

Twinity replicates the real life cities of Berlin, Singapore, London and Miami, and offers language learners virtual locations with specific languages being spoken. Zon has been created specifically for learners of Chinese.

There is no shortage of choices of virtual world platforms. The following lists describe a variety of different virtual world platforms, their features and their target audiences:

- ArianeB's list of 3D Virtual Worlds: A useful list of virtual worlds and multiplayer games, including embedded videos that show how they look.
- Chris Smith's list of virtual worlds: A comprehensive

list of virtual worlds, including some embedded videos.

- **Virtual Worlds List by Category:** As the title suggests, a categorised list of virtual worlds. Links only, no descriptions.

Open Source 3D platforms for educators, such as the ReactionGrid under OpenSim, which employs Hypergrid teleport technology, in conjunction with the emerging iED cross-platform and open source format File Formats Technology Working Group point to the future of a “Create Once, Experience Everywhere” Education Grid strategy.

OpenSim is employed as free open source standalone software, thus enabling a decentralized configuration of all educators, trainers, and users. Scott Provost, Director at the Free Open University, Washington DC, writes: “The advantage of Standalone is that Asset server and Inventory server are local on the same server and well connected to your sim. With Grids that is never the case. With Grids/ Clouds that is never the case. On OSGrid with 5,000 regions and hundreds of users scalability problems are unavoidable. We plan on proposing 130,000 Standalone mega regions (in US schools) with Extended UPnP Hypergrid services. The extended services would include a suitcase or limited assets that would be live on the client”. Such a standalone sim offers 180,000 prims for building, and can be distributed pre-configured together with a virtual world viewer using a USB storage stick or SD card. Pre-configured female and male avatars can also be stored on the stick, or even full-sim builds can be downloaded for targeted audiences without virtual world experience: Grid Demo, GovGrid Store. This is favorable for introductory users, who want a sandbox on demand and have no clue how to get started. Configuring an OpenSim standalone on a cellphone storage card has also been described, e.g. Nokia N900.

The Mixed Reality Users Community Group (MXU.CG) of the Immersive Education Initiative iED now offers a free open source Mixed Reality Kit.

Virtual World Conferences

- The first SLanguages conference took place on 23 June 2007. The SLanguages conference is now a free annual 24-hours event, bringing together practitioners and researchers in the field of language education in Second Life.
- The Webheads in Action Online Convergence (WIAOC) conferences make use of Second Life, as well as presentations in Elluminate. Webheads describes itself as “An online community of practice of teachers and educators, practising peace and professional development through Web 2.0 and computer mediated communication”.
- SL Experiments is a group managed by by Nergiz Kern (Daffodil Fargis in SL) for collecting and sharing ideas on how to use Second Life for teaching foreign languages. The group meets twice a month in Second Life. Sl Experiments also exists as a subgroup in the AVALON Ning.
- The Virtual Round Table conference takes place twice a year, focusing on language teaching technologies. A substantial part of the conference takes place in Second Life.
- The Virtual Worlds Best Practice in Education (VWBPE) is a community-based conference that provides opportunities for participants in all virtual worlds to share current teaching, learning, and research practices in 3D virtual environments. Conference presentations focus on teaching/learning, scholarly work, projects, events, activities and new

and innovative tools for virtual education. Presenters will focus on the identification of best practices in education designed for 3D virtual world technology

- Virtual Worlds Education Roundtable VWER meets weekly in SL and OpenSim alternately. The group meets each week to talk about issues that concern educators with regard to using virtual worlds as a teaching and learning tool. In late 2010, VWER announced, after a process of considering several alternatives, that they had opened a further virtual home, their own OpenSim grid, hosted by ReactionGrid. Details on this exciting and ongoing project can be found at the VWERGrid.
- iED Summits are official Immersive Education Initiative conferences organized specifically for educators, researchers, and administrators. iED Summits consist of presentations, panel discussions, break-out sessions and workshops that provide attendees with an in-depth overview of immersive learning platforms, technologies and cutting-edge research from around the world. iED Summits feature new and emerging virtual worlds, learning games, educational simulations, mixed/augmented reality, and related teaching tools, techniques, technologies, standards and best practices.
- The Virtual World Conference is an annual conference exploring the uses of virtual worlds for learning, collaborative work and business.
- Innovation in teaching and learning through immersive virtual worlds is a major theme of Researching Learning in Immersive Virtual Environments ReLIVE, a conference from The Open University to bring together researchers and educators in this field.

Beyond Virtual Worlds

Virtual World Language Learning is a rapidly expanding field and it converges with other closely related areas, such as the use of MMOGs, SIEs and Mixed Reality.

Massively Multiplayer Online Games (MMOGs)

MMOGs (Massively Multiplayer Online Games) are also used to support language learning, e.g. VWBPE 2011 provided state-of-art sessions for World of Warcraft in the Classroom. See also World of Warcraft in School. Elisabeth Hayes and John Carter McKnight describe an interdisciplinary university course that introduces students to community and governance in two virtual worlds, Second Life and World of Warcraft: Learning about Community in Virtual Worlds.

Synthetic Immersive Environments (SIEs)

SIEs are engineered 3D virtual spaces that integrate online gaming aspects. They are specifically designed for educational purposes and offer learners a collaborative and constructionist environment. They also allow the creators/designers to focus on specific skills and pedagogical objectives.

Mixed Reality Language Learning

Mixed reality convergence between virtual worlds and real life is offering new opportunities for language education. The Mixed Reality Users Community Group (MXU.CG) of the Immersive Education Initiative iED now offers a free open source Mixed Reality Kit (e.g. Mixed Reality Book: Earth Structure), deploying a so-called Quick Response code (QR Code): see Google Chrome Web Store.

Augmented Virtuality (AV) and Augmented Reality (AR) are gaining interest for language learning, especially for m-learning (Mobile Assisted Language Learning).

AV applications, such as the Layar and Wikitude programs for the Smartphone enable immersive and information-rich experiences in the real world and are therefore blurring the differences between real life and virtual worlds.

In contrast, Word Lens from QuestVisual is an AR application for the iPhone and iPod Touch (with video camera) which offers real time translation of text. You simply point your device's video camera at a sign and the program translates and superimposes the translated text onto the video in real time, thus establishing mobile capability for AR language learning.

VIRTUAL LEARNING ENVIRONMENT

A virtual learning environment (VLE) is a system designed to support teaching and learning in an educational setting, as distinct from a Managed Learning Environment (MLE), where the focus is on management.

Overview

A VLE will normally work over the Internet and provide a collection of tools such as those for assessment (particularly of types that can be marked automatically, such as multiple choice), communication, uploading of content, return of students' work, peer assessment, administration of student groups, collecting and organizing student grades, questionnaires, tracking tools, etc. New features in these systems include wikis, blogs, RSS and 3D virtual learning spaces. VLEs are often used in schools and other educational establishments in order to make the learning experience more interactive.

While originally created for distance education, VLEs are now most often used to supplement traditional face to face classroom activities, commonly known as Blended

Learning. These systems usually run on servers, to serve the course to students Multimedia and/or web pages.

In some programs, such as Elluminate, a virtual learning environment can be similar to a face-to-face classroom environment in that it allows direct communication with the teacher. Students can use emoticons to “raise their hand,” show that they are confused, show that they understand what the teacher is saying, and even give applause for something that the teacher says. Students are also able to talk to the teacher when called on. In many of these virtual learning environments the students are able to write on the “virtual classroom chalkboard.” This allows them to show their work for the rest of the class to see. Students can also be split up into groups in order to work with each other and discuss topics that the teacher introduces. Many virtual learning environments give teachers the ability to share multimedia files such as video and audio files as well as the ability to transfer important documents (Word, PDF,...etc.) directly to students.

In ‘Virtually There’, a book and DVD pack distributed freely to schools by the Yorkshire and Humber Grid for Learning Foundation (YHGfL), Professor Stephen Heppell writes in the foreword:

“Learning is breaking out of the narrow boxes that it was trapped in during the 20th century; teachers’ professionalism, reflection and ingenuity are leading learning to places that genuinely excite this new generation of connected young school students — and their teachers too. VLEs are helping to make sure that their learning is not confined to a particular building, or restricted to any single location or moment.”

Similar Terms

A VLE is a computer program that facilitates computerized learning or e-learning. Such e-learning systems are sometimes also called Learning Management System

(LMS), Content Management System (CMS), Learning Content Management System (LCMS), Managed Learning Environment (MLE), Learning Support System (LSS), Online Learning Centre (OLC), OpenCourseWare (OCW), or Learning Platform (LP); it is education via computer-mediated communication (CMC) or Online Education.

A more correct term may be a virtual environment for learning, rather than virtual learning environment. This removes any ambiguities and identifies that it is the environment which is virtual and not the learning. The term virtual may also contribute to confusion, suggesting that the learning is not real or authentic.

In the United States, CMS and LMS are the more common terms, however LMS is more frequently associated with software for managing corporate training programs rather than courses in traditional education institutions.

In the United Kingdom and many European countries, the terms VLE and MLE are favored; however, it is important to realize that these are two very different things. A VLE can be considered a subsystem of an MLE, whereas MLE refers to the wider infrastructure of information systems in an organization that support and enable electronic learning on a wider scale. In fact a rather pedantic reading of the term MLE could be extended to encompass the physical environment in which learning takes place (i.e. a school). Also the use of VLE avoids confusion with the use of LMS to mean "Library Management System" (which is more commonly referred to as Integrated Library System, or ILS, in the United States).

Becta, in the UK, have coined the term *learning platform* to cover both MLE and VLE as used in the schools sector. The term learning platform describes a broad range of ICT systems used to deliver and support learning. Through

a learning platform, hardware, software and supporting services are brought together to enable more effective ways of working within and outside the classroom. At the heart of any learning platform is the concept of a personalized online learning space for the pupil. This space should offer teachers and pupils access to stored work, e-learning resources, communication and collaboration with peers, and the facility to track progress.'

Facilities

A VLE should make it possible for a course designer to present to students, through a single, consistent, and intuitive interface, all the components required for a course of education or training. Although logically it is not a requirement, in practice VLEs always make extensive use of computers and the Internet. A VLE should implement all the following elements:

- The syllabus for the course
- Administrative information including the location of sessions, details of pre-requisites and co-requisites, credit information, and how to get help
- A notice board for up-to-date course information
- Student registration and tracking facilities, if necessary with payment options
- Basic teaching materials. These may be the complete content of the course, if the VLE is being used in a distance learning context, or copies of visual aids used in lectures or other classes where it is being used to support a campus-based course.
- Additional resources, including reading materials, and links to outside resources in libraries and on the Internet.
- Self-assessment quizzes which can be scored automatically

- Formal assessment procedures
- Electronic communication support including e-mail, threaded discussions and a chat room, with or without a moderator
- Differential access rights for instructors and students
- Production of documentation and statistics on the course in the format required for institutional administration and quality control
- All these facilities should be capable of being hyperlinked together
- Easy authoring tools for creating the necessary documents including the insertion of hyperlinks - though it is acceptable (arguably, preferable) for the VLE to be designed allowing standard word processors or other office software to be used for authoring.

In addition, the VLE should be capable of supporting numerous courses, so that students and instructors in a given institution (and, indeed, across institutions) experience a consistent interface when moving from one course to another.

Popularity

Universities and other institutions of higher and further education are increasingly turning to VLEs in order to:

- Economize on the time of teaching staff, especially when they are also involved in research and administration. The extent of the economy over traditional “talk-and-chalk” teaching is not yet clear, but for instructors without web development expertise, using a VLE absorbs less time and produces a more professional result.
- Provide a service for students who increasingly

look to the internet as the natural medium for finding information and resources.

- Ensure that quality control requirements are met by providing a standard vehicle for collecting the required information
- Facilitate the integration of distance and campus-based learning or of learning on different campuses.

For example, accredited institutions such as Chapman College University, Touro University, and Adams State College offer online, on-demand teacher training courses for educators to earn graduate credit and/or masters degrees. In the UK schools are being encouraged to make use of learning platforms. The DCSF in the UK government has published an eStrategy outlining priorities that include every learner in schools having access to an online learning space and e-portfolio.

Virtual learning environments also have become popular among younger students. Pennsylvania has a number of cyber charter schools available to offer students a choice in their education. The Pennsylvania Cyber Charter School is the largest one in Pennsylvania with an enrollment of 10,000 students from kindergarten through 12th grade.

Transferring Course Content

Most VLEs support Shareable Content Object Reference Model (SCORM) as a standard way to upload, launch and track courses. There are no commonly used standards that define how the learner's performance within a course should be transferred from one VLE to another.

Some institutions have attempted to combat this problem by agreeing to share content through open standards, such as those defined by the IMS Global Consortium. Local bodies such as in the schools sector in the UK the DCSF

via Becta have additionally defined a learning platform “conformance framework” to encourage interoperability.

Virtual Learning Environments are not limited only to students and learners in graduate level studies. There are many virtual learning environments being created at all times, especially due to the increased popularity of online public education for students in grades k-12. One example of a virtual learning environment for some of the youngest learners is coined with the name: Little Lincoln. “Little Lincoln is an interactive and engaging standards-based curriculum that combines rich multimedia with comprehensive offline activities. Little Lincoln is currently offered for Early Kindergarten, Kindergarten, First Grade, and Second Grade students. Little Lincoln Third Grade will be available for the 2011-2012 academic year.” This online learning environment allows for the students to utilize innovative technology while progressing through standards based curriculum. It is just one of many virtual learning environments available at this time.

The growth of online learning environments continues to grow as students in PA continue to choose charter schools. There appear to be a variety of reasons as to why students are choosing cyber school over traditional brick and mortar schools. The reasons vary from peer pressure to the need for flexibility to health issues.

Systems Available

For those wishing to deliver elearning there are many free open source and proprietary VLEs available for use. On-demand elearning services are also a popular choice because they can be deployed in minutes and do not require instructors and institutions to run their own servers.

Many VLEs are placed on a web server. In a typical VLE there are one or more programs or languages that

provides the user (Teacher-Student) interface, and which interacts with a database. For example, a VLE might use PHP as its web language/program, with MySQL as a database.

VLEs are increasingly found in new niches. These include new emerging technologies, as well as specialized markets. A VLE can be deployed on a USB drive as a child, which synchronizes from time to time with its web-based parent. VLEs can be used for training or in something as specialized as to meet ISO 9000 certification requirements.

Virtual World Learning Environments

Emerging technologies include Sloodle, a merge of Second Life, Moodle, i.e. integrating virtual worlds and course management. This early development approach hints at new options for enabling learning in a social, immersive, and interactive way. Another 3D virtual learning environment called Edusim brings a lessons driven 3D virtual environment to the classroom interactive whiteboard surface allowing the direct manipulation of 3D virtual objects. Umgumbo is an immersive 3D VLE set in a Newtonian simulation of the solar system. Still in development, Umgumbo will allow collaborative and interactive learning within personalized 3D spaces, including educational gaming, and is delivered from a single external website.

Brain Based Learning and Its Application for the Virtual Learning Environment

Brain based learning or brain-compatible learning theory focuses on concepts that create an optimal learning environment to maximize attainment and retention of information. Successful application is dependant upon everyone involved in the learning process - online course developers, educators and student to understand the

structure of the brain and focus on student learner's needs and styles to create brain based learning environments, materials and instruction in a fun, meaningful, personally enriching way. (Lucas, 2004) Brain based learning is much better than traditional lecture techniques. However the teacher must be aware of how to implement the techniques into the online learning environment. "Designers of educational tools must be artistic in their creation of brain-friendly environments. Instructors need to realize that the best way to learn is not through lecture, but by participation in realistic environments that let learners try new things safely" (Funderstanding, 1998 -2008).

Proper Ways of Using Brain Based Learning in the Virtual Classroom

Brain based learning is a topic that is challenging teachers, administrators, and neuroscientists to see what is best for students. By providing specific feedback, stimulating environments, and real life examples to students they will be more engaged and active in the classroom. A major proponent of virtual schools is that they provide students with an environment that is effective to them. Funderstandingstates, "Because every brain is different, educators should allow learners to customize their own environments" (Funderstanding, 1998 - 2008). By allowing the students and parents to choose the environment that is best for them. In addition, Crain states, "Children who developed a firm sense of trust in their caretakers can afford to leave them and independently explore the environment" (Crain, 1992). In the future, students will feel more comfortable to eventually leave their normal setting. Some students may be too nervous and anxious in a regular classroom so they are not learning. The virtual classrooms also provide more technology features than a traditional school setting. Nellie states, "Technology can

cater to these neuroscience brain-based findings in the computer lab as well as for online learning courses. Various Microsoft tools such as PowerPoint presentations, Excel, Word processor and other software with multimedia functions can be used by the teacher and students instead of using conventional outdated class tools” (Nellie Deutsch, 2003). One specific example that can be used is a PowerPoint presentation for class. Creating an “About Me” lesson allows the students to express themselves through PowerPoint. By doing this the students were able to learn how to use PowerPoint to expand their learning.

List of Some Virtual Learning Environments

Learning Management Systems

- Alphastudy - a web and mobile enabled LMS
- Claroline
- Desire2Learn
- JoomlaLMS - a LMS based on Joomla platform
- LAMS - the Learning Activity Management System
- RCampus - a course and ePortfolio management system
- SharePointLMS - a LMS based on MS SharePoint
- ITWorx_CLG

Course Management Systems

- CCNet
- Coggno - e-learning software platform and courseware creation toolkit

Free software and open source

- Chamilo
- Claroline
- Democrasoft
- Dokeos

- eFront
- ILIAS
- Moodle
- Sakai

Virtual Learning Environment

- Alphastudy - Learning and knowledge portals
- Moodle - An open source (free) modular php virtual learning software
- Blackboard - A family of virtual learning software
- Democrosoft - Collaborize Classroom - A free online learning platform for teachers and students
- CyberExtension - Virtual Managed Learning Environment
- Desire2Learn - A suite of learning software
- Elluminate Live - An interactive classroom environment
- FirstClass - Messaging and communications solution
- Heritage Key – Virtual historical environments, such as Tutankhamun’s tomb.
- itslearning - Norwegian Learning Environment, delivered as Software as a Service (SaaS), market leader in Norway, Sweden and UK.
- Mingoville - Introduction to the English language. Age 8 to 12 (Virtual World and Language games)
- RCampus A Learning and ePortfolio Management System with both personal and institutional access
- Saba Centra - Part of a Human Capital Development System
- SANSSpace - Course/Content Management with Digital Comparative Recorder for language learning.
- SpicyNodes - Create and share radial maps (related to concept maps and mind maps)

- WebCT - (Now a part of Blackboard) Software applications designed to enhance teaching and learning
- WebTrain - Virtual live classes, enrollment, attendance, attention monitoring.

Other Descriptions

- Apex Learning - K-12 online course service and AP test study
- ATutor - LCMS
- Dokeos - elearning and course management web application
- eCollege - comprehensive eLearning solution
- Pass-port - a commercial ePortfolio and assessment system that includes a course management component
- Spiral Universe - student information system

E-LEARNING

E-learning comprises all forms of electronically supported learning and teaching. The information and communication systems, whether networked or not, serve as specific media to implement the learning process. The term will still most likely be utilized to reference out-of-classroom and in-classroom educational experiences via technology, even as advances continue in regard to devices and curriculum.

E-learning is essentially the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-based learning, computer-based learning, virtual classroom opportunities and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM. It can be self-paced or instructor-led

and includes media in the form of text, image, animation, streaming video and audio.

Abbreviations like CBT (*Computer-Based Training*), IBT (*Internet-Based Training*) or WBT (*Web-Based Training*) have been used as synonyms to e-learning. Today one can still find these terms being used, along with variations of e-learning such as elearning, Elearning, and eLearning. The terms will be utilized throughout this article to indicate their validity under the broader terminology of E-learning.

Market

The worldwide e-learning industry is estimated to be worth over \$48 billion according to conservative estimates. Developments in internet and multimedia technologies are the basic enabler of e-learning, with consulting, content, technologies, services and support being identified as the five key sectors of the e-learning industry.

By 2006, 3.5 million students were participating in on-line learning at institutions of higher education in the United States. According to the Sloan Foundation reports, there has been an increase of around 12–14 percent per year on average in enrollments for fully online learning over the five years 2004–2009 in the US post-secondary system, compared with an average of approximately 2 per cent increase per year in enrollments overall. Allen and Seamen (2009) claim that almost a quarter of all students in post-secondary education were taking fully online courses in 2008, and a report by Ambient Insight Research suggests that in 2009, 44 per cent of post-secondary students in the USA were taking some or all of their courses online, and projected that this figure would rise to 81 percent by 2014. Thus it can be seen that e-learning is moving rapidly from the margins to being a predominant form of post-secondary education, at least in the USA. Many higher education,

for-profit institutions, now offer on-line classes. By contrast, only about half of private, non-profit schools offer them. The Sloan report, based on a poll of academic leaders, indicated that students generally appear to be at least as satisfied with their on-line classes as they are with traditional ones. Private institutions may become more involved with on-line presentations as the cost of instituting such a system decreases. Properly trained staff must also be hired to work with students on-line. These staff members need to understand the content area, and also be highly trained in the use of the computer and Internet. Online education is rapidly increasing, and online doctoral programs have even developed at leading research universities.

K-12 Learning

E-learning is also utilized by public K-12 schools in the United States. Some E-Learning environments take place in a traditional classroom, others allow students to attend classes from home or other locations. There are several states that are utilizing cyber and virtual school platforms for E-learning across the country that continued to increase. Public cyber schools enable students to log into synchronous or asynchronous courses anywhere there is an internet connection. Technology kits are usually provided that include computers, printers, and reimbursement for home internet use. Students are to use technology for school use only and must meet weekly work submission requirements. Teachers employed by K-12 online public cyber schools must be certified teachers in the state they are teaching in. Cyber schools allow for students to maintain their own pacing and progress, course selection, and provides the flexibility for students to create their own schedule.

History

In the early 1960s, Stanford University psychology

professors Patrick Suppes and Richard C. Atkinson experimented with using computers to teach math and reading to young children in elementary schools in East Palo Alto, California. Stanford's Education Program for Gifted Youth is descended from those early experiments.

Early e-learning systems, based on Computer-Based Learning/Training often attempted to replicate autocratic teaching styles whereby the role of the e-learning system was assumed to be for transferring knowledge, as opposed to systems developed later based on Computer Supported Collaborative Learning (CSCL), which encouraged the shared development of knowledge.

As early as 1993, William D. Graziadei described an online computer-delivered lecture, tutorial and assessment project using electronic mail. In 1997 he published an article which described developing an overall strategy for technology-based course development and management for an educational system. He said that products had to be easy to use and maintain, portable, replicable, scalable, and immediately affordable, and they had to have a high probability of success with long-term cost-effectiveness.

William D. Graziadei, Sharon Gallagher, Ronald N. Brown, Joseph Sasiadek Building Asynchronous and Synchronous Teaching-Learning Environments: Exploring a Course/Classroom Management System Solution </ref> In 1997 Graziadei, W.D., et al., published an article entitled "Building Asynchronous and Synchronous Teaching-Learning Environments: Exploring a Course/Classroom Management System Solution". They described a process at the State University of New York (SUNY) of evaluating products and developing an overall strategy for technology-based course development and management in teaching-learning. The product(s) had to be easy to use and maintain, portable, replicable, scalable, and immediately affordable,

and they had to have a high probability of success with long-term cost-effectiveness. Today many technologies can be, and are, used in e-learning, from blogs to collaborative software, ePortfolios, and virtual classrooms. Most eLearning situations use combinations of these techniques.

E-Learning 2.0

The term E-Learning 2.0 is a neologism for CSCL systems that came about during the emergence of Web 2.0. From an E-Learning 2.0 perspective, conventional e-learning systems were based on instructional packets, which were delivered to students using assignments. Assignments were evaluated by the teacher. In contrast, the new e-learning places increased emphasis on social learning and use of social software such as blogs, wikis, podcasts and virtual worlds such as *Second Life*.

E-Learning 2.0, by contrast to e-learning systems not based on CSCL, assumes that knowledge (as meaning and understanding) is socially constructed. Learning takes place through conversations about content and grounded interaction about problems and actions. Advocates of social learning claim that one of the best ways to learn something is to teach it to others.

However, it should be noted that many early online courses, such as those developed by Murray Turoff and Starr Roxanne Hiltz in the 1970s and 80s at the New Jersey Institute of Technology, courses at the University of Guelph in Canada, the British Open University, and the online distance courses at the University of British Columbia (where Web CT, now incorporated into Blackboard Inc. was first developed), have always made heavy use of online discussion between students. Also, from the start, practitioners such as Harasim (1995) have put heavy emphasis on the use of learning networks for knowledge

construction, long before the term e-learning, let alone e-learning 2.0, was even considered.

There is also an increased use of virtual classrooms (online presentations delivered live) as an online learning platform and classroom for a diverse set of education providers such as Minnesota State Colleges and Universities and Sachem School District.

In addition to virtual classroom environments, social networks have become an important part of E-learning 2.0. Social networks have been used to foster online learning communities around subjects as diverse as test preparation and language education. Mobile Assisted Language Learning (MALL) is a term used to describe using handheld computers or cell phones to assist in language learning. Some feel, however, that schools have not caught up with the social networking trends. Few traditional educators promote social networking unless they are communicating with their own colleagues.

Approaches to E-Learning Services

E-learning services have evolved since computers were first used in education. There is a trend to move towards blended learning services, where computer-based activities are integrated with practical or classroom-based situations.

Bates and Poole (2003) and the OECD (2005) suggest that different types or forms of e-learning can be considered as a continuum, from no e-learning, i.e. no use of computers and/or the Internet for teaching and learning, through classroom aids, such as making classroom lecture Powerpoint slides available to students through a course web site or learning management system, to laptop programs, where students are required to bring laptops to class and use them as part of a face-to-face class, to hybrid learning, where classroom time is reduced but not eliminated, with

more time devoted to online learning, through to fully online learning, which is a form of distance education. This classification is somewhat similar to that of the Sloan Commission reports on the status of e-learning, which refer to web enhanced, web supplemented and web dependent to reflect increasing intensity of technology use. In the Bates and Poole continuum, 'blended learning' can cover classroom aids, laptops and hybrid learning, while 'distributed learning' can incorporate either hybrid or fully online learning.

It can be seen then that e-learning can describe a wide range of applications, and it is often by no means clear even in peer reviewed research publications which form of e-learning is being discussed. However, Bates and Poole argue that when instructors say they are using e-learning, this most often refers to the use of technology as classroom aids, although over time, there has been a gradual increase in fully online learning.

Computer-based Learning

Computer-based learning, sometimes abbreviated to CBL, refers to the use of computers as a key component of the educational environment. While this can refer to the use of computers in a classroom, the term more broadly refers to a structured environment in which computers are used for teaching purposes.

Cassandra B. Whyte researched about the ever increasing role that computers would play in higher education. This evolution, to include computer-supported collaborative learning, in addition to data management, has been realized. The type of computers have changed over the years from cumbersome, slow devices taking up much space in the classroom, home, and office to laptops and handheld devices that are more portable in form and

size and this minimalization of technology devices will continue.

Computer-based Training

Computer-Based Trainings (CBTs) are self-paced learning activities accessible via a computer or handheld device. CBTs typically present content in a linear fashion, much like reading an online book or manual. For this reason they are often used to teach static processes, such as using software or completing mathematical equations. The term Computer-Based Training is often used interchangeably with Web-based training (WBT) with the primary difference being the delivery method. Where CBTs are typically delivered via CD-ROM, WBTs are delivered via the Internet using a web browser. Assessing learning in a CBT usually comes in the form of multiple choice questions, or other assessments that can be easily scored by a computer such as drag-and-drop, radial button, simulation or other interactive means. Assessments are easily scored and recorded via online software, providing immediate end-user feedback and completion status. Users are often able to print completion records in the form of certificates.

CBTs provide learning stimulus beyond traditional learning methodology from textbook, manual, or classroom-based instruction. For example, CBTs offer user-friendly solutions for satisfying continuing education requirements. Instead of limiting students to attending courses or reading printed manuals, students are able to acquire knowledge and skills through methods that are much more conducive to individual learning preferences. For example, CBTs offer visual learning benefits through animation or video, not typically offered by any other means.

CBTs can be a good alternative to printed learning

materials since rich media, including videos or animations, can easily be embedded to enhance the learning. Another advantage to CBTs are that they can be easily distributed to a wide audience at a relatively low cost once the initial development is completed.

However, CBTs pose some learning challenges as well. Typically the creation of effective CBTs requires enormous resources. The software for developing CBTs (such as Flash or Adobe Director) is often more complex than a subject matter expert or teacher is able to use. In addition, the lack of human interaction can limit both the type of content that can be presented as well as the type of assessment that can be performed. Many learning organizations are beginning to use smaller CBT/WBT activities as part of a broader online learning program which may include online discussion or other interactive elements.

Computer-Supported Collaborative Learning (CSCL)

Computer-supported collaborative learning (CSCL) is one of the most promising innovations to improve teaching and learning with the help of modern information and communication technology. Most recent developments in CSCL have been called E-Learning 2.0, but the concept of collaborative or group learning whereby instructional methods are designed to encourage or require students to work together on learning tasks has existed much longer. It is widely agreed to distinguish collaborative learning from the traditional 'direct transfer' model in which the instructor is assumed to be the distributor of knowledge and skills, which is often given the neologism E-Learning 1.0, even though this direct transfer method most accurately reflects Computer-Based Learning systems (CBL).

In *Datacloud: Toward a New Theory of Online Work*, Johndan Johnson-Eilola describes a specific computer-

supported collaboration space: The Smart Board. According to Johnson-Eilola, a “Smart Board system provides a 72-inch, rear projection, touchscreen, intelligent whiteboard surface for work” (79). In *Datacloud*, Johnson-Eilola asserts that “[w]e are attempting to understand how users move within information spaces, how users can exist within information spaces rather than merely gaze at them, and how information spaces must be shared with others rather than being private, lived within rather than simply visited” (82). He explains how the Smart Board system offers an information space that allows his students to engage in active collaboration. He makes three distinct claims regarding the functionality of the technology: 1) The Smart Board allows users to work with large amounts of information, 2) It offers an information space that invites active collaboration, 3) The work produced is often “dynamic and contingent”. Johnson-Eilola further explains that with the Smart Board “...information work becom[es] a odied experience” (81). Users have the opportunity to engage with—inhabit—the technology by direct manipulation. Moreover, this space allows for more than one user; essentially, it invites multiple users.

When using smart boards information is able to be introduced to students in a new, fun, and engaging way. Teachers and/or students are able to draw on the board using different colors. This can help focus ones attention on particular areas of the screen. The marks made on the smart board are able to be erased. This makes it easy to show the information in its original form. When using smart boards teaching and learning become a more active experience for both the student and the teacher.

Locus of Control remains an important consideration in successful engagement of E-learners whether using the Smart Board or another E-learning modality. According to

the work of Cassandra B. Whyte, the continuing attention to aspects of motivation and success in regard to E-learning should be kept in context and concert with other educational efforts. Information about motivational tendencies can help educators, psychologists, and technologists develop insights to help students perform better academically.

Technology-Enhanced Learning (TEL)

Technology enhanced learning (TEL) has the goal to provide socio-technical innovations (also improving efficiency and cost effectiveness) for e-learning practices, regarding individuals and organizations, independent of time, place and pace. The field of TEL therefore applies to the support of any learning activity through technology.

Technology Issues

Along with the terms *learning technology*, *instructional technology*, and Educational Technology, the term is generally used to refer to the use of technology in learning in a much broader sense than the computer-based training or *Computer Aided Instruction* of the 1980s. It is also broader than the terms *Online Learning* or *Online Education* which generally refer to purely web-based learning. In cases where mobile technologies are used, the term M-learning has become more common. E-learning, however, also has implications beyond just the technology and refers to the actual learning that takes place using these systems.

E-learning is naturally suited to distance learning and flexible learning, but can also be used in conjunction with face-to-face teaching, in which case the term Blended learning is commonly used. E-Learning pioneer Bernard Luskin argues that the “E” must be understood to have broad meaning if e-Learning is to be effective. Luskin says that the “e” should be interpreted to mean exciting, energetic, enthusiastic, emotional, extended, excellent, and educational

in addition to “electronic” that is a traditional national interpretation. This broader interpretation allows for 21st century applications and brings learning and media psychology into the equation.

In higher education especially, the increasing tendency is to create a Virtual Learning Environment (VLE) (which is sometimes combined with a Management Information System (MIS) to create a Managed Learning Environment) in which all aspects of a course are handled through a consistent user interface standard throughout the institution. A growing number of physical universities, as well as newer online-only colleges, have begun to offer a select set of academic degree and certificate programs via the Internet at a wide range of levels and in a wide range of disciplines. While some programs require students to attend some campus classes or orientations, many are delivered completely online. In addition, several universities offer online student support services, such as online advising and registration, e-counseling, online textbook purchase, student governments and student newspapers.

E-Learning can also refer to educational web sites such as those offering learning scenarios, worksheets and interactive exercises for children. The term is also used extensively in the business sector where it generally refers to cost-effective online training. The recent trend in the E-Learning sector is screencasting. There are many screencasting tools available but the latest buzz is all about the web based screencasting tools which allow the users to create screencasts directly from their browser and make the video available online so that the viewers can stream the video directly. The advantage of such tools is that it gives the presenter the ability to show his ideas and flow of thoughts rather than simply explain them, which may be more confusing when delivered via simple text

instructions. With the combination of video and audio, the expert can mimic the one on one experience of the classroom and deliver clear, complete instructions. From the learner's point of view this provides the ability to pause and rewind and gives the learner the advantage of moving at their own pace, something a classroom cannot always offer.

Communication Technologies Used in E-learning

Communication technologies are generally categorized as asynchronous or synchronous. *Asynchronous* activities use technologies such as blogs, wikis, and discussion boards. The idea here is that participants may engage in the exchange of ideas or information without the dependency of other participants involvement at the same time. Electronic mail (Email) is also asynchronous in that mail can be sent or received without having both the participants' involvement at the same time. Asynchronous learning also gives students the ability to work at their own pace. This is particularly beneficial for students who have health problems. They have the opportunity to complete their work in a low stress environment.

Synchronous activities involve the exchange of ideas and information with one or more participants during the same period of time. A face to face discussion is an example of synchronous communications. *Synchronous* activities occur with all participants joining in at once, as with an online chat session or a virtual classroom or meeting.

Virtual classrooms and meetings can often use a mix of communication technologies. Participants in a virtual classroom use icons called emoticons to communicate feelings and responses to questions or statements. Students are able to 'write on the board' and even share their desktop, when given rights by the teacher. Other communication technologies available in a virtual classroom include text

notes, microphone rights, and breakout sessions. Breakout sessions allow the participants to work collaboratively in a small group setting to accomplish a task as well as allow the teacher to have private conversations with his or her students.

In *asynchronous* online courses, students proceed at their own pace. If they need to listen to a lecture a second time, or think about a question for awhile, they may do so without fearing that they will hold back the rest of the class. Through online courses, students can earn their diplomas more quickly, or repeat failed courses without the embarrassment of being in a class with younger students. Students also have access to an incredible variety of enrichment courses in online learning, and can participate in college courses, internships, sports, or work and still graduate with their class.

In many models, the writing community and the communication channels relate with the E-learning and the M-learning communities. Both the communities provide a general overview of the basic learning models and the activities required for the participants to join the learning sessions across the virtual classroom or even across standard classrooms enabled by technology. Many activities, essential for the learners in these environments, require frequent chat sessions in the form of virtual classrooms and/or blog meetings.

Learning Management System (LMS) and Learning Content Management System (LCMS)

A learning management system (LMS) is software used for delivering, tracking and managing training/education. LMSs range from systems for managing training/educational records to software for distributing courses over the Internet and offering features for online collaboration.

A learning content management system (LCMS) is software for authoring, editing and indexing e-learning content (courses, reusable content objects). An LCMS may be solely dedicated to producing and publishing content that is hosted on an LMS, or it can host the content itself. The Aviation Industry Computer-Based Training Committee (AICC) specification provides support for content that is hosted separately from the LMS.

A LMS allows for teachers and administrators to track attendance, time on task, and student progress. LMS also allows for not only teachers and administrators to track these variables but parents and students as well. Parents can log on to the LMS to track grades. Students log on to the LMS to submit homework and to access the course syllabus and lessons.

Computer-aided Assessment

Computer-aided Assessment (also but less commonly referred to as E-assessment), ranging from automated multiple-choice tests to more sophisticated systems is becoming increasingly common. With some systems, feedback can be geared towards a student's specific mistakes or the computer can navigate the student through a series of questions adapting to what the student appears to have learned or not learned.

The best examples follow a Formative Assessment structure and are called "Online Formative Assessment". This involves making an initial formative assessment by sifting out the incorrect answers. The author/teacher will then explain what the pupil should have done with each question. It will then give the pupil at least one practice at each slight variation of sifted out questions. This is the formative learning stage. The next stage is to make a Summative Assessment by a new set of questions only

covering the topics previously taught. Some will take this even further and repeat the cycle such as BOFA which is aimed at the Eleven plus exam set in the UK. The term *learning design* has sometimes come to refer to the type of activity enabled by software such as the open-source system LAMS which supports sequences of activities that can be both adaptive and collaborative. The IMS Learning Design specification is intended as a standard format for learning designs, and IMS LD Level A is supported in LAMS V2. elearning has been replacing the traditional settings due to its cost effectiveness.

Electronic Performance Support Systems (EPSS)

Electronic performance support systems (EPSS) is a “computer-based system that improves worker productivity by providing on-the-job access to integrated information, advice, and learning experiences”. 1991, Barry Raybould

Content Issues

Content is a core component of E-learning and includes issues such as pedagogy and learning object re-use.

Pedagogical Elements

Pedagogical elements are an attempt to define structures or units of educational material. For example, this could be a lesson, an assignment, a multiple choice question, a quiz, a discussion group or a case study. These units should be format independent, so although it may be in any of the following methods, pedagogical structures would not include a textbook, a web page, a video conference or Podcast.

When beginning to create E-Learning content, the pedagogical approaches need to be evaluated. Simple pedagogical approaches make it easy to create content, but lack flexibility, richness and downstream functionality. On the other hand, complex pedagogical approaches can

be difficult to set up and slow to develop, though they have the potential to provide more engaging learning experiences for students. Somewhere between these extremes is an ideal pedagogy that allows a particular educator to effectively create educational materials while simultaneously providing the most engaging educational experiences for students.

Pedagogical Approaches or Perspectives

It is possible to use various pedagogical approaches for eLearning which include:

- instructional design – the traditional pedagogy of instruction which is curriculum focused, and is developed by a centralized educating group or a single teacher.
- social-constructivist – this pedagogy is particularly well afforded by the use of discussion forums, blogs, wiki and on-line collaborative activities. It is a collaborative approach that opens educational content creation to a wider group including the students themselves. The One Laptop Per Child Foundation attempted to use a constructivist approach in its project
- Laurillard’s Conversational Model is also particularly relevant to eLearning, and Gilly Salmon’s Five-Stage Model is a pedagogical approach to the use of discussion boards.
- Cognitive perspective focuses on the cognitive processes involved in learning as well as how the brain works.
- Emotional perspective focuses on the emotional aspects of learning, like motivation, engagement, fun, etc.
- Behavioural perspective focuses on the skills and

behavioural outcomes of the learning process. Role-playing and application to on-the-job settings.

- Contextual perspective focuses on the environmental and social aspects which can stimulate learning. Interaction with other people, collaborative discovery and the importance of peer support as well as pressure.
- Mode Neutral Convergence or promotion of 'transmodal' learning where online and classroom learners can coexist within one learning environment thus encouraging interconnectivity and the harnessing of collective intelligence.

Reusability, Standards and Learning Objects

Much effort has been put into the technical reuse of electronically-based teaching materials and in particular creating or re-using *Learning Objects*. These are self contained units that are properly tagged with keywords, or other metadata, and often stored in an XML file format. Creating a course requires putting together a sequence of learning objects. There are both proprietary and open, non-commercial and commercial, peer-reviewed repositories of learning objects such as the Merlot repository.

A common standard format for e-learning content is SCORM whilst other specifications allow for the transporting of "learning objects" (Schools Framework) or categorizing metadata (LOM).

These standards themselves are early in the maturity process with the oldest being 8 years old. They are also relatively vertical specific: SIF is primarily pK-12, LOM is primarily Corp, Military and Higher Ed, and SCORM is primarily Military and Corp with some Higher Ed. PESC- the Post-Secondary Education Standards Council- is also making headway in developing standards and learning

objects for the Higher Ed space, while SIF is beginning to seriously turn towards Instructional and Curriculum learning objects.

In the US pK12 space there are a host of content standards that are critical as well- the NCES data standards are a prime example. Each state government's content standards and achievement benchmarks are critical metadata for linking e-learning objects in that space.

An excellent example of e-learning that relates to knowledge management and reusability is Navy E-Learning, which is available to Active Duty, Retired, or Disable Military members. This on-line tool provides certificate courses to enrich the user in various subjects related to military training and civilian skill sets. The e-learning system not only provides learning objectives, but also evaluates the progress of the student and credit can be earned toward higher learning institutions. This reuse is an excellent example of knowledge retention and the cyclical process of knowledge transfer and use of data and records.

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3

Computer-Based Learning Management Systems: An Overview

COMPUTER-BASED ASSESSMENT

A Computer-Based Assessment (CBA), also known as Computer-Based Testing (CBT), e-assessment, computerized testing and computer-administered testing, is a method of administering tests in which the responses are electronically recorded, assessed, or both. As the name implies, Computer-Based Assessment makes use of a computer or an equivalent electronic device such as a cell phone or PDA. CBA systems enable educators and trainers to author, schedule, deliver, and report on surveys, quizzes, tests and exams. Computer-Based Assessment may be a stand-alone system or a part of a virtual learning environment, possibly accessed via the World Wide Web.

Advantages

General advantages of CBA systems over traditional paper-and-pencil testing (PPT) have been demonstrated in several comparative works and include: increased delivery, administration and scoring efficiency; reduced costs for many elements of the testing lifecycle; improved test security resulting from electronic transmission and encryption; consistency and reliability; faster and more controlled test

revision process with shorter response time; faster decision-making as the result of immediate scoring and reporting; unbiased test administration and scoring; fewer response entry and recognition errors; fewer comprehension errors caused by the testing process; improved translation and localization with universal availability of content; new advanced and flexible item types; increased candidate acceptance and satisfaction; evolutionary step toward future testing methodologies.

In addition to traditional testing approaches carried out in a PPT mode, there are a variety of aspects needed to be taken into account when CBA is deployed, such as software quality, secure delivery, reliable network (if Internet-based), capacities, support, maintenance, software costs for development and test delivery, including licenses. Any of the delivery modes, whether Paper-Pencil and/or computer-based, comprises advantages and challenges which can hardly be compared, especially in relation to estimated costs. The use of CBA includes additional benefits which can be achieved from an organisational, psychological, analytical and pedagogical perspective. Many experts agree on the overall added value and advantages of e-testing in large scale assessments.

It is also envisaged that computer-based formative assessment, in particular, will play an increasingly important role in learning, with the increased use of banks of question items for the construction and delivery of dynamic, on-demand assessments. This can be witnessed by current pioneering projects such as the SQA's SOLAR Project.

LEARNING MANAGEMENT SYSTEM

A learning management system (commonly abbreviated as LMS) is a software application for the administration, documentation, tracking, and reporting of training programs,

classroom and online events, e-learning programs, and training content. As described in (Ellis 2009) a robust LMS should be able to do the following:

- centralize and automate administration
- use self-service and self-guided services
- assemble and deliver learning content rapidly
- consolidate training initiatives on a scalable web-based platform
- support portability and standards
- personalize content and enable knowledge reuse.

LMSs range from systems for managing training and educational records, to software for distributing courses over the Internet with features for online collaboration. Corporate training use LMSs to automate record-keeping and employee registration. Student self-service (e.g., self-registration on instructor-led training), training workflow (e.g., user notification, manager approval, wait-list management), the provision of on-line learning (e.g., Computer-Based Training, read & understand), on-line assessment, management of continuous professional education (CPE), collaborative learning (e.g., application sharing, discussion threads), and training resource management (e.g., instructors, facilities, equipment), are dimensions to Learning Management Systems.

Some LMSs are Web-based to facilitate access to learning content and administration. LMSs are used by regulated industries (e.g. financial services and biopharma) for compliance training. They are also used by educational institutions to enhance and support classroom teaching and offering courses to a larger population of learners across the globe.

Some LMS providers include “performance management

systems”, which encompass employee appraisals, competency management, skills-gap analysis, succession planning, and multi-rater assessments (i.e., 360 degree reviews). Modern techniques now employ Competency-based learning to discover learning gaps and guide training material selection. For the commercial market, some Learning and Performance Management Systems include recruitment and reward functionality.

Characteristics

LMSs cater to educational, administrative, and deployment requirements. While an LMS for corporate learning, for example, may share many characteristics with a VLE, or virtual learning environment, used by educational institutions, they each meet unique needs. The virtual learning environment used by universities and colleges allow instructors to manage their courses and exchange information with students for a course that in most cases will last several weeks and will meet several times during those weeks. In the corporate setting a course may be much shorter in length, completed in a single instructor-led event or online session.

The characteristics shared by both types of LMSs include:

- Manage users, roles, courses, instructors, facilities, and generate reports
- Course calendar
- Learning Path
- Student messaging and notifications
- Assessment and testing handling before and after testing
- Display scores and transcripts
- Grading of coursework and roster processing, including wait listing

- Web-based or blended course delivery

Characteristics more specific to corporate learning, which sometimes includes franchisees or other business partners, include:

- Auto enrollment (enrolling Students in courses when required according to predefined criteria, such as job title or work location)
- Manager enrollment and approval
- Boolean definitions for prerequisites or equivalencies
- Integration with performance tracking and management systems
- Planning tools to identify skill gaps at departmental and individual level
- Curriculum, required and elective training requirements at an individual and organizational level
- Grouping students according to demographic units (geographic region, product line, business size, etc.)
- Assign corporate and partner employees to more than one job title at more than one demographic unit

Technical Aspects

Most LMSs are web-based, built using a variety of development platforms, like Java/J2EE, Microsoft .NET or PHP. They usually employ the use of a database like MySQL, Microsoft SQL Server or Oracle as back-end. Although most of the systems are commercially developed and have commercial software licenses there are several systems that have an open-source license.

Learning Content Management System (LCMS)

A learning content management system (LCMS) is a related technology to the learning management system in

that it is focused on the development, management and publishing of the content that will typically be delivered via an LMS. An LCMS is a multi-user environment where developers may create, store, reuse, manage, and deliver digital learning content from a central object repository. The LMS cannot create and manipulate courses; it cannot reuse the content of one course to build another. The LCMS, however, can create, manage and deliver not only training modules but also manage and edit all the individual pieces that make up a catalog of training. LCMS applications allow users to create, import, manage, search for and reuse small units or “chunks” of digital learning content and assets, commonly referred to as learning objects. These assets may include media files developed in other authoring tools, assessment items, simulations, text, graphics or any other object that makes up the content within the course being created. An LCMS manages the process of creating, editing, storing and delivering e-learning content, ILT materials and other training support deliverables such as job aids.

Learning Management Systems compared to Learning Content Management Systems

Some systems have tools to deliver and manage instructor-led synchronous and asynchronous online training based on learning object methodology. These systems are called Learning Content Management Systems or LCMSs. LCMSs provide tools for authoring and reusing or repurposing content (mutated learning objects) MLO as well as virtual spaces for student interaction (such as discussion forums, live chat rooms and live web-conferences). Despite this distinction, the term LMS is often used to refer to both an LMS and an LCMS, although the LCMS is a further development of the LMS. Due to this conformity issue, the acronym CLCIMS (*Computer Learning Content*

Information Management System) is now widely used to create a uniform phonetic way of referencing any learning system software based on advanced learning technology methodology.

In essence, an LMS is software for planning, delivering, and managing learning events within an organization, including online, virtual classroom, and instructor-led courses. For example, an LMS can simplify global certification efforts, enable entities to align learning initiatives with strategic goals, and provide a means of enterprise-level skills management. The focus of an LMS is to manage students, keeping track of their progress and performance across all types of training activities. It performs administrative tasks, such as reporting to instructors, HR and other ERP systems but isn't used to create course content. By contrast, an LCMS is software for managing learning content across an organization's various training development areas. It provides developers, authors, instructional designers, and subject matter experts the means to create and re-use e-learning content and reduce duplicated development efforts. In the remote AICC hosting approach, an LCMS may host the content in a central repository and allow multiple LMSs to access it.

Primary business problems an LCMS solves are

- centralized management of an organization's learning content for efficient searching and retrieval,
- productivity gains around rapid and condensed development timelines,
- productivity gains around assembly, maintenance and publishing / branding / delivery of learning content.

Rather than developing entire courses and adapting them to multiple audiences, an LCMS provides the ability

for single course instances to be modified and republished for various audiences maintaining versions and history. The objects stored in the centralized repository can be made available to course developers and content experts throughout an organization for potential reuse and repurpose. This eliminates duplicate development efforts and allows for the rapid assembly of customized content.

To look at this another way, an LMS is learner-centric. It focuses on e-learning process management and content delivery. In essence, an LMS is software for planning, delivering and managing learning events within an organization, including online, virtual classroom, and instructor-led courses. For example, an LMS can simplify global certification efforts, enable entities to align learning initiatives with strategic goals and provide a means for enterprise-level skills management. The focus of an LMS is to manage students, keeping track of their progress and performance across all types of training activities. It performs administrative tasks, such as reporting to instructors, HR and other ERP systems but it isn't used to create course content.

An LCMS is content-centric. Here, the focus is on the authoring and management of e-learning reusable content.

By contrast, LCMS solutions are ideally suited to create content-centric learning strategies, supporting multiple methods for gathering and organizing content, leveraging content for multiple purposes, and operation for mission critical purposes. LCMS technology can either be used in tandem with an LMS, or as a standalone application for learning initiatives that require rapid development and distribution of learning content.

Rather than developing entire courses and adapting them to multiple audiences, an LCMS is designed for

managing learning content across an organization's various training development areas. It provides developers, authors, instructional designers, and subject matter experts the means to create and re-use e-learning content and reduce duplicated development efforts. An LCMS provides the ability for single course instances to be modified and republished for various audiences maintaining versions and history. The objects stored in the centralized repository can be made available to course developers and content experts throughout an organization for potential reuse and repurpose. This allows for the rapid assembly of customized content.

In addition, Brandon Hall believes that: "when LCMS technology is appropriately applied and matched to an orchestrated e-learning strategy, with a complete instructional design plan for designing and using learning objects, great efficiencies can and will be achieved, such as:

- The ability to make instantaneous, company-wide changes to critical learning content
- Rapid and productive content development efforts
- Seamless collaboration among subject matter experts and course designers
- The ability to create multiple, derivative versions of content applicable to different audiences from senior management to line-level workers
- Access to find and reuse learning content, 'just-in-time' and 'just enough'
- Ultimate reusability of content by making it available through a wide array of output types such as structured e-learning courses, CD-ROM courses, learning material available from a Palm device or PocketPC, print-based learning for use in classroom settings, and so on."

Learning Management Industry

In the relatively new LMS market, commercial vendors for corporate and education applications range from new entrants to those that entered the market in the nineties. In addition to commercial packages, many open source solutions are available.

As reported in (Bersin et al. 2009), LMSs represent an \$860 million market, made up of more than 60 different providers. The six largest LMS product companies constitute approximately 50% of the market. In addition to the remaining smaller LMS product vendors, training outsourcing firms, enterprise resource planning vendors, and consulting firms all compete for part of the learning management market. Approximately 40 percent of U.S. training organizations reported that they have an LMS installed, a figure that has not changed significantly over the past two years. The small business market offers the greatest opportunity for growth, as only 36 percent of these companies are using an LMS. Many of these businesses would like a low-cost, easy-to-use, easy-to-maintain system – but, as yet, they are not willing to make the commitment. An LMS is still a nontrivial investment in money and resources.

According to a 2009 report by American Society for Training and Development (ASTD) 91 percent of ASTD respondents are using LMS's in their organizations, with more than half purchasing rather than building their systems, and one-fifth of respondents opting to go with a hosted platform. And whether built or bought, the majority of respondents are satisfied with their current LMS, with 22.2 percent very satisfied, 31.1 percent satisfied, and 25.6 percent somewhat satisfied. Still, some 13.3 said they were unsatisfied, and 8.8 said they were very unsatisfied.

Most buyers of LMSs utilize an authoring tool to create their e-learning content, which is then hosted on an LMS. In many cases LMSs include a primitive authoring tool for basic content manipulation. For advanced content creation buyers must choose an authoring software that integrates with their LMS in order for their content to be hosted. There are authoring tools on the market, which meet AICC and SCORM standards and therefore content created in tools such as these can be hosted on an AICC or SCORM certified LMS. By May 2010, ADL had validated 301 SCORM-certified products while 329 products were compliant.

Trends

Another upcoming trend in this technology is 'Channel Learning' where organizations are sharing online contents and learning from their partner firms. According to a survey by trainingindustry.com, for many buyers channel learning is not their number one priority, but often there is a gap when the HR department oversees training and development initiatives, where the focus is consolidated inside traditional corporate boundaries. Software technology companies are at the front end of this curve, placing higher priority on channel trainings.

Today the biggest trend in the e-learning market is for these systems to be integrated with 'Talent Management Systems'. A talent management software serves towards the process of recruiting, managing, assessing, developing and maintaining an organization's most important resources. Bersin research shows that in 2009 more than 70 percent of large companies have an LMS already and almost one third of these companies are considering replacing or upgrading these systems with integrated talent management systems.

LIST OF LEARNING MANAGEMENT SYSTEMS

The following is a list of learning management systems.

Open Source Learning Management Systems

- aTutor
- Claroline
- Chamilo
- DoceboLMS
- Dokeos
- eFront
- ILIAS
- Instructure
- Moodle
- OLAT
- Sakai
- WeBWorK

Proprietary Learning Management Systems

- Alphastudy
- Blackboard Learning System
- CERTPOINT Systems Inc.
- Desire2Learn
- QuestionMark
- CCNet
- Coggno
- eCollege
- Fedena
- GeoLearning
- GlobalScholar
- Glow (Scottish Schools National Intranet)
- Gyrus Systems
- HotChalk

- Informetica
- it's learning
- ITWorx CLG (Connected Learning Gateway)
- JoomlaLMS
- Learn.com
- Meridian Knowledge Solutions
- Plateau Systems
- Saba Software
- Scipio
- SharePointLMS
- SSLearn
- Thinking Cap LMS
- Vitalect
- WebStudy Learning LMS

Historical

- CourseInfo LLC
- WebCT (acquired by Blackboard in February 2006)
- ANGEL Learning (acquired by Blackboard in May 2009)

INTELLIGENT TUTORING SYSTEM

An intelligent tutoring system (ITS) is any computer system that provides direct customized instruction or feedback to students, i.e. without the intervention of human beings, whilst performing a task. Thus, ITS implements the theory of learning by doing. An ITS may employ a range of different technologies. However, usually such systems are more narrowly conceived of as artificial intelligence systems, more specifically expert systems made to simulate aspects of a human tutor. Intelligent Tutor Systems have been around since the late 1970s, but increased in popularity in the 1990s.

The Structure of an ITS System

Intelligent tutoring systems consist of four different subsystems or modules: the interface module, the expert module, the student module, and the tutor module. The *interface module* provides the means for the student to interact with the ITS, usually through a graphical user interface and sometimes through a rich simulation of the task domain the student is learning (e.g., controlling a power plant or performing a medical operation). The *expert module* references an expert or domain model containing a description of the knowledge or behaviors that represent expertise in the subject-matter domain the ITS is teaching—often an expert system or cognitive model. An example would be the kind of diagnostic and subsequent corrective actions an expert technician takes when confronted with a malfunctioning thermostat. The *student module* uses a student model containing descriptions of student knowledge or behaviors, including his misconceptions and knowledge gaps. An apprentice technician might, for instance, believe a thermostat also signals too high temperatures to a furnace (misconception) or might not know about thermostats that also gauge the outdoor temperature (knowledge gap). A mismatch between a student's behavior or knowledge and the expert's presumed behavior or knowledge is signaled to the *tutor module*, which subsequently takes corrective action, such as providing feedback or remedial instruction. To be able to do this, it needs information about what a human tutor in such situations would do: the tutor model.

An intelligent tutoring system is only as effective as the various models it relies on to adequately model expert, student and tutor knowledge and behavior. Thus, building an ITS needs careful preparation in terms of describing the knowledge and possible behaviors of experts, students and tutors. This description needs to be done in a formal

language in order that the ITS may process the information and draw inferences in order to generate feedback or instruction. Therefore a mere description is not enough; the knowledge contained in the models should be organized and linked to an inference engine. It is through the latter's interaction with the descriptive data that tutorial feedback is generated.

Use in Practice

All this is a substantial amount of work, even if authoring tools have become available to ease the task. This means that building an ITS is an option only in situations in which they, in spite of their relatively high development costs, still reduce the overall costs through reducing the need for human instructors or sufficiently boosting overall productivity. Such situations occur when large groups need to be tutored simultaneously or many replicated tutoring efforts are needed. Cases in point are technical training situations such as training of military recruits and high school mathematics. One specific type of intelligent tutoring system, Cognitive Tutors, has been incorporated into mathematics curricula in a substantial number of United States high schools, producing improved student learning outcomes on final exams and standardized tests. Intelligent tutoring systems have been constructed to help students learn geography, circuits, medical diagnosis, computer programming, mathematics, physics, genetics, chemistry, etc. Intelligent Language Tutoring Systems (ILTS), e.g. this one, teach natural language to first or second language learners. ILTS requires specialized natural language processing tools such large dictionaries, and morphological and grammatical analyzers with acceptable coverage.

ITS Conference

The Intelligent Tutoring Systems conference was

typically held every other year in Montreal (Canada) by Claude Frasson and Gilles Gauthier in 1988, 1992, 1996 and 2000; in San Antonio (US) by Carol Redfield and Valerie Shute in 1998; in Biarritz (France) and San Sebastian (Spain) by Guy Gouarderes and Stefano Cerri in 2002; in Maceio (Brazil) by Rosa Maria Vicari and Fábio Paraguacu in 2004; in Jhongli (Taiwan) by Tak-Wai Chan in 2006. The conference was recently back in Montreal in 2008 (for its 20th anniversary) by Roger Nkambou and Susanne Lajoie. ITS'2010 was held in Pittsburgh (US) by Jack Mostow, Judy Kay, and Vincent Aleven. The International Artificial Intelligence in Education (AIED) Society (<http://iaied.org>) publishes *The International Journal of Artificial Intelligence in Education (IJAIED)* and produces the International Conference on Artificial Intelligence in Education every odd numbered year. The American Association of Artificial Intelligence (AAAI)(www.aaai.org) sometimes has symposia and papers related to intelligent tutoring systems. A number of books have been written on ITS including three published by Lawrence Erlbaum Associates.

INSTRUCTIONAL TECHNOLOGY

In education, instructional technology is “the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning,” according to the Association for Educational Communications and Technology (AECT) Definitions and Terminology Committee. Instructional technology is often referred to as a part of educational technology but the use of these terms has changed over the years. While instructional technology covers the processes and systems of learning and instruction, educational technology includes other systems used in the process of developing human capability.

History

The first use of instructional technology cannot be attributed to a specific person or time. Many histories of instructional technology start in the early 20th century, while others go back to the 17th century. This depends on the definition of *instructional technology*. Definitions that focus on a systems approach tend to reach further back in history, while those definitions focused on sensory devices are more recent.

The use of audio and visual instruction was boosted as a military response to the problems of a labor shortage during World War II in the United States. There was a definitive need to fill the factories with skilled labor. Instructional technology provided a methodology for training in a systematic and efficient manner.

With it came the use of highly structured manuals, instructional films, and standardized tests. Thomas Edison saw the value of instructional technology in films but did not formalize the science of instruction as the US military did so well.

Current Status

Instructional technology is a growing field of study which uses technology as a means to solve educational challenges, both in the classroom and in distance learning environments.

While instructional technology promises solutions to many educational problems, resistance from faculty and administrators to the use of technology in the classroom is not unusual. This reaction can arise from the belief—or fear—that the ultimate aim of instructional technology is to reduce or even remove the human element of instruction. However, most instructional technologists would counter

that education will always require human intervention from instructors or facilitators.

Many graduate programs are producing instructional designers, who increasingly are being employed by industry and universities to create materials for distance education programs. These professionals often employ e-learning tools, which provide distance learners the opportunity to interact with instructors and experts in the field, even if they are not located physically close to each other.

More recently a new form of Instructional technology known as Human Performance Technology has evolved. HPT focuses on performance problems and deals primarily with corporate entities.

Relation to Learning Theory

The purpose of instructional technology, of course, is the promotion of learning. Learning theory (education) has influenced Instructional design and Instructional designers (the practitioners of Instructional Technology). Instructional Technologies promote communication and interactivity. These two come together under the general heading of Interaction. Moore (1989) argues that there are three types of learner interaction (learner-content, learner-instructor, and learner-learner interactions). In the years since Moore's article, several philosophical views have surfaced that relate Instructional technology to these types of interaction. Most traditional researchers (those subscribing to Cognitivism) argue that learner-content interaction is perhaps the most important endeavor of Instructional technology. Some researchers (those subscribing to constructivism) argue that Moore's social interactions, (learner-instructor and learner-learner interactions), are as useful as learner-content interaction.

Areas

Razavi (2005) advocates the idea that educational technology covers instructional technology. It includes instructional technology and the field study in human teaching and learning. So educational technology is broader than instructional technology. Instructional technology itself consists of two major parts: one is teaching technology and the other is learning technology. In the education industry, the term “instructional technology” is frequently used interchangeably with “educational technology.” Human Performance Technology (HPT) has a focus on corporate environments. Learning sciences is a growing area of focus dealing instructional techniques and learning theories.

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4

Focus on Computer Assisted Language Learning

MOBILE ASSISTED LANGUAGE LEARNING

Definition

Mobile Assisted Language Learning (MALL) describes an approach to language learning that is assisted or enhanced through the use of a handheld mobile device.

MALL is a subset of both Mobile Learning (m-learning) and Computer-assisted language learning (CALL). MALL has evolved to support students' language learning with the increased use of mobile technologies such as mobile phones (cellphones), MP3 and MP4 players, PDAs and devices such as the iPhone or iPad. With MALL, students are able to access language learning materials and to communicate with their teachers and peers at any time, anywhere.

History

1980s

- Twarog and Pereszlenyi Pinter used telephones to provide distant language learners with feedback and assistance.

1990s

- Instructors at Brigham Young University-Hawaii taught a distance education English course from Hawaii to Tonga via telephone and computer (Green, Collier, & Evans, 2001)

2000s

- Dickey (2001) utilized teleconferencing to teach an English conversation course to students in South Korea.
- Stanford University learning lab used integrated mobile phones in a Spanish learning program in 2001 (Brown, 2001).
- Thornton and Houser (2002; 2003; 2005) developed several innovative projects using mobile phones to teach English at a Japanese university. They also developed a course management system, Poodle, to facilitate deploying language learning material to mobile phones.
- City College Southampton developed a web based “media board” (similar to a web-board but supporting Multimedia Messaging Service (MMS) as well as Short Message Service (SMS) and supplied learners of English as a Second Language (ESL) with mobile phones with inbuilt cameras and voice recording facilities (JISC, 2005).
- University of Wisconsin–Madison, developed several foreign language courses which have used wireless handheld computers for various classroom activities (Samuels, 2003).
- Duke University provided all incoming freshmen with free iPods equipped with voice recorders. Amongst the pilot courses utilizing the players were several language courses, which utilized both

their listening and recording capabilities (Belanger, 2005).

- United Kingdom's Open University used voice recorders and mini-camcorders to record interviews with other students and locals and to create audiovisual tours in distance-learning German and Spanish course (Kukulka-Hulme, 2005). The Open University also recently used mobile phones for language learning
- A project in Ireland used MALL for Irish Language learning and assessment
- The Learning Federation (TLF) used MALL for Indonesian Language learning across three states

Current Trends

Today, due to the growth of wireless and emerging technologies, MALL is available through numerous devices including mobile phones, iPods, tablet PCs, hand-held computers, PDAs, MP3 players, Smartphones and more. MALL designers have begun to move away from merely copying the traditions of standard non-mobile language learning and are implementing techniques that maximize the benefits of these new devices. The increasing number of possible delivery tools has spawned a wide-range of mobile language learning programs, from very-short tutorials to full courses. The number of people capable of producing MALL content is also on the rise, due largely to a combination of increased popularity, demand and the advent of content generation tools that simplify the programming process through the use of templates and macros.

MALL currently serves not only as a primary source of language education for students but also supports the retention and utilization of newly-acquired language skills—however they were acquired. Through mobile participation

in short exercises and tasks, learners are able to keep their linguistic talents sharp while reducing the risk of degradation of valuable knowledge, skills and abilities.

The Future of MALL

Consensus among the limited literature and studies available specifically about MALL indicate that the demand for it will only increase—along with the demand for second language acquisition and learning flexibility. Predicted growth is reinforced by the overall decrease in free time. With people working longer hours, the time necessary for formal, traditional classroom-based or even standard online courses will decrease. MALL will be an ideal solution to busy students and professionals seeking to acquire one or more new languages.

What mobile devices lack in capability (regarding sound and video quality and screen size) they make up for in portability. In the future, however, we can expect mobile devices to deliver better quality than is currently available among most mobile devices. It is expected that designers will capitalize on this increase in quality—designing MALL programs that employ student-focused, media-rich, flexible and collaborative learning strategies. Additionally, changes in the cost and availability of wireless service—a luxury to most in the not-too-distant past—will make MALL available to a far wider and diverse audience.

MALL Professional Organizations

At the writing of this article, it is difficult to find organizations that focus specifically on Mobile Assisted Language Learning. Some of the resources for MALL are primarily language learning websites with some space dedicated to technology in language learning. Other resources are primarily educational technology websites that dedicate some of their efforts to language learning.

- Handheld Learning – Promotes learning with mobile or ubiquitous technologies. Their conference is the international signature event for learning using mobile or ubiquitous technologies. <http://www.handheldlearning.co.uk/>
- SALT conference include sessions on learning languages over mobile phones
- Mobile Learning Global Consortium – This LinkedIn group serves as a collaborative forum for the ways and methods being used to push the envelope beyond the cutting edge of mobility, which help people learn, connect, and achieve, as it relates to academia, government, industry, and the mass consumer market.
- WMUTE - Wireless, Mobile and Ubiquitous Technologies in Education. WMUTE provides opportunity for communication among local and international researchers, and for researchers to be acquainted with the market needs related to mobile learning. <http://www.wmute2008.org/index.htm>

Collaborative Learning in MALL

Collaborative learning is the acquisition of knowledge, skills or attitudes occurring in individuals as a result of group interaction. Collaborative learning is a student-centered approach to learning where the instructor is more like a facilitator than a teacher.

Unlike other techniques collaborative learning encourages all involved to help support and motivate each other to achieve the learning goal. Because the collaborative learning is student-centered it often succeeds in engaging the learner. A language can be learned through collaborative learning with the use of mobile devices But mobile devices

don't actually drive the learning, learners do. The devices, be they phones, palm pilots or laptops, are used as tools, like a pencil or calculator, to accentuate or aid the learning process.

Duke University's use of iPods in 2004 is an example of using collaborative learning in MALL. The university provided a new tool for the students, particularly those taking a language course. The students in language courses used the iPods in various ways, including working collaboratively with language tutors. The students would record themselves completing an oral assignment and the tutors provided feedback on their assignment. The students also used the iPods to record conversations in the language they were learning, downloading podcasts, store and listen to songs in the language they were learning.

Collaborating on mobile devices is dependent on the device. The following are examples of collaborative learning using mobile devices:

- Collaboration on a mobile phone can be achieved by asynchronous text messaging and instant messaging or a phone conversation. In each instance learning can take place but the phones serve only as the delivery method for that information.
- A tablet PC or a PDA can allow learners to collaborate on documents while at different locations, find information from multiple sources to build ideas with partners, and make information about learning activities portable and easily accessible.

The effectiveness of collaborating varies on the project and mobile device.

Affordances and Constraints

Enhancing language learning through MALL affords

some dynamics not available through the traditional classroom that the language learner can take advantage of. Some of these affordances are even unique to m-learning compared to regular e-learning. In the same way, there are some constraints to m-learning that limit what can be done in language acquisition through m-learning compared to traditional e-learning or classroom learning.

Among the most noted affordances for MALL is ubiquitous access to learning anytime at any place that the user has reception. Compared to classroom or e-learning, the user does not need to be sitting in a classroom or at a computer to access learning materials. This enables users to brush up on language skills just before or just after a conversation in the language they are learning. Handheld delivery also affords new dynamics for collaborative learning as users can share the language learning process in small synchronous groups (Nah, et al. 2008).

Kloper et al. (2002) claimed 5 properties of mobile devices which can produce unique educational affordances:

- Portability-the small size and weight of mobile devices means they can be taken to different sites or moved around within a site.
- Social interactivity-data exchange and collaboration with other learners can happen face-to-face.
- Context sensitivity-mobile devices can both gather and respond to real or simulated data unique to the current location, environment and time.
- Connectivity-a shared network can be created by connecting mobile devices to data collection devices, other devices or to a common network.
- Individuality- scaffolding for difficult activities can be customized for individual learners.

The most notable constraints for earlier MALL include poor sound and display quality coupled with very limited devices and download speeds. Newer integrated PDA devices have narrowed the gap with higher access speeds, larger screens, having functions and capacities similar to laptop computers (Nah, et al. 2008).

MALL Resources

As with Professional Organizations, resources that focus specifically on Mobile Assisted Language Learning are not common (check Augmented Reality Language Learning). We more often find resources that are primarily language learning websites with some space dedicated to technology in language learning and vice-versa.

Belanger, Y. "Duke University iPod first year experience final evaluation report".2005. http://cit.duke.edu/pdf/ipod_initiative_04_05.pdf

BJET - British Journal of Educational Technology <http://www.blackwellpublishing.com/journal.asp?ref=0007-1013> (2008 vol. 39)

Brown, E. (Ed.) "Mobile learning explorations at Stanford Learning Lab." <http://sll.stanford.edu/projects/tomprof/newtomprof/postings/290.html>2001

Green, B.A., Collier, K.J., & Evans, N. "Teaching tomorrow's class today: English by telephone and computer from Hawaii to Tonga." In L.E. Henrichsen (Ed.), *Distance-learning program* (pp. 71–82). Alexandria, VA: Teachers of English to Speakers of Other Language, Inc. 2001

IJEL - International Journal on e-Learning <http://www.ace.org/pubs/IJEL/> (Specific volumes dedicated to m-learning)

IRRODL - International Review of Research in Open

and Distance Learning <http://www.irrodl.org/> (2007 Vol. 8, No. 2)

JCAL - Journal of Computer Assisted Learning <http://www.blackwellpublishing.com/journal.asp?ref=0266-4909&site=1> (2003 vol. 19, 2005 vol. 21)

JISC - Joint Information Systems Committee. Multimedia learning with mobile phones. Innovative Practices with Elearning. Case studies: Anytime, any place Learning. 2005 http://www.jisc.ac.uk/uploaded_documents/southampton.pdf

[BOOK] Klopfer, Eric. "Augmented Learning: Research and Design of Mobile Educational Games." MIT Press, 2008.

Klopfer, E, Squire, K and Jenkins, H. "Environmental Detectives: PDAs as a window into a virtual simulated world." Proceedings of IEEE International Workshop on Wireless and Mobile Technologies in Education. Vaxjo, Sweden: IEEE Computer Society, 95-98 2002

[BOOK] Kululka-Hulme, Agnes. Traxler, John. "Mobile Learning: A Handbook For Educators and Trainers (The Open and Flexible Learning Series)." Routledge, 2005.

Language Learning & Technology - Language Learning & Technology is a refereed journal which began publication in July 1997. The journal seeks to disseminate research to foreign and second language educators in the US and around the world on issues related to technology and language education. <http://lt.msu.edu/>

[REPORT] Menzies, David. "Duke University iPod First-Year Experience." Duke's University Center for Instructional Technology coordinated an evaluation of the academic use of iPod, drawing on course-level feedback; student and

faculty focus groups; a broad survey of first-year students and faculty; and discussions and feedback among staff, administrators and important campus stakeholder groups. This evaluation focused on the feasibility and effectiveness of the iPod as a tool for faculty and student academic use. This report summarizes the main findings of this collaborative assessment effort.

COMPUTER LANGUAGES

Why Don't We Just Use English?

Natural languages, such as English, are ambiguous, fuzzily structured and have large (and changing) vocabularies. Computers have no common sense, so computer languages must be very precise — they have relatively few, exactly defined, rules for composition of programs, and strictly controlled vocabularies in which unknown words must be defined before they can be used. It is a major goal of research in Artificial Intelligence to find out how to make computers understand natural languages, and the more we learn, the harder it seems to be!

Why Don't We Just Use Assembly Language?

Sometimes we have to use assembly language (Low-Level Language, LLL) because there just isn't any other sensible way of telling the computer what it must do. However, most programming is done in High-Level Languages (HLLs), so what benefits does this bring? The most important answer is productivity - it is usually easier, or more cost-effective, to use a HLL. Some of the reasons for this are:

- easy to write: useful concepts & facilities, relevant to application
- easy to read: computer, your future self, others - for reuse, maintenance, enhancement etc.

- portability: other compiler/toolset suppliers, users, computers - standards
- error detection & reporting

How Many Computer Languages are There?***Late 1940s***

first electronic computers & LLLs

1950s

First HLLs for computers

1969

About 120 HLLs, about 15 in widespread use

1977

About 80 HLLs in active (non-trivial) use

Today

More than 2000 HLLs

Why Do We Use More than One Computer Language?

Different kinds of languages emphasise different things about the problem, and so are better at describing different aspects of the solution, or even different kinds of problems and solutions. Computer Science is ever-changing, so there is continual evolution of the concepts we need to use and the notations for describing these concepts.

For example, Operational languages express how something is achieved, and make the reader work out what is being achieved. Declarative languages express what must be achieved, and make the system work out how to achieve it.

The earliest languages had few restrictions, so they were very powerful, but turned out to be very dangerous to use. After a while, people developed languages that were

much safer to use, but there were complaints about their lack of power. Nowadays, we are starting to see languages that are both safe and powerful, but the process has a long way to go yet.

What are the Important Differences between Computer Languages?

Saying the Same Thing in Different Ways - Syntactic Differences

infix

$$a = b + c$$

prefix

(set a, (add b, c))

postfix

$$b c + a =$$

“english”

ADD b TO c GIVING a

distributed

PAR

to_a \rightarrow b + c

to_a ? a

Saying Different Things - Semantic Differences

Imperative Paradigm

The very earliest languages had to be based on something, and that was probably simple instructions give to humans without much vocabulary or common sense i.e. children. The basic ideas are about describing state (e.g. the current state, or a desired next state, of a particular set of things), the actions that modify the state, and the sequence of the actions. In a computation, state is

represented by the values of registers (PC etc.) and memory (variables etc.). e.g. making tea:

```
declare kettle, teapot, water, tea_leaves;  
kettle= water;  
boil (kettle);  
teapot= tea_leaves;  
teapot= teapot + kettle;
```

However, although this is intuitive for simple problems, it became clear that this did not scale well - i.e. it becomes disproportionately hard to use as problem size increases. To determine whether a program will work correctly, we must examine e.g. all possible combinations of actions on all of the state.

To reduce the number of possible combinations, we can control:

- which actions are permitted on different parts of the state - type checking
- whereabouts in the program particular actions can be used or parts of the state accessed - scope

Increasing awareness of scope and type checking carried language design in two directions. The main stream of language design included these ideas in most programming languages, and gave rise to new programming paradigms which maximised the control over state (objects), or minimised the use of state (functional, logic). However, as the problem became better understood, it became clear that in some situations it could be an advantage to avoid scopes and types altogether (scripting).

Object Oriented Paradigm

This is similar to Imperative but with maximum use of types & scopes - keep state in objects, each type of object

(class) having its own set of actions (methods). Furthermore, the state in an object can often only be accessed or modified via its associated methods.

Functional Paradigm

Functional languages emphasise the transformations of values (so the notation usually makes it easy to describe & examine values):

```
let boiling_water = boil (put_in (kettle, [water]))
in put_in (teapot, [tea_leaves, boiling_water])
end
```

In particular, values don't have state, so they can be substituted freely:

```
put_in (teapot, [tea_leaves, boil (put_in (kettle, [water]))])
```

Logic Paradigm

Define a problem by describing its facts and properties, and then solve it by giving the system a goal to prove using those facts and properties.

```
make(Con,tea):-water_proof(Con),heat_resistant(Con),
contains(Con,tea_leaves),contains(Con,boiling_water).
source(tea_caddy,tea_leaves).
source(tap,water).
source(Con,boiling_water):-canboil(Con),contains(Con,water).
contains(Con,Item):-source(Con,Item).
contains(Con,Item):-source(Con2,Item),move(Item,Con,Con2).
canboil(kettle).
water_proof(teapot).
heat_resistant(teapot).
move(Item,Con,Con2).
```

If we ask “can we make tea in a teapot” by typing `make(teapot, tea)`. the system answers yes, or if we ask “what can we make tea in” by typing `make(X, tea)`. we get

X = teapot We can even get the system to tell us how to make tea:

```

move(Item,Con,Con2):- write('move '), write(Item),
write(' from '), write(Con2), write(' to '), write(Con), nl.
canboil(kettle):- write('boil kettle'), nl.
and make(teapot, tea). will output:
move tea_leaves from tea_caddy to teapot
move water from tap to kettle
boil kettle
move boiling_water from kettle to teapot

```

Parallel Paradigm

Another difficulty with Imperative programming was the concept of sequence - there are many circumstances where the exact order of some actions does not matter, as long as they are all done before we progress to the next step. In parallel languages, if actions don't interact, work on them in any order (non-determinism), or even simultaneously (multi-processing).

CHAN OF ANY to_pot, to_kettle, kettle_to_pot, to_cup:

```

declare boiling_water:
PAR
declare water:
SEQ — kettle
to_kettle ? water
boil ( )
kettle_to_pot —> boiling_water
declare tea_leaves:
SEQ — teapot
PAR
to_pot ? tea_leaves
kettle_to_pot ? boiling_water
to_cup —> tea

```

Scripting Paradigm

So far, we have been thinking about languages suitable for solving very large problems, where the resulting programs are tens of thousands or more lines long, written and maintained by more than one person. However, not all problems require industrial-strength solutions, and different requirements have given rise to different kinds of languages. The situations where they are applicable are:

- building applications by “gluing together” existing components
- controlling applications that have a programmable interface
- writing programs where ease of development is more important than anything else (such as run-time efficiency, or maintainability)

The resulting languages are greatly simplified from the programmers point of view, so that “scripting languages make programmers of us all”. A major design pressure is to minimise the amount that users have to write, and therefore that they can get wrong. In particular, they minimise the use of declarations, and thus the use of types or scopes - they often only have one type, the string (so numbers are held as a series of digit characters). This reduces the usefulness of compilation, and means that more work must be done at run-time, so these languages are often interpreted (and thus run much more slowly). They are often used to write simple little programs that are unlikely to ever be run again.

The earliest such languages were precursors to what we now know as CLIs or shells. Many of the thousands of existing programming languages are scripting languages designed to control specific applications. Widely-used scripting languages include AWK, Bash, JavaScript, Perl,

Python, Rexx, and Tcl. Some of the ideas behind scripting languages are also relevant to more main-stream languages, such as Visual Basic.

There is a big danger lurking in all of this - the very simplicity of scripting languages makes them easy to overuse, and there is a new generation of users busy reinventing the mistakes of the previous generations, writing programs that no-one understands or can maintain.

PROGRAMMING LANGUAGE

A programming language is an artificial language designed to express computations that can be performed by a machine, particularly a computer. Programming languages can be used to create programs that control the behavior of a machine, to express algorithms precisely, or as a mode of human communication.

The earliest programming languages predate the invention of the computer, and were used to direct the behavior of machines such as Jacquard looms and player pianos. Thousands of different programming languages have been created, mainly in the computer field, with many more being created every year. Most programming languages describe computation in an imperative style, i.e., as a sequence of commands, although some languages, such as those that support functional programming or logic programming, use alternative forms of description.

A programming language is usually split into the two components of syntax (form) and semantics (meaning) and many programming languages have some kind of written specification of their syntax and/or semantics. Some languages are defined by a specification document, for example, the C programming language is specified by an ISO Standard, while other languages, such as Perl, have a dominant implementation that is used as a reference.

Definitions

A programming language is a notation for writing programs, which are specifications of a computation or algorithm. Some, but not all, authors restrict the term “programming language” to those languages that can express *all* possible algorithms. Traits often considered important for what constitutes a programming language include:

- *Function and target:* A *computer programming language* is a language used to write computer programs, which involve a computer performing some kind of computation or algorithm and possibly control external devices such as printers, disk drives, robots, and so on. For example PostScript programs are frequently created by another program to control a computer printer or display. More generally, a programming language may describe computation on some, possibly abstract, machine. It is generally accepted that a complete specification for a programming language includes a description, possibly idealized, of a machine or processor for that language. In most practical contexts, a programming language involves a computer; consequently programming languages are usually defined and studied this way. Programming languages differ from natural languages in that natural languages are only used for interaction between people, while programming languages also allow humans to communicate instructions to machines.
- *Abstractions:* Programming languages usually contain abstractions for defining and manipulating data structures or controlling the flow of execution. The practical necessity that a programming language support adequate abstractions is expressed by the

abstraction principle; this principle is sometimes formulated as recommendation to the programmer to make proper use of such abstractions.

- *Expressive power*: The theory of computation classifies languages by the computations they are capable of expressing. All Turing complete languages can implement the same set of algorithms. ANSI/ISO SQL and Charity are examples of languages that are not Turing complete, yet often called programming languages.

Markup languages like XML, HTML or troff, which define structured data, are not generally considered programming languages. Programming languages may, however, share the syntax with markup languages if a computational semantics is defined. XSLT, for example, is a Turing complete XML dialect. Moreover, LaTeX, which is mostly used for structuring documents, also contains a Turing complete subset.

The term *computer language* is sometimes used interchangeably with programming language. However, the usage of both terms varies among authors, including the exact scope of each. One usage describes programming languages as a subset of computer languages. In this vein, languages used in computing that have a different goal than expressing computer programs are generically designated computer languages. For instance, markup languages are sometimes referred to as computer languages to emphasize that they are not meant to be used for programming. Another usage regards programming languages as theoretical constructs for programming abstract machines, and computer languages as the subset thereof that runs on physical computers, which have finite hardware resources. John C. Reynolds emphasizes that formal specification languages are just as much programming

languages as are the languages intended for execution. He also argues that textual and even graphical input formats that affect the behavior of a computer are programming languages, despite the fact they are commonly not Turing-complete, and remarks that ignorance of programming language concepts is the reason for many flaws in input formats.

Elements

All programming languages have some primitive building blocks for the description of data and the processes or transformations applied to them (like the addition of two numbers or the selection of an item from a collection). These primitives are defined by syntactic and semantic rules which describe their structure and meaning respectively.

Syntax

A programming language's surface form is known as its syntax. Most programming languages are purely textual; they use sequences of text including words, numbers, and punctuation, much like written natural languages. On the other hand, there are some programming languages which are more graphical in nature, using visual relationships between symbols to specify a program.

The syntax of a language describes the possible combinations of symbols that form a syntactically correct program. The meaning given to a combination of symbols is handled by semantics (either formal or hard-coded in a reference implementation). Since most languages are textual, this article discusses textual syntax.

Programming language syntax is usually defined using a combination of regular expressions (for lexical structure) and Backus–Naur Form (for grammatical structure). Below is a simple grammar.

This grammar specifies the following:

- an *expression* is either an *atom* or a *list*;
- an *atom* is either a *number* or a *symbol*;
- a *number* is an unbroken sequence of one or more decimal digits, optionally preceded by a plus or minus sign;
- a *symbol* is a letter followed by zero or more of any characters (excluding whitespace); and
- a *list* is a matched pair of parentheses, with zero or more *expressions* inside it.

The following are examples of well-formed token sequences in this grammar: '12345', '()', '(a b c232 (1))'

Not all syntactically correct programs are semantically correct. Many syntactically correct programs are nonetheless ill-formed, per the language's rules; and may (depending on the language specification and the soundness of the implementation) result in an error on translation or execution. In some cases, such programs may exhibit undefined behavior. Even when a program is well-defined within a language, it may still have a meaning that is not intended by the person who wrote it.

Using natural language as an example, it may not be possible to assign a meaning to a grammatically correct sentence or the sentence may be false:

- "Colorless green ideas sleep furiously." is grammatically well-formed but has no generally accepted meaning.
- "John is a married bachelor." is grammatically well-formed but expresses a meaning that cannot be true.

The following C language fragment is syntactically correct, but performs an operation that is not semantically

defined (because `p` is a null pointer, the operations `p->real` and `p->im` have no meaning):

```
complex *p = NULL;
complex abs_p = sqrt (p->real * p->real + p->im * p->im);
```

If the type declaration on the first line were omitted, the program would trigger an error on compilation, as the variable “`p`” would not be defined. But the program would still be syntactically correct, since type declarations provide only semantic information.

The grammar needed to specify a programming language can be classified by its position in the Chomsky hierarchy. The syntax of most programming languages can be specified using a Type-2 grammar, i.e., they are context-free grammars. Some languages, including Perl and Lisp, contain constructs that allow execution during the parsing phase. Languages that have constructs that allow the programmer to alter the behavior of the parser make syntax analysis an undecidable problem, and generally blur the distinction between parsing and execution. In contrast to Lisp’s macro system and Perl’s BEGIN blocks, which may contain general computations, C macros are merely string replacements, and do not require code execution.

Semantics

The term *semantics* refers to the meaning of languages, as opposed to their form (syntax).

Static Semantics

The static semantics defines restrictions on the structure of valid texts that are hard or impossible to express in standard syntactic formalisms. For compiled languages, static semantics essentially include those semantic rules that can be checked at compile time. Examples include checking that every identifier is declared before it is used

(in languages that require such declarations) or that the labels on the arms of a case statement are distinct. Many important restrictions of this type, like checking that identifiers are used in the appropriate context (e.g. not adding an integer to a function name), or that subroutine calls have the appropriate number and type of arguments, can be enforced by defining them as rules in a logic called a type system. Other forms of static analyses like data flow analysis may also be part of static semantics. Newer programming languages like Java and C# have definite assignment analysis, a form of data flow analysis, as part of their static semantics.

Dynamic Semantics

Once data has been specified, the machine must be instructed to perform operations on the data. For example, the semantics may define the strategy by which expressions are evaluated to values, or the manner in which control structures conditionally execute statements. The *dynamic semantics* (also known as *execution semantics*) of a language defines how and when the various constructs of a language should produce a program behavior. There are many ways of defining execution semantics. Natural language is often used to specify the execution semantics of languages commonly used in practice. A significant amount of academic research went into formal semantics of programming languages, which allow execution semantics to be specified in a formal manner. Results from this field of research have seen limited application to programming language design and implementation outside academia.

Type System

A type system defines how a programming language classifies values and expressions into *types*, how it can manipulate those types and how they interact. The goal of

a type system is to verify and usually enforce a certain level of correctness in programs written in that language by detecting certain incorrect operations. Any decidable type system involves a trade-off: while it rejects many incorrect programs, it can also prohibit some correct, albeit unusual programs. In order to bypass this downside, a number of languages have *type loopholes*, usually unchecked casts that may be used by the programmer to explicitly allow a normally disallowed operation between different types. In most typed languages, the type system is used only to type check programs, but a number of languages, usually functional ones, infer types, relieving the programmer from the need to write type annotations. The formal design and study of type systems is known as *type theory*.

Typed Versus Untyped Languages: A language is *typed* if the specification of every operation defines types of data to which the operation is applicable, with the implication that it is not applicable to other types. For example, the data represented by “this text between the quotes” is a string. In most programming languages, dividing a number by a string has no meaning. Most modern programming languages will therefore reject any program attempting to perform such an operation. In some languages, the meaningless operation will be detected when the program is compiled (“static” type checking), and rejected by the compiler, while in others, it will be detected when the program is run (“dynamic” type checking), resulting in a runtime exception.

A special case of typed languages are the *single-type* languages. These are often scripting or markup languages, such as REXX or SGML, and have only one data type—most commonly character strings which are used for both symbolic and numeric data.

In contrast, an *untyped language*, such as most assembly languages, allows any operation to be performed on any data, which are generally considered to be sequences of bits of various lengths. High-level languages which are untyped include BCPL and some varieties of Forth.

In practice, while few languages are considered typed from the point of view of type theory (verifying or rejecting *all* operations), most modern languages offer a degree of typing. Many production languages provide means to bypass or subvert the type system.

Static Versus Dynamic Typing: In *static typing*, all expressions have their types determined prior to when the program is executed, typically at compile-time. For example, 1 and (2+2) are integer expressions; they cannot be passed to a function that expects a string, or stored in a variable that is defined to hold dates.

Statically typed languages can be either *manifestly typed* or *type-inferred*. In the first case, the programmer must explicitly write types at certain textual positions (for example, at variable declarations). In the second case, the compiler *infers* the types of expressions and declarations based on context. Most mainstream statically typed languages, such as C++, C# and Java, are manifestly typed. Complete type inference has traditionally been associated with less mainstream languages, such as Haskell and ML. However, many manifestly typed languages support partial type inference; for example, Java and C# both infer types in certain limited cases.

Dynamic typing, also called *latent typing*, determines the type-safety of operations at runtime; in other words, types are associated with *runtime values* rather than *textual expressions*. As with type-inferred languages, dynamically typed languages do not require the programmer to write

explicit type annotations on expressions. Among other things, this may permit a single variable to refer to values of different types at different points in the program execution. However, type errors cannot be automatically detected until a piece of code is actually executed, potentially making debugging more difficult. Ruby, Lisp, JavaScript, and Python are dynamically typed.

Weak and Strong Typing: *Weak typing* allows a value of one type to be treated as another, for example treating a string as a number. This can occasionally be useful, but it can also allow some kinds of program faults to go undetected at compile time and even at runtime.

Strong typing prevents the above. An attempt to perform an operation on the wrong type of value raises an error. Strongly typed languages are often termed *type-safe* or *safe*.

An alternative definition for “weakly typed” refers to languages, such as Perl and JavaScript, which permit a large number of implicit type conversions. In JavaScript, for example, the expression $2 * x$ implicitly converts x to a number, and this conversion succeeds even if x is null, undefined, an Array, or a string of letters. Such implicit conversions are often useful, but they can mask programming errors. *Strong* and *static* are now generally considered orthogonal concepts, but usage in the literature differs. Some use the term *strongly typed* to mean *strongly, statically typed*, or, even more confusingly, to mean simply *statically typed*. Thus C has been called both strongly typed and weakly, statically typed.

Standard Library and Run-Time System

Most programming languages have an associated core library (sometimes known as the ‘standard library’, especially if it is included as part of the published language standard),

which is conventionally made available by all implementations of the language. Core libraries typically include definitions for commonly used algorithms, data structures, and mechanisms for input and output.

A language's core library is often treated as part of the language by its users, although the designers may have treated it as a separate entity. Many language specifications define a core that must be made available in all implementations, and in the case of standardized languages this core library may be required. The line between a language and its core library therefore differs from language to language. Indeed, some languages are designed so that the meanings of certain syntactic constructs cannot even be described without referring to the core library. For example, in Java, a string literal is defined as an instance of the `java.lang.String` class; similarly, in Smalltalk, an anonymous function expression (a "block") constructs an instance of the library's `BlockContext` class. Conversely, Scheme contains multiple coherent subsets that suffice to construct the rest of the language as library macros, and so the language designers do not even bother to say which portions of the language must be implemented as language constructs, and which must be implemented as parts of a library.

Design and Implementation

Programming languages share properties with natural languages related to their purpose as vehicles for communication, having a syntactic form separate from its semantics, and showing *language families* of related languages branching one from another. But as artificial constructs, they also differ in fundamental ways from languages that have evolved through usage. A significant difference is that a programming language can be fully described and studied in its entirety, since it has a precise

and finite definition. By contrast, natural languages have changing meanings given by their users in different communities. While constructed languages are also artificial languages designed from the ground up with a specific purpose, they lack the precise and complete semantic definition that a programming language has. Many languages have been designed from scratch, altered to meet new needs, combined with other languages, and eventually fallen into disuse. Although there have been attempts to design one “universal” programming language that serves all purposes, all of them have failed to be generally accepted as filling this role. The need for diverse programming languages arises from the diversity of contexts in which languages are used:

- Programs range from tiny scripts written by individual hobbyists to huge systems written by hundreds of programmers.
- Programmers range in expertise from novices who need simplicity above all else, to experts who may be comfortable with considerable complexity.
- Programs must balance speed, size, and simplicity on systems ranging from microcontrollers to supercomputers.
- Programs may be written once and not change for generations, or they may undergo continual modification.
- Finally, programmers may simply differ in their tastes: they may be accustomed to discussing problems and expressing them in a particular language.

One common trend in the development of programming languages has been to add more ability to solve problems using a higher level of abstraction. The earliest programming

languages were tied very closely to the underlying hardware of the computer. As new programming languages have developed, features have been added that let programmers express ideas that are more remote from simple translation into underlying hardware instructions. Because programmers are less tied to the complexity of the computer, their programs can do more computing with less effort from the programmer. This lets them write more functionality per time unit. Natural language processors have been proposed as a way to eliminate the need for a specialized language for programming. However, this goal remains distant and its benefits are open to debate. Edsger W. Dijkstra took the position that the use of a formal language is essential to prevent the introduction of meaningless constructs, and dismissed natural language programming as “foolish”. Alan Perlis was similarly dismissive of the idea. Hybrid approaches have been taken in Structured English and SQL. A language’s designers and users must construct a number of artifacts that govern and enable the practice of programming. The most important of these artifacts are the language *specification* and *implementation*.

Specification

The specification of a programming language is intended to provide a definition that the language users and the implementors can use to determine whether the behavior of a program is correct, given its source code.

A programming language specification can take several forms, including the following:

- An explicit definition of the syntax, static semantics, and execution semantics of the language. While syntax is commonly specified using a formal grammar, semantic definitions may be written in

natural language (e.g., as in the C language), or a formal semantics (e.g., as in Standard ML and Scheme specifications).

- A description of the behavior of a translator for the language (e.g., the C++ and Fortran specifications). The syntax and semantics of the language have to be inferred from this description, which may be written in natural or a formal language.
- A *reference* or *model* implementation, sometimes written in the language being specified (e.g., Prolog or ANSI REXX). The syntax and semantics of the language are explicit in the behavior of the reference implementation.

Implementation

An implementation of a programming language provides a way to execute that program on one or more configurations of hardware and software. There are, broadly, two approaches to programming language implementation: *compilation* and *interpretation*. It is generally possible to implement a language using either technique.

The output of a compiler may be executed by hardware or a program called an interpreter. In some implementations that make use of the interpreter approach there is no distinct boundary between compiling and interpreting. For instance, some implementations of BASIC compile and then execute the source a line at a time.

Programs that are executed directly on the hardware usually run several orders of magnitude faster than those that are interpreted in software.

One technique for improving the performance of interpreted programs is just-in-time compilation. Here the virtual machine, just before execution, translates the blocks

of bytecode which are going to be used to machine code, for direct execution on the hardware.

Usage

Thousands of different programming languages have been created, mainly in the computing field. Programming languages differ from most other forms of human expression in that they require a greater degree of precision and completeness. When using a natural language to communicate with other people, human authors and speakers can be ambiguous and make small errors, and still expect their intent to be understood. However, figuratively speaking, computers “do exactly what they are told to do”, and cannot “understand” what code the programmer intended to write. The combination of the language definition, a program, and the program’s inputs must fully specify the external behavior that occurs when the program is executed, within the domain of control of that program.

A programming language provides a structured mechanism for defining pieces of data, and the operations or transformations that may be carried out automatically on that data. A programmer uses the abstractions present in the language to represent the concepts involved in a computation. These concepts are represented as a collection of the simplest elements available (called primitives). *Programming* is the process by which programmers combine these primitives to compose new programs, or adapt existing ones to new uses or a changing environment.

Programs for a computer might be executed in a batch process without human interaction, or a user might type commands in an interactive session of an interpreter. In this case the “commands” are simply programs, whose execution is chained together. When a language is used to give commands to a software application (such as a shell) it is called a scripting language.

Measuring Language Usage

It is difficult to determine which programming languages are most widely used, and what usage means varies by context. One language may occupy the greater number of programmer hours, a different one have more lines of code, and a third utilize the most CPU time. Some languages are very popular for particular kinds of applications. For example, COBOL is still strong in the corporate data center, often on large mainframes; FORTRAN in scientific and engineering applications; C in embedded applications and operating systems; and other languages are regularly used to write many different kinds of applications.

Various methods of measuring language popularity, each subject to a different bias over what is measured, have been proposed:

- counting the number of job advertisements that mention the language
- the number of books sold that teach or describe the language
- estimates of the number of existing lines of code written in the language—which may underestimate languages not often found in public searches
- counts of language references (i.e., to the name of the language) found using a web search engine.

Combining and averaging information from various internet sites, langpop.com claims that in 2008 the 10 most cited programming languages are (in alphabetical order): C, C++, C#, Java, JavaScript, Perl, PHP, Python, Ruby, and SQL.

Taxonomies

There is no overarching classification scheme for programming languages. A given programming language

does not usually have a single ancestor language. Languages commonly arise by combining the elements of several predecessor languages with new ideas in circulation at the time. Ideas that originate in one language will diffuse throughout a family of related languages, and then leap suddenly across familial gaps to appear in an entirely different family.

The task is further complicated by the fact that languages can be classified along multiple axes. For example, Java is both an object-oriented language (because it encourages object-oriented organization) and a concurrent language (because it contains built-in constructs for running multiple threads in parallel). Python is an object-oriented scripting language.

In broad strokes, programming languages divide into *programming paradigms* and a classification by *intended domain of use*. Traditionally, programming languages have been regarded as describing computation in terms of imperative sentences, i.e. issuing commands. These are generally called imperative programming languages. A great deal of research in programming languages has been aimed at blurring the distinction between a program as a set of instructions and a program as an assertion about the desired answer, which is the main feature of declarative programming. More refined paradigms include procedural programming, object-oriented programming, functional programming, and logic programming; some languages are hybrids of paradigms or multi-paradigmatic. An assembly language is not so much a paradigm as a direct model of an underlying machine architecture. By purpose, programming languages might be considered general purpose, system programming languages, scripting languages, domain-specific languages, or concurrent/

distributed languages (or a combination of these). Some general purpose languages were designed largely with educational goals.

A programming language may also be classified by factors unrelated to programming paradigm. For instance, most programming languages use English language keywords, while a minority do not. Other languages may be classified as being esoteric or not.

History

Early Developments

The first programming languages predate the modern computer. The 19th century had “programmable” looms and player piano scrolls which implemented what are today recognized as examples of domain-specific languages. By the beginning of the twentieth century, punch cards encoded data and directed mechanical processing. In the 1930s and 1940s, the formalisms of Alonzo Church’s lambda calculus and Alan Turing’s Turing machines provided mathematical abstractions for expressing algorithms; the lambda calculus remains influential in language design.

In the 1940s, the first electrically powered digital computers were created. The first high-level programming language to be designed for a computer was Plankalkul, developed for the German Z3 by Konrad Zuse between 1943 and 1945. However, it was not implemented until 1998 and 2000.

Programmers of early 1950s computers, notably UNIVAC I and IBM 701, used machine language programs, that is, the first generation language (1GL). 1GL programming was quickly superseded by similarly machine-specific, but mnemonic, second generation languages (2GL) known as assembly languages or “assembler”. Later in the

1950s, assembly language programming, which had evolved to include the use of macro instructions, was followed by the development of “third generation” programming languages (3GL), such as FORTRAN, LISP, and COBOL. 3GLs are more abstract and are “portable”, or at least implemented similarly on computers that do not support the same native machine code. Updated versions of all of these 3GLs are still in general use, and each has strongly influenced the development of later languages. At the end of the 1950s, the language formalized as ALGOL 60 was introduced, and most later programming languages are, in many respects, descendants of Algol. The format and use of the early programming languages was heavily influenced by the constraints of the interface.

Refinement

The period from the 1960s to the late 1970s brought the development of the major language paradigms now in use, though many aspects were refinements of ideas in the very first Third-generation programming languages:

- APL introduced *array programming* and influenced functional programming.
- PL/I (NPL) was designed in the early 1960s to incorporate the best ideas from FORTRAN and COBOL.
- In the 1960s, Simula was the first language designed to support *object-oriented programming*; in the mid-1970s, Smalltalk followed with the first “purely” object-oriented language.
- C was developed between 1969 and 1973 as a *system programming* language, and remains popular.
- Prolog, designed in 1972, was the first *logic programming* language.
- In 1978, ML built a polymorphic type system on

top of Lisp, pioneering *statically typed functional programming* languages.

Each of these languages spawned an entire family of descendants, and most modern languages count at least one of them in their ancestry. The 1960s and 1970s also saw considerable debate over the merits of *structured programming*, and whether programming languages should be designed to support it. Edsger Dijkstra, in a famous 1968 letter published in the Communications of the ACM, argued that GOTO statements should be eliminated from all “higher level” programming languages.

The 1960s and 1970s also saw expansion of techniques that reduced the footprint of a program as well as improved productivity of the programmer and user. The card deck for an early 4GL was a lot smaller for the same functionality expressed in a 3GL deck.

Consolidation and Growth

The 1980s were years of relative consolidation. C++ combined object-oriented and systems programming. The United States government standardized Ada, a systems programming language derived from Pascal and intended for use by defense contractors. In Japan and elsewhere, vast sums were spent investigating so-called “fifth generation” languages that incorporated logic programming constructs. The functional languages community moved to standardize ML and Lisp. Rather than inventing new paradigms, all of these movements elaborated upon the ideas invented in the previous decade.

One important trend in language design for programming large-scale systems during the 1980s was an increased focus on the use of *modules*, or large-scale organizational units of code. Modula-2, Ada, and ML all developed notable module systems in the 1980s, although

other languages, such as PL/I, already had extensive support for modular programming. Module systems were often wedded to generic programming constructs.

The rapid growth of the Internet in the mid-1990s created opportunities for new languages. Perl, originally a Unix scripting tool first released in 1987, became common in dynamic websites. Java came to be used for server-side programming, and bytecode virtual machines became popular again in commercial settings with their promise of “Write once, run anywhere” (UCSD Pascal had been popular for a time in the early 1980s). These developments were not fundamentally novel, rather they were refinements to existing languages and paradigms, and largely based on the C family of programming languages.

Programming language evolution continues, in both industry and research. Current directions include security and reliability verification, new kinds of modularity (mixins, delegates, aspects), and database integration such as Microsoft’s LINQ.

The 4GLs are examples of languages which are domain-specific, such as SQL, which manipulates and returns sets of data rather than the scalar values which are canonical to most programming languages. Perl, for example, with its ‘here document’ can hold multiple 4GL programs, as well as multiple JavaScript programs, in part of its own perl code and use variable interpolation in the ‘here document’ to support multi-language programming.

DATA EXCHANGE LANGUAGE

Data exchange languages are formal languages specifically designed to support the communication of data and metadata. There are two kinds of data exchange languages: Markup languages work with embedded data

structuring mark-up, while data model based languages apply pre-defined standardised data models.

Examples of the first category languages include JSON, YAML and REBOL.

Examples of the second category are the ISO STEP application protocols (ISO 10303) and ISO 13584 with dedicated fixed data models and ISO 10303-221, ISO 15926 and the Gellish language with flexible multi-purpose data models. The latter two combine a generic data model where the domain specific concepts are defined in an extensible accompanying dictionary (or vocabulary) of concepts in which the concepts are arranged in a taxonomy.

Programming languages such as JavaScript also provide direct support for the exchange of data.

Some data exchange languages, such as XML and REBOL, support dialecting, the definition of domain-specific sublanguages.

PROTIUM (COMPUTER LANGUAGE)

Protium is a universal, symbolic programming language system, based on a systematic *a priori* analysis of the tasks required for computation. Devised and developed by the Protium Blue company, headed by Australian programming language historian and developer Diarmuid Pigott, Protium is polymorphic in type with considerable character flexibility. It is pasigraphic after the fashion of John Wilkins, Gottfried Leibniz and Charles K. Bliss, and does not favour one host natural language over another. The company is located in Fremantle, Western Australia.

QUERY LANGUAGE

Query languages are computer languages used to make queries into databases and information systems.

Broadly, query languages can be classified according to whether they are database query languages or information retrieval query languages. Examples include:

- .QL is a proprietary object-oriented query language for querying relational databases; successor of Datalog;
- Common Query Language (CQL) a formal language for representing queries to information retrieval systems such as web indexes or bibliographic catalogues.
- CQLF (CODASYL Query Language, Flat) is a query language for CODASYL-type databases;
- Concept-Oriented Query Language (COQL) is used in the concept-oriented model (COM). It is based on a novel data modeling construct, concept, and uses such operations as projection and de-projection for multi-dimensional analysis, analytical operations and inference;
- D is a query language for truly relational database management systems (TRDBMS);
- DMX is a query language for Data Mining models;
- Datalog is a query language for deductive databases;
- ERROL is a query language over the Entity-relationship model (ERM) which mimics major Natural language constructs (of the English language and possibly other languages). It is especially tailored for relational databases;
- Gellish English is a language that can be used for queries in Gellish English Databases [1], for dialogues (requests and responses) as well as for information modeling and knowledge modeling;
- HTSQL is a query language that translates HTTP queries to SQL;

- ISBL is a query language for PRTV, one of the earliest relational database management systems;
- LINQ query-expressions is a way to query various data sources from .NET languages
- LDAP is an application protocol for querying and modifying directory services running over TCP/IP;
- MQL is a cheminformatics query language for a substructure search allowing beside nominal properties also numerical properties;
- MDX is a query language for OLAP databases;
- OQL is Object Query Language;
- OCL (Object Constraint Language). Despite its name, OCL is also an object query language and an OMG standard;
- OPath, intended for use in querying WinFS *Stores*;
- Poliqarp Query Language is a special query language designed to analyze annotated text. Used in the Poliqarp search engine;
- QUEL is a relational database access language, similar in most ways to SQL;
- RDQL is a RDF query language;
- SeRQL (“Sesame RDF Query Language”, pronounced “circle”) is a new RDF/RDFS query language that is currently being developed by Aduna as part of Sesame.
- SMARTS is the cheminformatics standard for a substructure search;
- SPARQL is a query language for RDF graphs;
- SQL is a well known query language for relational databases;
- SuprTool is a proprietary query language for SuprTool, a database access program used for

accessing data in *Image/SQL* (formerly TurboIMAGE) and Oracle databases;

- TMQL Topic Map Query Language is a query language for Topic Maps;
- XQuery is a query language for XML data sources;
- XPath is a declarative language for navigating XML documents;
- XSQL is a query language combining the power of XML and the power of SQL, it is currently under development;
- YQL is an SQL-like query language created by Yahoo!

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5

Focus on Communicative Language Teaching and Educational Programming Languages

COMMUNICATIVE LANGUAGE TEACHING

Communicative language teaching (CLT) is an approach to the teaching of second and foreign languages that emphasizes interaction as both the means and the ultimate goal of learning a language. It is also referred to as “communicative approach to the teaching of foreign languages” or simply the “communicative approach”.

Relationship with Other Methods and Approaches

Historically, CLT has been seen as a response to the audio-lingual method (ALM), and as an extension or development of the notional-functional syllabus. Task-based language learning, a more recent refinement of CLT, has gained considerably in popularity.

The Audio-Lingual Method

The audio-lingual method (ALM) arose as a direct result of the need for foreign language proficiency in listening and speaking skills during and after World War II. It is closely tied to behaviorism, and thus made drilling, repetition, and habit-formation central elements of

instruction. Proponents of ALM felt that this emphasis on repetition needed a corollary emphasis on accuracy, claiming that continual repetition of errors would lead to the fixed acquisition of incorrect structures and non-standard pronunciation.

In the classroom, lessons were often organized by grammatical structure and presented through short dialogues. Often, students listened repeatedly to recordings of conversations (for example, in the language lab) and focused on accurately mimicking the pronunciation and grammatical structures in these dialogs.

Critics of ALM asserted that this over-emphasis on repetition and accuracy ultimately did not help students achieve communicative competence in the target language. Noam Chomsky argued “Language is not a habit structure. Ordinary linguistic behaviour characteristically involves innovation, formation of new sentences and patterns in accordance with rules of great abstractness and intricacy”. They looked for new ways to present and organize language instruction, and advocated the notional functional syllabus, and eventually CLT as the most effective way to teach second and foreign languages. However, audio-lingual methodology is still prevalent in many text books and teaching materials. Moreover, advocates of audio-lingual methods point to their success in improving aspects of language that are habit driven, most notably pronunciation.

The Notional-Functional Syllabus

A notional-functional syllabus is more a way of organizing a language learning curriculum than a method or an approach to teaching. In a notional-functional syllabus, instruction is organized not in terms of grammatical structure as had often been done with the ALM, but in terms of “notions” and “functions.” In this model, a “notion”

is a particular context in which people communicate, and a “function” is a specific purpose for a speaker in a given context. As an example, the “notion” or context *shopping* requires numerous language functions including asking about prices or features of a product and bargaining. Similarly, the notion *party* would require numerous functions like introductions and greetings and discussing interests and hobbies. Proponents of the notional-functional syllabus claimed that it addressed the deficiencies they found in the ALM by helping students develop their ability to effectively communicate in a variety of real-life contexts.

Learning by Teaching (LdL)

Learning by teaching is a widespread method in Germany (Jean-Pol Martin). The students take the teacher’s role and teach their peers.

CLT is usually characterized as a broad *approach* to teaching, rather than as a teaching *method* with a clearly defined set of classroom practices. As such, it is most often defined as a list of general principles or features. One of the most recognized of these lists is David Nunan’s (1991) five features of CLT:

1. An emphasis on learning to communicate through interaction in the target language.
2. The introduction of authentic texts into the learning situation.
3. The provision of opportunities for learners to focus, not only on language but also on the Learning Management process.
4. An enhancement of the learner’s own personal experiences as important contributing elements to classroom learning.
5. An attempt to link classroom language learning with language activities outside the classroom.

These five features are claimed by practitioners of CLT to show that they are very interested in the needs and desires of their learners as well as the connection between the language as it is taught in their class and as it used outside the classroom. Under this broad umbrella definition, any teaching practice that helps students develop their communicative competence in an authentic context is deemed an acceptable and beneficial form of instruction. Thus, in the classroom CLT often takes the form of pair and group work requiring negotiation and cooperation between learners, fluency-based activities that encourage learners to develop their confidence, role-plays in which students practice and develop language functions, as well as judicious use of grammar and pronunciation focused activities.

In the mid 1990s the Dogma 95 manifesto influenced language teaching through the Dogme language teaching movement, who proposed that published materials can stifle the communicative approach. As such the aim of the Dogme approach to language teaching is to focus on real conversations about real subjects so that communication is the engine of learning. This communication may lead to explanation, but that this in turn will lead to further communication.

Classroom Activities Used in CLT

Example Activities

Role Play

Interviews

Information Gap

Games

Language Exchanges

Surveys

Pair Work

Learning by teaching

However, not all courses that utilize the Communicative Language approach will restrict their activities solely to these. Some courses will have the students take occasional grammar quizzes, or prepare at home using non-communicative drills, for instance.

Critiques of CLT

One of the most famous attacks on communicative language teaching was offered by Michael Swan in the *English Language Teaching Journal* in 1985. Henry Widdowson responded in defense of CLT, also in the *ELT Journal* (1985 39(3):158-161). More recently other writers (e.g. Bax) have critiqued CLT for paying insufficient attention to the context in which teaching and learning take place, though CLT has also been defended against this charge (e.g. Harmer 2003). Often, the communicative approach is deemed a success if the teacher understands the student. But, if the teacher is from the same region as the student, the teacher will understand errors resulting from an influence from their first language. Native speakers of the target language may still have difficulty understanding them. This observation may call for new thinking on and adaptation of the communicative approach. The adapted communicative approach should be a simulation where the teacher pretends to understand only what any regular speaker of the target language would and reacts accordingly (Hattum 2006).

LANGUAGE ACQUISITION

Language acquisition is the process by which humans acquire the capacity to perceive, produce and use words to understand and communicate. This capacity involves the picking up of diverse capacities including syntax, phonetics, and an extensive vocabulary. This language might be vocal as with speech or manual as in sign. Language acquisition

usually refers to first language acquisition, which studies infants' acquisition of their native language, rather than *second language acquisition*, which deals with acquisition (in both children and adults) of additional languages.

The capacity to acquire and use language is a key aspect that distinguishes humans from other organisms. While many forms of animal communication exist, they have a limited range of nonsyntactically structured vocabulary tokens that lack cross cultural variation between groups. A major concern in understanding language acquisition is how these capacities are picked up by infants from what appears to be very little input. A range of theories of language acquisition has been created in order to explain this apparent problem including innatism in which a child is born prepared in some manner with these capacities, as opposed to the other theories in which language is simply learned.

History

Plato felt that the word-meaning mapping in some form was innate. Sanskrit grammarians debated over twelve centuries whether meaning was god-given (possibly innate) or was learned from older convention—e.g. a child learning the word for cow by listening to trusted speakers talking about cows. In modern times, empiricists like Hobbes and Locke argued that knowledge (and for Locke, language) emerge ultimately from abstracted sense impressions. This led to Carnap's *Aufbau*, an attempt to learn all knowledge from sense datum, using the notion of "remembered as similar" to bind these into clusters, which would eventually map to language. Under Behaviorism, it was argued that language may be learned through a form of operant conditioning. In B.F. Skinner's *Verbal Behaviour* (1957), he suggested that the successful use of a sign such as a word or lexical unit, given a certain stimulus, reinforces

its “momentary” or contextual probability. Empiricist theories of language acquisition include statistical learning theories of language acquisition, Relational Frame Theory, functionalist linguistics, social interactionist theory, and usage-based language acquisition.

This behaviourist idea was strongly attacked by Noam Chomsky in a review article in 1959, calling it “largely mythology” and a “serious delusion”. Instead, Chomsky argued for a more theoretical approach, based on a study of syntax.

General Approaches

Social Interactionism

Social interactionist theory consists of a number of hypotheses on language acquisition. These hypotheses deal with written, spoken, or visual social tools which consist of complex systems of symbols and rules on language acquisition and development. The compromise between “nature” and “nurture” is the “interactionist” approach. In addition, for years, psychologists and researchers have been asking the same question. What are the language behaviors that nature provides innately and what are those behaviors that are realized by environmental exposure, which is nurture.

Relational Frame Theory

The relational frame theory (Hayes, Barnes-Holmes, Roche, 2001), provides a wholly selectionist/learning account of the origin and development of language competence and complexity. Based upon the principles of Skinnerian behaviorism, RFT posits that children acquire language purely through interacting with the environment. RFT theorists introduced the concept of functional contextualism in language learning, which emphasizes the importance of predicting and influencing psychological events, such as

thoughts, feelings, and behaviors, by focusing on manipulable variables in their context. RFT distinguishes itself from Skinner's work by identifying and defining a particular type of operant conditioning known as derived relational responding, a learning process that to date appears to occur only in humans possessing a capacity for language. Empirical studies supporting the predictions of RFT suggest that children learn language via a system of inherent reinforcements, challenging the view that language acquisition is based upon innate, language-specific cognitive capacities.

Emergentism

Emergentist theories, such as MacWhinney's competition model, posit that language acquisition is a cognitive process that emerges from the interaction of biological pressures and the environment. According to these theories, neither nature nor nurture alone is sufficient to trigger language learning; both of these influences must work together in order to allow children to acquire a language. The proponents of these theories argue that general cognitive processes subserve language acquisition and that the end result of these processes is language-specific phenomena, such as word learning and grammar acquisition. The findings of many empirical studies support the predictions of these theories, suggesting that language acquisition is a more complex process than many believe.

Syntax

Generativism

Generative grammar, associated especially with the work of Noam Chomsky, is currently one of the principal approaches to children's acquisition of syntax. The leading idea is that human biology imposes narrow constraints on the child's "hypothesis space" during language acquisition.

In the Principles and Parameters Framework, which has dominated generative syntax since Chomsky's (1980) *Lectures on Government and Binding*, the acquisition of syntax resembles ordering from a menu: The human brain comes equipped with a limited set of choices, and the child selects the correct options using her parents' speech, in combination with the context.

An important argument in favor of the generative approach is the Poverty of the stimulus argument. The child's input (a finite number of sentences encountered by the child, together with information about the context in which they were uttered) is in principle compatible with an infinite number of conceivable grammars. Moreover, few if any children can rely on corrective feedback from adults when they make a grammatical error. Yet, barring situations of medical abnormality or extreme privation, all the children in a given speech-community converge on very much the same grammar by the age of about five years. An especially dramatic example is provided by children who for medical reasons are unable to produce speech, and therefore can literally never be corrected for a grammatical error, yet nonetheless converge on the same grammar as their typically developing peers, according to comprehension-based tests of grammar.

Considerations such as these have led Chomsky, Jerry Fodor, Eric Lenneberg and others to argue that the types of grammar that the child needs to consider must be narrowly constrained by human biology (the nativist position). These innate constraints are sometimes referred to as universal grammar, the human "language faculty," or the "language instinct."

Empiricism

Since Chomsky in the 1950s, many criticisms of the

basic assumptions of generative theory have been put forth. Critics argue that the concept of a Language Acquisition Device (LAD) is unsupported by evolutionary anthropology, which tends to show a gradual adaptation of the human brain and vocal chords to the use of language, rather than a sudden appearance of a complete set of binary parameters delineating the whole spectrum of possible grammars ever to have existed and ever to exist. (Binary parameters are common to digital computers but not, as it turns out, to neurological systems such as the human brain.)

Further, while generative theory has several hypothetical constructs (such as movement, empty categories, complex underlying structures, and strict binary branching) that cannot possibly be acquired from any amount of linguistic input, it is unclear that human language is actually *anything like* the generative conception of it. Since language, as imagined by nativists, is unlearnably complex, subscribers to this theory argue that it must therefore be innate. A different theory of language, however, may yield different conclusions. While all theories of language acquisition posit some degree of innateness, a less convoluted theory might involve less innate structure and more learning. Under such a theory of grammar, the input, combined with both general and language-specific learning capacities, might be sufficient for acquisition.

Since 1980, linguists studying children, such as Melissa Bowerman, and psychologists following Jean Piaget, like Elizabeth Bates and Jean Mandler, came to suspect that there may indeed be many learning processes involved in the acquisition process, and that ignoring the role of learning may have been a mistake. In recent years, opposition to the nativist position has multiplied. The debate has centered on whether the inborn capabilities are language-specific or domain-general, such as those that enable the infant to

visually make sense of the world in terms of objects and actions. The anti-nativist view has many strands, but a frequent theme is that language emerges from usage in social contexts, using learning mechanisms that are a part of a general cognitive learning apparatus (which is what is innate). This position has been championed by Elizabeth Bates, Catherine Snow, Brian MacWhinney, Michael Tomasello, Michael Ramscar, William O'Grady, and others. Philosophers, such as Fiona Cowie and Barbara Scholz with Geoffrey Pullum have also argued against certain nativist claims in support of empiricism.

Statistical Learning

Some language acquisition researchers, such as Elissa Newport, Richard Aslin, and Jenny Saffran, believe that language acquisition is based primarily on general learning mechanisms, namely statistical learning. The development of connectionist models that are able to successfully learn words and syntactical conventions supports the predictions of statistical learning theories of language acquisition, as do empirical studies of children's learning of words and syntax.

Chunking

Chunking theories of language acquisition constitute a group of theories related to statistical learning theories in that they assume that the input from the environment plays an essential role; however, they postulate different learning mechanisms. The central idea of these theories is that language development occurs through the incremental acquisition of meaningful chunks of elementary constituents, which can be words, phonemes, or syllables. Recently, this approach has been highly successful in simulating several phenomena in the acquisition of syntactic categories and the acquisition of phonological knowledge. The approach

has several features that make it unique: the models are implemented as computer programs, which enables clear-cut and quantitative predictions to be made; they learn from naturalistic input, made of actual child-directed utterances; they produce actual utterances, which can be compared with children's utterances; and they have simulated phenomena in several languages, including English, Spanish, and German.

Researchers at the Max Planck Institute for Evolutionary Anthropology have developed a computer model analyzing early toddler conversations to predict the structure of later conversations. They showed that toddlers develop their own individual rules for speaking with slots into which they could put certain kinds of words. A significant outcome of the research was that rules inferred from toddler speech were better predictors of subsequent speech than traditional grammars.

Vocabulary Acquisition

The capacity to acquire the ability to incorporate the pronunciation of new words depends upon the capacity to engage in speech repetition. Children with reduced abilities to repeat nonwords (a marker of speech repetition abilities) show a slower rate of vocabulary expansion than children for whom this is easy. It has been proposed that the elementary units of speech has been selected to enhance the ease with which sound and visual input can be mapped into motor vocalization. Several computational models of vocabulary acquisition have been proposed so far.

Meaning

Children learn on average 10 to 15 new word meanings each day, but only one of these words can be accounted for by direct instruction. The other nine to 14 word meanings need to be picked up in some other way. It has been

proposed that children acquire these meanings with the use of processes modeled by latent semantic analysis; that is, when they meet an unfamiliar word, children can use information in its context to correctly guess its rough area of meaning.

Neurocognitive Research

According to several linguists, neurocognitive research has confirmed many standards of language learning, such as: “learning engages the entire person (cognitive, affective, and psychomotor domains), the human brain seeks patterns in its searching for meaning, emotions affect all aspects of learning, retention and recall, past experience always affects new learning, the brain’s working memory has a limited capacity, lecture usually results in the lowest degree of retention, rehearsal is essential for retention, practice [alone] does not make perfect, and each brain is unique” (Sousa, 2006, p. 274). In terms of genetics, the gene *ROBO1* has been associated with phonological buffer integrity or length

LANGUAGE EDUCATION

Language education is the teaching and learning of a foreign or second language. Language education is a branch of applied linguistics.

Need for Language Education

People need to learn a second language because of globalization; connections are becoming inevitable among nations, states and organizations which creates a huge need for knowing another language or more multilingualism. The uses of common languages are in areas such as trade, tourism international relations between governments, technology, media and science. Therefore, many countries such as Japan (Kubota, 1998) and China (Kirkpatrick & Zhichang, 2002) create education policies to teach at least

one foreign language at primary and secondary school level. However, some countries such as India, Singapore, Malaysia and Philippines use a second official language in their governing system. According to GAO (2010) many Chinese people are giving enormous importance to foreign language learning, especially learning English Language.

History of Foreign Language Education

Ancient to Medieval Period

Although the need to learn foreign languages is almost as old as human history itself, the origins of modern language education are in the study and teaching of Latin in the 17th century. Latin had for many centuries been the dominant language of education, commerce, religion, and government in much of the Western world, but it was displaced by French, Italian, and English by the end of the 16th century. John Amos Comenius was one of many people who tried to reverse this trend. He composed a complete course for learning Latin, covering the entire school curriculum, culminating in his *Opera Didactica Omnia*, 1657.

In this work, Comenius also outlined his theory of language acquisition. He is one of the first theorists to write systematically about how languages are learned and about pedagogical methodology for language acquisition. He held that language acquisition must be allied with sensation and experience. Teaching must be oral. The schoolroom should have models of things, and failing that, pictures of them. As a result, he also published the world's first illustrated children's book, *Orbis Sensualim Pictus*. The study of Latin diminished from the study of a living language to be used in the real world to a subject in the school curriculum. Such decline brought about a new justification for its study. It was then claimed that its

study developed intellectual abilities, and the study of Latin grammar became an end in and of itself.

“Grammar schools” from the 16th to 18th centuries focused on teaching the grammatical aspects of Classical Latin. Advanced students continued grammar study with the addition of rhetoric.

18th Century

The study of modern languages did not become part of the curriculum of European schools until the 18th century. Based on the purely academic study of Latin, students of modern languages did much of the same exercises, studying grammatical rules and translating abstract sentences. Oral work was minimal, and students were instead required to memorize grammatical rules and apply these to decode written texts in the target language. This tradition-inspired method became known as the ‘grammar-translation method’.

19th–20th Century

Innovation in foreign language teaching began in the 19th century and became very rapid in the 20th century. It led to a number of different and sometimes conflicting methods, each trying to be a major improvement over the previous or contemporary methods. The earliest applied linguists included Jean Manesca, Heinrich Gottfried Ollendorff (1803–1865), Henry Sweet (1845–1912), Otto Jespersen (1860–1943), and Harold Palmer (1877–1949). They worked on setting language teaching principles and approaches based on linguistic and psychological theories, but they left many of the specific practical details for others to devise.

Those looking at the history of foreign-language education in the 20th century and the methods of teaching (such as those related below) might be tempted to think

that it is a history of failure. Very few students in U.S. universities who have a foreign language as a major manage to reach something called “minimum professional proficiency”. Even the “reading knowledge” required for a PhD degree is comparable only to what second-year language students read and only very few researchers who are native English speakers can read and assess information written in languages other than English. Even a number of famous linguists are monolingual.

However, anecdotal evidence for successful second or foreign language learning is easy to find, leading to a discrepancy between these cases and the failure of most language programs, which helps make the research of second language acquisition emotionally charged. Older methods and approaches such as the grammar translation method or the direct method are dismissed and even ridiculed as newer methods and approaches are invented and promoted as the only and complete solution to the problem of the high failure rates of foreign language students.

Most books on language teaching list the various methods that have been used in the past, often ending with the author’s new method. These new methods are usually presented as coming only from the author’s mind, as the authors generally give no credence to what was done before and do not explain how it relates to the new method. For example, descriptive linguists seem to claim unhesitatingly that there were no scientifically-based language teaching methods before their work (which led to the audio-lingual method developed for the U.S. Army in World War II). However, there is significant evidence to the contrary. It is also often inferred or even stated that older methods were completely ineffective or have died out completely when even the oldest methods are still used (e.g. the Berlitz version of the direct method). One reason

for this situation is that proponents of new methods have been so sure that their ideas are so new and so correct that they could not conceive that the older ones have enough validity to cause controversy. This was in turn caused by emphasis on new scientific advances, which has tended to blind researchers to precedents in older work.(p. 5)

There have been two major branches in the field of language learning; the empirical and theoretical, and these have almost completely separate histories, with each gaining ground over the other at one point in time or another. Examples of researchers on the empiricist side are Jespersen, Palmer, and Leonard Bloomfield, who promote mimicry and memorization with pattern drills. These methods follow from the basic empiricist position that language acquisition basically results from habits formed by conditioning and drilling. In its most extreme form, language learning is seen as basically the same as any other learning in any other species, human language being essentially the same as communication behaviors seen in other species.

On the theoretical side are, for example, Francois Gouin, M.D. Berlitz, and Elime de Sauze, whose rationalist theories of language acquisition dovetail with linguistic work done by Noam Chomsky and others. These have led to a wider variety of teaching methods ranging from the grammar-translation method to Gouin's "series method" to the direct methods of Berlitz and de Sauze. With these methods, students generate original and meaningful sentences to gain a functional knowledge of the rules of grammar. This follows from the rationalist position that man is born to think and that language use is a uniquely human trait impossible in other species. Given that human languages share many common traits, the idea is that humans share a universal grammar which is built into our brain structure. This allows us to create sentences that we have never

heard before but that can still be immediately understood by anyone who understands the specific language being spoken. The rivalry of the two camps is intense, with little communication or cooperation between them.

Methods of Teaching Foreign Languages

Language education may take place as a general school subject or in a specialized language school. There are many methods of teaching languages. Some have fallen into relative obscurity and others are widely used; still others have a small following, but offer useful insights.

While sometimes confused, the terms “approach”, “method” and “technique” are hierarchical concepts. An approach is a set of correlative assumptions about the nature of language and language learning, but does not involve procedure or provide any details about how such assumptions should translate into the classroom setting. Such can be related to second language acquisition theory.

There are three principal views at this level:

1. The structural view treats language as a system of structurally related elements to code meaning (e.g. grammar).
2. The functional view sees language as a vehicle to express or accomplish a certain function, such as requesting something.
3. The interactive view sees language as a vehicle for the creation and maintenance of social relations, focusing on patterns of moves, acts, negotiation and interaction found in conversational exchanges. This view has been fairly dominant since the 1980s.

Examples of structural methods are grammar translation and the audio-lingual method. Examples of functional methods include the oral approach / situational

language teaching. Examples of interactive methods include the direct method, the series method, communicative language teaching, language immersion, the proprioceptive language learning method, the Silent Way, Suggestopedia, the Natural Approach, Total Physical Response, Teaching Proficiency through Reading and Storytelling and Dogme language teaching.

A method is a plan for presenting the language material to be learned and should be based upon a selected approach. In order for an approach to be translated into a method, an instructional system must be designed considering the objectives of the teaching/learning, how the content is to be selected and organized, the types of tasks to be performed, the roles of students and the roles of teachers. A technique is a very specific, concrete stratagem or trick designed to accomplish an immediate objective. Such are derived from the controlling method, and less-directly, with the approach.

Learning Strategies

Code Switching

Code switching, that is, changing between languages at some point in a sentence or utterance, is a commonly used communication strategy among language learners and bilinguals. While traditional methods of formal instruction often discourage code switching, students, especially those placed in a language immersion situation, often use it. If viewed as a learning strategy, wherein the student uses the target language as much as possible but reverts to their native language for any element of an utterance that they are unable to produce in the target language (as, e.g., in Wolfgang Butzkamm's concept of enlightened monolingualism), then it has the advantages that it encourages fluency development and motivation and a sense of accomplishment by enabling the student to

discuss topics of interest to him or her early in the learning process—before requisite vocabulary has been memorized. It is particularly effective for students whose native language is English, due to the high probability of a simple English word or short phrase being understood by the conversational partner.

Teaching Strategies

Blended Learning

Blended learning combines face-to-face teaching with distance education, frequently electronic, either computer-based or web-based. It has been a major growth point in the ELT (English Language Teaching) industry over the last ten years. Some people, though, use the phrase 'Blended Learning' to refer to learning taking place while the focus is on other activities. For example, playing a card game that requires calling for cards may allow blended learning of numbers (1 to 10).

Skills Teaching

When talking about language skills, the four basic ones are: listening, speaking, reading and writing. However, other, more socially-based skills have been identified more recently such as summarizing, describing, narrating etc. In addition, more general learning skills such as study skills and knowing how one learns have been applied to language classrooms.

In the 1970s and 1980s the four basic skills were generally taught in isolation in a very rigid order, such as listening before speaking. However, since then, it has been recognized that we generally use more than one skill at a time, leading to more integrated exercises. Speaking is a skill that often is underrepresented in the traditional classroom. This could be due to the fact that it is considered a less-academic skill than writing, is transient and

improvised (thus harder to assess and teach through rote imitation).

More recent textbooks stress the importance of students working with other students in pairs and groups, sometimes the entire class. Pair and group work give opportunities for more students to participate more actively. However, supervision of pairs and groups is important to make sure everyone participates as equally as possible. Such activities also provide opportunities for peer teaching, where weaker learners can find support from stronger classmates.

Sandwich Technique

In foreign language teaching, the sandwich technique is the oral insertion of an idiomatic translation in the mother tongue between an unknown phrase in the learned language and its repetition, in order to convey meaning as rapidly and completely as possible. The mother tongue equivalent can be given almost as an aside, with a slight break in the flow of speech to mark it as an intruder. When modeling a dialogue sentence for students to repeat, the teacher not only gives an oral mother tongue equivalent for unknown words or phrases, but repeats the foreign language phrase before students imitate it: L2 => L1 => L2. For example, a German teacher of English might engage in the following exchange with the students:

Teacher: "Let me try - lass mich mal versuchen - let me try."

Students: "Let me try."

Mother Tongue Mirroring

Mother tongue mirroring is the adaptation of the time-honoured technique of literal translation or word-for word translation for pedagogical purposes. The aim is to make foreign constructions salient and transparent to learners and, in many cases, spare them the technical jargon of

grammatical analysis. It differs from literal translation and interlinear text as used in the past since it takes the progress learners have made into account and only focuses upon a specific structure at a time. As a didactic device, it can only be used to the extent that it remains intelligible to the learner, unless it is combined with a normal idiomatic translation.

Back-Chaining

Back-chaining is a technique used in teaching oral language skills, especially with polysyllabic or difficult words. The teacher pronounces the last syllable, the student repeats, and then the teacher continues, working backwards from the end of the word to the beginning.

For example, to teach the name 'Mussorgsky' a teacher will pronounce the last syllable: *-sky*, and have the student repeat it. Then the teacher will repeat it with *-sorg-* attached before: *-sorg-sky*, and all that remains is the first syllable: *Mus-sorg-sky*.

Language Education by Region

Practices in language education vary significantly by region. Firstly, the languages being learned differ; in the United States, Spanish is the most popular language to be learned, whereas the most popular language to be learned in Australia is Japanese. Also, teaching methods tend to differ by region. Language immersion is popular in some European countries, but is not used very much in the United States.

Language Study Holidays

An increasing number of people are now combining holidays with language study in the native country. This enables the student to experience the target culture by meeting local people. Such a holiday often combines formal

lessons, cultural excursions, leisure activities, and a homestay, perhaps with time to travel in the country afterwards. Language study holidays are popular across Europe and Asia due to the ease of transportation and variety of nearby countries. These holidays have become increasingly more popular in Central and South America in such countries as Guatemala, Ecuador and Peru.

With the increasing prevalence of international business transactions, it is now important to have multiple languages at one's disposal. This is also evident in businesses outsourcing their departments to Eastern Europe.

Language Education on the Internet

The Internet has emerged as a powerful medium to teach and learn foreign languages. Websites that provide language education on the Internet may be broadly classified under 3 categories:

1. Language exchange websites
2. Language portals
3. Virtual online schools
4. Support websites

Language Exchange Websites

Language exchange facilitates language learning by placing users with complementary language skills in contact with each other. For instance, *User A* is a native Spanish speaker and wants to learn English; *User B* is a native English speaker and wants to learn Spanish. Language exchange websites essentially treat *knowledge of a language* as a commodity, and provide a market like environment for the commodity to be exchanged. Users typically contact each other via text chat, voice-over-IP, or email.

Language exchanges have also been viewed as a helpful tool to aid language learning at language schools. Language

exchanges tend to benefit oral proficiency, fluency, colloquial vocabulary acquisition, and vernacular usage, rather than formal grammar or writing skills.

Portals that Provide Language Content

There are a number of Internet portals that offer language content, some in interactive form. Content typically includes phrases with translation in multiple languages, text to speech engines (TTS), learning activities such as quizzes or puzzles based on language concepts. While some of this content is free, a large fraction of the content on offer is available for a fee, especially where the content is tailored to the needs of language tests such as TOEFL, for the United States.

In general, language education on the Internet provides a good supplement to real world language schooling. However, the commercial nature of the Internet, including pop-up and occasionally irrelevant text or banner ads might be seen as a distraction from a good learning experience.

Virtual World-Based Language Schools

These are schools operating online in MMOs and virtual worlds. Unlike other language education on the Internet, virtual world schools are usually designed as an alternative to physical schools. In 2005, the virtual world Second Life started to be used for foreign language tuition, sometimes with entire businesses being developed.

Foreign language English has gained an online presence, with several schools operating entirely online. In addition, Spain's language and cultural institute Instituto Cervantes has an "island" on Second Life. A list of educational projects (including some language schools) in Second Life can be found on the second life Educational wiki, or the SimTeach site.

Minority Language Education

Minority Language Education Policy

The principle policy arguments in favor of promoting minority language education are the need for multilingual workforces, intellectual and cultural benefits and greater inclusion in global information society. Access to education in a minority language is also seen as a human right as granted by the European Convention on Human Rights and Fundamental Freedoms, the European Charter for Regional or Minority Languages and the UN Human Rights Committee. Bilingual Education has been implemented in many countries including the United States, in order to promote both the use and appreciation of the minority language, as well as the majority language concerned.

Materials and E-Learning for Minority Language Education

Suitable resources for teaching and learning minority languages can be difficult to find and access, which has led to calls for the increased development of materials for minority language teaching. The internet offers opportunities to access a wider range of texts, audios and videos. Language learning 2.0 (the use of web 2.0 tools for language education) offers opportunities for material development for lesser-taught languages and to bring together geographically dispersed teachers and learners.

Acronyms and Abbreviations

- ALL: Apprenticeship Language Learning
- CALL: computer-assisted language learning
- CLIL: content and language integrated learning
- CLL: community language learning
- DELE: Diploma de Espanol como Lengua Extranjera
- EFL English as a foreign language

- ELT English language teaching
- FLL foreign language learning
- FLT foreign language teaching
- L1: first language, native language, mother tongue
- L2: second language (or any additional language)
- LDL: Lernen durch Lehren (German for learning by teaching)
- LOTE: Languages Other Than English
- SLA: second language acquisition
- TELL: technology-enhanced language learning
- TEFL: teaching English as a foreign language N.B. This article is about travel-teaching.
- TEFLA: teaching English as a foreign language to adults
- TPR: Total Physical Response
- TPRS: Teaching Proficiency through Reading and Storytelling
- UNICert is a European language education system of many universities based on the Common European Framework of Reference for Languages.

LIST OF EDUCATIONAL PROGRAMMING LANGUAGES

An educational programming language is a programming language that is designed primarily as a learning instrument and not so much as a tool for writing programs for real-world work.

Learning Paths

Many educational programming languages position themselves inside a learning path, that is a sequence of languages each designed to build on the others moving a student from easy to understand and entertaining

environments to full professional environments. Some of the better known are presented below.

Assembly Language

Originally, machine code was the first and only way to program computers. Assembly language was the next type of language used, and thus is one of the oldest families of computer languages in use today. Thus, many dialects and implementations are available, usually some for each computer processor architecture. It is very basic and termed a low level programming language. It is one of the more difficult languages to work with, being untyped, and rigid, but that is how computers work at low level. Several simplified dialects exist for education.

Low level languages must be written for a specific processor architecture. They cannot be written or taught in isolation, without reference thereto. Thus, unlike higher level languages, using an educational assembly language needs a processor representation, or is based on such. Assembly is the most helpful programming language to use for learning about fundamental computer processor operation.

- Little Man Computer (LMC) is an instructional model of a simple von Neumann architecture computer, with all basic features of modern computers. It can be programmed in machine code (usually decimal) or assembly. The model uses a little man in a small room. At one end are 100 mailboxes (memory), each can hold a three digit instruction or data. At the other end are two mailboxes labeled INBOX and OUTBOX which receive and emit data. In the middle is a work area with a simple two function (add and subtract) calculator called Accumulator and a resettable

counter called Program Counter which is similar to what is used to record how many people enter a building. The student loads the mailboxes, then signals the little man to begin work.

- Next Byte Codes (NBC) is a simple language with assembly language syntax that is used to program Lego Mindstorms NXT programmable bricks. The command line compiler emits NXT compatible machine code, and supports Windows, Mac OS, Linux.
- Little Computer 3 (LC-3), is an assembly language with a simplified instruction set, but can be used to write moderately complex assembly programs and is a theoretically viable target for C compilers. It is simpler than x86 assembly but has many features similar to those in more complex languages. These features make it useful for teaching basic programming and computer architecture to beginning college computer science and computer engineering students, which is its most common use.
- DLX is a reduced instruction set computer (RISC) processor architecture by the main designers of the MIPS and the Berkeley RISC designs, two benchmark examples of RISC design. DLX is essentially a cleaned up, simplified MIPS, with a simple 32-bit load/store architecture. It is widely used in college-level computer architecture courses.
- MIX and MMIX are hypothetical computers used in Donald Knuth's monograph, *The Art of Computer Programming (TAOCP)*. Paraphrasing Knuth: *The MIX systems are computers intended to illustrate machine-level aspects of programming, so its machine language is simple, elegant, easy to learn. It also*

includes all the complexities needed for high performance in practice, so in principle it can be built and perhaps be competitive with some of the fast general-purpose computers. They are hybrids programmable in binary and decimal numbers; most programs written for them will work using either form. Software implementations for MIX and MMIX have been developed by Knuth and made freely available. Several versions of both emulators exist. MIX is a 1960s-style computer. It is superseded by MMIX, a newer modern computer architecture, a 64-bit RISC instruction set architecture (ISA). For MMIX, Knuth collaborated with the architects of the MIPS and Alpha ISAs.

Java Based

Sun's recommended path is Greenfoot to BlueJ to Netbeans/BlueJ to Netbeans/Java.

- Greenfoot is an interactive Java development environment developed primarily for educational purposes. It allows easy development of two-dimensional graphical applications, such as simulations and interactive games. It is mainly aimed at programming education (object-oriented programming with Java) at high school and early university level.
- BlueJ is an integrated Java environment specifically designed for introductory teaching, first year college student. It eliminates some of Java's complex syntax, the difficulties of I/O and represents the object/class relationships visually. The BlueJ environment was developed as part of a university research project about teaching object-orientation to beginners (the Blue system). The aim of BlueJ is to provide

an easy-to-use teaching environment for the Java language that facilitates the teaching of Java to first year students. Special emphasis has been placed on visualization and interaction techniques to create a highly interactive environment that encourages experimentation and exploration.

- NetBeans BlueJ Edition is an integrated development environment (IDE) meant to transition students from the introductory IDE BlueJ to the more professional IDE NetBeans. Sun provides a free curriculum, designed for and tested in high schools for use in teaching Java/BlueJ.
- NetBeans / Java This is a professional level platform. NetBeans refers to both a platform for the development of applications for the network, and an integrated development environment (IDE) developed using the NetBeans Platform. The NetBeans Platform is a reusable framework for simplifying the development of other desktop applications. The platform offers services common to desktop applications, allowing developers to focus on the logic specific to their application. The NetBeans IDE is an open-source integrated development environment written entirely in Java using the NetBeans Platform. NetBeans IDE supports development of all Java application types (Java SE, web, EJB and mobile applications) out of the box. Among other features are an Ant-based project system, version control and refactoring.

Lisp Based

Lisp is the second oldest family of computer languages in use today, and as such has a host of dialects and implementations at a wide range of difficulties. Lisp was originally created as a practical mathematical notation for

computer programs, based on lambda calculus, which makes it particularly well suited for teaching theories of computation. As one of the earliest programming languages, Lisp pioneered many ideas in computer science, including tree data structures, automatic storage management, dynamic typing, object-oriented programming, and the self-hosting compiler all of which are useful for learning computer science. The name *LISP* derives from “LIST Processing language”. Linked lists are one of Lisp languages’ major data structures, and Lisp source code is itself made up of lists. As a result, Lisp programs can manipulate source code as a data structure, giving rise to the macro systems that allow programmers to create new syntax or even new domain-specific languages embedded in Lisp. So Lisps are useful for learning language design, and creating custom languages. A reasonable learning path would be Logo followed by any educational variant such as Scheme or newLISP, followed by a professional variant such as Common LISP.

- Logo is a language that was specifically designed to introduce children to programming. The first part of learning Logo deals with “turtle graphics” (derived from turtle robots used as early as 1969 with proto-Logo. In modern implementations, an abstract drawing device, called the *turtle*, is used to make programming for children very attractive by concentrating on doing turtle graphics. Seymour Papert, the inventor of Logo, was a major thinker in constructionism, a variety of constructivist learning theory. Papert argued that activities like writing would naturally be learned by much younger children providing that they adopted a computation culture. Logo was thus designed not only to teach programming, and computation concepts but to

enhance a child's entire well being in a culture increasingly dominated by technology, "*more important than having an early start on intellectual building, is being saved from a long period of dependency during which one learns to think of learning as something that has to be dished out by a more powerful other...Such children would not define themselves or allow society to define them as intellectually helpless.*" It has been used with children as young as 3 and has a track record of 30 years of success in education. Since Logo is actually a streamlined version of LISP with more advanced students it can be used to introduce the basic concepts of computer science and even artificial intelligence. Brian Harvey wrote a series *Computer Science Logo Style* for self study of computer science based on Logo. Logo is widely available on virtually every platform, in both free and commercial versions.

- Scheme was originally designed in 1975 to serve a tutorial purpose. LISPs of the day used non-recursive control structures to implement lambda calculus, primarily since LISPs were still being implemented for efficiency reasons in hardware. Guy L. Steele, Jr. and Gerald Jay Sussman constructed Scheme as a fast interpreted language on top of an underlying LISP with cheap procedure calls. Pedagogically this allowed for teaching programming in terms of domain-specific languages and meta-circular evaluators. The publication of *Structure and Interpretation of Computer Programs* in 1984 incorporated this educational philosophy into a canonical textbook, which changed the predominance of Pascal as the university programming language.

“The publication of Abelson and Sussman’s *Structure*

and Interpretation of Computer Programs (sicp) (Abelson et al., 1985) revolutionized the landscape of the introductory computing curriculum in the 1980s. Most importantly, the book liberated the introductory course from the tyranny of syntax. Instead of arranging a course around the syntax of a currently fashionable programming language, sicp focused the first course on the study of important ideas in computing: functional abstraction, data abstraction, streams, data-directed programming, implementation of message-passing objects, interpreters, compilers, and register machines.

Over a short period, many universities in the US and around the world switched their first course to sicp and Scheme. The book became a major bestseller for MIT Press. Along with sicp, the Scheme programming language (became widely used. It was no longer the subject of a few individual courses at Indiana University, MIT, and Yale, but the language of choice in introductory courses all over the world.

Since then the Scheme community has introduced several pedagogic programming environments for less advanced courses of particular notes is the PLT Scheme outreach effort with its DrScheme environment, freely available text *How to Design Programs* and *TeachScheme!* educator training.

- newLISP aims to provide a fast, powerful, cross-platform, full-featured scripting version of the Lisp programming language which uses only a modest amount of system resources such as disk space and memory. It is particularly suited for learners because of its simple, consistent, streamlined, Lisp environment that minimizes the learning curve and maximizes programmer productivity and pleasure.

- Common Lisp (CL) is a general-purpose (professional), multi-paradigm programming language supporting a combination of procedural, functional and object-oriented programming paradigms. As a dynamic programming language, it facilitates rapid development, with iterative compiling into efficient run-time programs. Lisp is different from most other professional languages in the use of S-expressions to denote both code and data structure. Function and macro calls are written as lists, with the name of the function first. Developed to standardize the divergent variants of Lisp which predated it, it is not an implementation but rather a language specification. Several implementations of the CL standard exist, including proprietary products and open source software.

Scala Based

- Kojo is an interactive desktop development environment developed primarily for educational purposes application that runs on Windows, Linux, and the Mac. It is a learning environment, with many different features that help with the exploration, learning, and teaching of concepts in the areas of computer programming and critical thinking, math and science, art, music, and creative thinking, computer and internet literacy.
- Spde is an offshoot of the Processing environment to support sketches written in Scala, a powerfully object-oriented and functional language.

Smalltalk/Squeak Based

As part of the One Laptop per Child project, Smalltalk has developed a sequence of languages, each designed to act as an introduction to the next. The structure is Scratch

to Etoys to Squeak to any Smalltalk. Each provides graphical environments which may be used to teach not only programming concepts to kids, but also physics and mathematics simulations, story-telling exercises, etc., through the use of constructive learning. Smalltalk and Squeak are fully featured application development languages that have been around and well respected for decades; Scratch is a children's learning tool.

- Scratch is a visual programming language based on and implemented in Squeak. It has the goal of teaching programming concepts to children and letting them create games, videos, and music. In Scratch, all the interactive objects, graphics, and sounds can be easily imported to a new program and combined in new ways. That way, beginners can get quick results and be motivated to try further. The Scratch community has developed and uploaded over 1,500,000 projects. It is developed at MIT Media Lab.
- Etoys is based on the idea of programmable virtual entities behaving on the computer screen. Etoys provides a media-rich authoring environment with a simple, powerful scripted object model for many kinds of objects created by end-users. It includes 2D and 3D graphics, images, text, particles, presentations, web-pages, videos, sound and MIDI, the ability to share desktops with other Etoy users in real-time, so many forms of immersive mentoring and play can be done over the Internet. It is multilingual, and has been used successfully in United States, Europe, South America, Japan, Korea, India, Nepal, and elsewhere. The program is aimed at children 9-12.
- Squeak is a modern, open source, full-featured

implementation of the Smalltalk programming language and environment. Smalltalk is an object-oriented, dynamically typed, reflective programming language created as the language to underpin the “new world” of computing exemplified by “human–computer symbiosis.” Like Lisp, it has image-based persistence, so everything is modifiable from within the language itself. It has greatly influenced the industry introducing many of the concepts in object-oriented programming and just-in-time compilation. Squeak is the vehicle for a wide range of projects including multimedia applications, educational platforms and commercial web application development. Squeak is designed to be highly-portable and easy to debug, analyze, and change, as its virtual machine is written fully in Smalltalk. The main site maintains a list of free tutorials, and Stephane Ducasse maintains a large collection of Free Online Books related to Smalltalk and Squeak. The commonly used professional language in greatest use today which incorporates many of Smalltalk’s ideas is Objective-C.

BASIC

BASIC is a language invented in 1964 to provide computer access to non-science students. It became popular on mini computers during the 1960s, and became the standard computing language for microcomputers during the late 1970s and early 1980s. The goals of BASIC were focused on the needs of learning to program easily: be easy for beginners to use, be interactive, provide clear and friendly error messages, respond quickly, do not require an understanding of computer hardware or operating systems. What made BASIC particularly useful for education was the small size of programs. Useful programs to illustrate

a concept could be written in a dozen lines. At the same time BASIC did not require mathematical or computer science sophistication. BASIC continues to this day to be a language which is frequently self-taught with excellent tutorials and implementations. See List of BASIC dialects by platform for a complete list. BASIC offers a learning path from learning oriented BASICs such as Microsoft Small Basic, BASIC-256 and SiMPLE, to more full featured BASICs like Visual Basic .NET and Gambas.

- Visual Basic .NET with a freely available Visual Basic Express Edition including an K-12 learning center and Beginner adult learning center
- Microsoft Small Basic is an restricted version of Visual Basic designed as a first programming language, “aimed at bringing ‘fun’ back to programming”. The language is explicitly quite small with only 15 keywords and each of them is quite natural. Object specific libraries for things of general interest and of interest to kids (for example Flickr) children are able to create entertaining interactive programs, on the net or on the desktop. The system utilizes the Microsoft Visual Studio IDE to provide auto-completion and context sensitive help.
- Gambas which is a freely available easy to use BASIC for Linux with a wikibook on Gambas available.
- Basic-256 [4] an easy to use version of BASIC designed to teach anybody the basics of computer programming. It uses traditional BASIC control structures (gosub, for loops, goto) for ease of understanding program flow-control. It has a built-in graphics mode that allows children to draw pictures on screen after minutes. It includes tutorials

that introduce programming concepts through fun exercises.

- SiMPLE is a programming development system that was created to provide easy programming capabilities for everybody, especially non-professionals. SiMPLE is vaguely reminiscent of the AppleSoft BASIC. SiMPLE is a compiled language. In addition, SiMPLE allows users to create their own libraries of frequently used functions. “Simple” is a generic term for three slightly different versions of the language: Micro-SiMPLE to use only 4 keywords, Pro-SiMPLE, and Ultra-SiMPLE use of 23 keywords.

Children

- AgentSheets is an award winning game and simulation authoring tool that is simple enough to be used by middle school students to learn about computer science by making video games, yet sophisticated enough to allow NASA scientist to create simulations of Space Shuttle payload. AgentSheets is supported through a complete curriculum called Scalable Game Design starting with simple Frogger-like games all the way up to Sim-like games with sophisticated artificial intelligence. AgentSheets supports game (animation, interaction, sound, speech synthesis/recognition (Mac)) and science applications (plots, output to spreadsheets, 3D plot (Mac)). English, Greek, and Japanese versions are available. AgentSheets formed the basis for LegoSheets a programming language for the Lego Mindstorms. which had a less steep learning curve than Brick Logo.
- Alice is a free programming software designed to

teach event driven object oriented programming to children. Programmers create interactive stories using a modern IDE interface with a drag and drop style of programming. The target audience is middle school girls though most children with computer experience will find it entertaining and educational. A variant of Alice designed with an even stronger story telling bent called Story Telling Alice is also available.

- **Baltie** is an educational graphic oriented programming tool for children, youth (and adults). Baltie is also main character of this software a little wizard keen to execute miscellaneous commands and to conjure pictures (tiles) in his scene. With Balties help children will quickly realize what is a computer and how to master and program the computer. All that by playing. Baltie can be used also for exercising logical thinking. It makes no demands on child's knowledge, only playfulness and imagination are required. It is used in many countries in the basic schools. The new version of Baltie 4 fully supports C#. More usage information is at the (SGP Systems).
- **CiMPLE** is a visual programming language for programming robotic kit for children. It is built on top of C as a DSL. ThinkLabs an Indian Robotics education based startup has built it for iPitara Robotic kit. CiMPLE visual language bears strong resemblance to written C programming language. Approximately 5000+ students in India have brought the iPitara kit and programmed it using CiMPLE. More information is at (CiMPLE Original Developers Weblog) and (Robo.in).
- **E-Slate** is an exploratory learning environment. It

provides a workbench for creating highly dynamic software with rich functionality, by non-programmers. Educational activity ideas can be turned into software with minimal authoring effort in the form of interactive Microworlds which contain specially designed educational components. E-Slate components are provided as a kit of pre-fabricated, interoperable computational objects. Software Microworlds can be very easily constructed by plugging components in various configurations. The behaviour of both components and Microworlds, can be programmed in a Logo-based scripting language. E-Slate is currently based on the Java platform and related technologies. More information and download is at (RA-CTI / Greek Ministry of Education).

- Guido van Robot is a robot control program similar to Logo or Karel J. Robot, with a minimal Python syntax. It is designed to be minimalistic and generic to any high level language. There is a variant that includes the full Python syntax and a canonical set of lessons called RUR-PLE.
- PythonTurtle is a LOGO like turtle graphics made in wxPython. There is also Python standard Turtle graphics module (based on TK), and a Python Turtle Demo — collection of 50+ demos, which are intended as examples for using Python and turtlegraphics in an educational setting.
- Hackety Hack is a free Ruby-based environment aiming to make learning programming easy for beginners, especially teenagers.
- Karel, Karel++, and Karel J. Robot are languages aimed at absolute beginners, used to control a simple robot in a city consisting of a rectangular grid of

streets. While Karel is its own programming language, Karel++ is a version of Karel implemented in C++, while Karel J. Robot is a version of Karel implemented in Java.

- Kodu is a language that is simple and entirely icon-based. It was incubated out of Microsoft Research as a project to reach younger children and especially girls into enjoying technology. Programs are composed of pages, which are divided into rules, which are further divided into conditions and actions. Conditions are evaluated simultaneously. The Kodu language is designed specifically for game development and provides specialized primitives derived from gaming scenarios. Programs are expressed in physical terms, using concepts like vision, hearing, and time to control character behavior. While not as general-purpose as classical programming languages, Kodu can express advanced game design concepts in a simple, direct, and intuitive manner. The Kodu tool is available in three forms: PC as a free download in public beta and academic forms, and as a low-cost Xbox 360 Live download.
- Learn to Program BASIC is a BASIC interpreter with an interactive course intended to teach the language to middle school students. Game-specific additions to the BASIC language include 2D sprite support. Programs written in “LTPB” could be executed on computers without the software by means of a freely-distributable “runner”.
- Lego Mindstorms is a line of Lego sets combining programmable bricks with electric motors, sensors, Lego bricks, and Lego Technic pieces (such as gears, axles, and beams). Mindstorms originated from the programmable sensor blocks used in the line of

educational toys. The first retail version of Lego Mindstorms was released in 1998 and marketed commercially as the Robotics Invention System (RIS). The current version was released in 2006 as Lego Mindstorms NXT. A wide range of programming languages is used for the mindstorms from Logo to BASIC to derivatives of Java, Smalltalk and C. The Mindstorm approach to programming now have dedicated physical sites called Computer Clubhouses.

- Mama is an educational object oriented programming language designed to help young students start programming by providing all the language elements in the student mother tongue. Mama programming language is available in several languages, with both LTR and RTL language direction support. A new variant of Mama was built on top of Carnegie Mellon's *Alice* development environment, supporting scripting of the 3D stage objects. This new variant of Mama was designed to help young students start programming by building 3D animations and games. A document about educational programming principles explains Mama's design considerations.
- Phrogram (the second generation product of *Kid's Programming Language*) is a commercial easy-to-learn programming language and Integrated Development Environment introduced in 2006. It emphasizes graphics and sounds, making it especially easy to develop games and entertaining educational material. Phrogram is a simplified structured language, and offers component-based development features such as classes and methods. It is modeled on modern IDEs such as Eclipse and Visual Studio. NET, and intends to prepare a

beginner to graduate to these or other professional development environments.

- RoboMind is a simple educational programming environment that lets beginners program a robot. It introduces popular programming techniques and also some robotics and artificial intelligence. The robot can be programmed in Arabic, Chinese, Dutch, English and Swedish.
- Stagecast Creator is a visual programming system based on programming by demonstration. Users demonstrate to the system what to do by moving icons on the screen, and it generates rules for the objects (characters). Users can create two-dimensional simulations that model a concept, multi-level games, interactive stories, etc.

Historical

- Pascal is the most well-known programming language that was designed with education in mind. From the late 1970s to the late 1980s, it was the primary choice in introductory computer science classes for teaching students programming in both the US and Europe. Its use for real-world applications has since increased, and regarding it as a purely educational programming language has since become somewhat controversial.

University

- A++ represents a more recent attempt to create a language designed to provide an efficient tool for basic training in programming.
- Curry is a teaching language designed to amalgamate the most important declarative programming paradigms, namely functional programming (nested expressions, higher-order

functions, lazy evaluation) and logic programming (logical variables, partial data structures, built-in search). It also integrates the two most important operational principles developed in the area of integrated functional logic languages: “residuation” and “narrowing”.

- Haskell is often used by universities in place of LISP or Scheme. Its primary goal was to function equally well as a language for teaching, research and application design. It is a purely functional, extremely expressive lazy functional programming language. Sample courses are available online, as are multiple books and tutorials. An education specific compiler / IDE, called Helium has been created. Another advantage of Haskell is in teaching inductive methods. Because of the advantages of Haskell’s syntax inductive proofs become as easy or easier as they are on paper, unlike the LISP/Scheme family which introduces additional syntax.
- M2001 is a modular mathematical language for developing and presenting mathematical algorithms, from modern discrete to classical continuous mathematics. It is built on a semantic framework based in category theory, with a syntax similar to that of Pascal or Modula-2. It is designed for education only, so efficiency and ease of implementation are far less vital in its development than generality and range of application. It was created to play a strong role in forming a formal algorithmic foundation for first-year college math students.
- Oz is a programming language designed to teach computer theory. It supports most major paradigms in one language so that students can learn paradigms

without having to learn multiple syntaxes. Oz contains in a simple and well-factored way most of the concepts of the major programming paradigms, including logic, functional (both lazy and eager), imperative, object-oriented, constraint, distributed, and concurrent programming. It has a canonical textbook *Concepts, Techniques, and Models of Computer Programming* and a freely available standard implementation the Mozart Programming System.

- Qi II is a functional programming language. The Qi core language is a simplification of the Lisp language, but it includes most of the features common to modern functional programming languages such as pattern matching, currying, partial applications, guards and (optional) static type checking. It also includes an embedded Prolog as part of the distribution called *Qi Prolog*. The combination of all these features within the Lisp environment makes Qi in many senses a rationalization and modernization of Lisp. Qi is free for non commercial use, and has a free canonical textbook *Functional Programming in Qi*.

SEMANTICS OF PROGRAMMING LANGUAGES

In programming language theory, semantics is the field concerned with the rigorous mathematical study of the meaning of programming languages and models of computation. The formal semantics of a language is given by a mathematical model that describes the possible computations described by the language.

Overview

The field of formal semantics encompasses all of the following:

- The definition of semantic models
- The relations between different semantic models
- The relations between different approaches to meaning
- The relation between computation and the underlying mathematical structures from fields such as logic, set theory, model theory, category theory, etc.

It has close links with other areas of computer science such as programming language design, type theory, compilers and interpreters, program verification and model checking.

Approaches

There are many approaches to formal semantics; these approaches belong to three major classes:

- Denotational semantics, whereby each phrase in the language is translated into a *denotation*, i.e. a phrase in some other language. Denotational semantics loosely corresponds to compilation, although the “target language” is usually a mathematical formalism rather than another computer language. For example, denotational semantics of functional languages often translates the language into domain theory;
- Operational semantics, whereby the execution of the language is described directly (rather than by translation). Operational semantics loosely corresponds to interpretation, although again the “implementation language” of the interpreter is generally a mathematical formalism. Operational semantics may define an abstract machine (such as the SECD machine), and give meaning to phrases by describing the transitions they induce on states

of the machine. Alternatively, as with the pure lambda calculus, operational semantics can be defined via syntactic transformations on phrases of the language itself;

- Axiomatic semantics, whereby one gives meaning to phrases by describing the *logical axioms* that apply to them. Axiomatic semantics makes no distinction between a phrase's meaning and the logical formulas that describe it; its meaning *is* exactly what can be proven about it in some logic. The canonical example of axiomatic semantics is Hoare logic.

The distinctions between the three broad classes of approaches can sometimes be vague, but all known approaches to formal semantics use the above techniques, or some combination thereof.

Apart from the choice between denotational, operational, or axiomatic approaches, most variation in formal semantic systems arises from the choice of supporting mathematical formalism.

Variations

Some variations of formal semantics include the following:

- Action semantics is an approach that tries to modularize denotational semantics, splitting the formalization process in two layers (macro and microsemantics) and predefining three semantic entities (actions, data and yielders) to simplify the specification;
- Algebraic semantics describes semantics in terms of algebras;
- Attribute grammars define systems that

systematically compute “metadata” (called *attributes*) for the various cases of the language’s syntax. Attribute grammars can be understood as a denotational semantics where the target language is simply the original language enriched with attribute annotations. Aside from formal semantics, attribute grammars have also been used for code generation in compilers, and to augment regular or context-free grammars with context-sensitive conditions;

- Categorical (or “functorial”) semantics uses category theory as the core mathematical formalism;
- Concurrency semantics is a catch-all term for any formal semantics that describes concurrent computations. Historically important concurrent formalisms have included the Actor model and process calculi;
- Game semantics uses a metaphor inspired by game theory.
- Predicate transformer semantics, developed by Edsger W. Dijkstra, describes the meaning of a program fragment as the function transforming a postcondition to the precondition needed to establish it.

Describing Relationships

For a variety of reasons, one might wish to describe the relationships between different formal semantics. For example:

- To prove that a particular operational semantics for a language satisfies the logical formulas of an axiomatic semantics for that language. Such a proof demonstrates that it is “sound” to reason about a

particular (operational) *interpretation strategy* using a particular (axiomatic) *proof system*.

- To prove that operational semantics over a high-level machine is related by a bisimulation with the semantics over a low-level machine, whereby the low-level abstract machine contains more primitive operations than the high-level abstract machine definition of a given language. Such a proof demonstrates that the low-level machine “faithfully implements” the high-level machine.

It is also possible to relate multiple semantics through abstractions via the theory of abstract interpretation.

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Glossary

Abbreviations: Letter(s) or shortened word used instead of a full word or phrase.

Accent: The features of pronunciation which indicate the regional or the social identity of a speaker.

Acquisition: The process by which language skills are developed – particularly in infancy.

Adjectives: A word which modifies a noun or a pronoun.

Adverbs: A word which modifies a verb, an adverb, or an adjective.

Agreement: The grammatical logic and coherence between parts of a sentence.

Alliteration: The repetition of consonant sounds – usually at the beginning of words.

Apostrophes: A raised comma used to denote either possession or contraction.

Application & app: An application (often called “app” for short) is simply a program with a GUI. Note that it is different from an applet.

Articles: A word that specifies whether a noun is definite or indefinite.

Assonance: The repetition of vowel sounds.

Audience: The person or persons receiving a speech or piece of writing.

Boot: Starting up an OS is booting it. If the computer is already running, it is more often called rebooting.

Brackets: Curved or square punctuation marks enclosing words inserted into a text.

Browser: A browser is a program used to browse the web. Some common browsers include Netscape, MSIE (Microsoft Internet Explorer), Safari, Lynx, Mosaic, Amaya, Arena, Chimera, Opera, Cyberdog, HotJava, etc.

Bug: A bug is a mistake in the design of something, especially software. A really severe bug can cause something to crash.

Capitals: Upper-case letters used to indicate names, titles, and important words.

Chat: Chatting is like e-mail, only it is done instantaneously and can directly involve multiple people at once. While e-mail now relies on one more or less standard protocol, chatting still has a couple competing ones. Of particular note are IRC and Instant Messenger. One step beyond chatting is called MUDding.

Clauses: A structural unit of language which is smaller than the sentence but larger than phrases or words, and which contains a finite verb.

Cliche: An over-used phrase or expression.

Click: To press a mouse button. When done twice in rapid succession, it is referred to as a double-click.

Colons: A punctuation mark indicating a pause ranking between a semicolon and a full stop.

Commas: A punctuation mark indicating a short pause in a sentence.

Conjunction: A word which connects words or other constructions.

Consonant: An alphabetic element other than a vowel.

Context: The setting in which speech or writing takes place.

Cursor: A point of attention on the computer screen, often marked with a flashing line or block. Text typed into the computer will usually appear at the cursor.

Database: A database is a collection of data, typically organized to make common retrievals easy and efficient. Some common database programs include Oracle, Sybase, Postgres, Informix, Filemaker, Adabas, etc.

Desktop: A desktop system is a computer designed to sit in one position on a desk somewhere and not move around. Most general purpose computers are desktop systems. Calling a system a desktop implies nothing about its platform. The fastest desktop system at any given time is typically either an Alpha or PowerPC based system, but the SPARC and PA-RISC based systems are also often in the running. Industrial strength desktops are typically called workstations.

Dialect: A form of speech peculiar to a district, class, or person.

Diglossia: The existence of two official languages in a society.

Diphthong: Two vowel characters representing the sound of a single vowel.

Directory: Also called "folder", a directory is a collection of files typically created for organizational purposes. Note that a directory is itself a file, so a directory can generally contain other directories. It differs in this way from a partition.

Disk: A disk is a physical object used for storing data. It will not forget its data when it loses power. It is always used in conjunction with a disk drive. Some disks can be removed from their drives, some cannot. Generally it is possible to write new information to

a disk in addition to reading data from it, but this is not always the case.

Drive: A device for storing and/or retrieving data. Some drives (such as disk drives, zip drives, and tape drives) are typically capable of having new data written to them, but some others (like CD-ROMs or DVD-ROMs) are not. Some drives have random access (like disk drives, zip drives, CD-ROMs, and DVD-ROMs), while others only have sequential access (like tape drives).

Ellipsis: The omission of words from a sentence.

Figure of speech: Expressive use language in non-literal form to produce striking effect.

File: A file is a unit of (usually named) information stored on a computer.

Firmware: Sort of in-between hardware and software, firmware consists of modifiable programs embedded in hardware. Firmware updates should be treated with care since they can literally destroy the underlying hardware if done improperly. There are also cases where neglecting to apply a firmware update can destroy the underlying hardware, so user beware.

Floppy: An extremely common type of removable disk. Floppies do not hold too much data, but most computers are capable of reading them. Note though that there are different competing format used for floppies, so that a floppy written by one type of computer might not directly work on another. Also sometimes called “diskette”.

Form: The outward appearance or structure of language, as opposed to its function, meaning, or social use

Format: The manner in which data is stored; its organization. For example, VHS, SVHS, and Beta

are three different formats of video tape. They are not 100% compatible with each other, but information can be transferred from one to the other with the proper equipment (but not always without loss; SVHS contains more information than either of the other two). Computer information can be stored in literally hundreds of different formats, and can represent text, sounds, graphics, animations, etc. Computer information can be exchanged via different computer types provided both computers can interpret the format used.

Full stop: A punctuation mark indicating the end of a sentence

Function keys: On a computer keyboard, the keys that start with an "F" that are usually (but not always) found on the top row. They are meant to perform user-defined tasks.

Function: The role language plays to express ideas or attitudes

Grammar: The study of sentence structure, especially with reference to syntax and semantics

Grapheme: The smallest unit in the writing system of a language

Graphics: Anything visually displayed on a computer that is not text.

Graphology: The study of writing systems

Hardware: The physical portion of the computer.

Homonyms: Words with the same spelling but with different meanings

Hypertext: A hypertext document is like a text document with the ability to contain pointers to other regions of (possibly other) hypertext documents.

Hyphen: A short horizontal mark used to connect words or syllables, or to divide words into parts

Idiom: A sequence of words which forms a whole unit of meaning

Internet: The Internet is the world-wide network of computers. There is only one Internet, and thus it is typically capitalized (although it is sometimes referred to as “the ‘net”). It is different from an intranet.

Intonation: The use of pitch in speech to create contrast and variation

Irony: Saying [or writing] one thing, whilst meaning the opposite

Jargon: The technical language of an occupation or group

Language change: The development and changes in a language

Language: Computer programs can be written in a variety of different languages. Different languages are optimized for different tasks. Common languages include Java, C, C++, ForTran, Pascal, Lisp, and BASIC. Some people classify languages into two categories, higher-level and lower-level. These people would consider assembly language and machine language lower-level languages and all other languages higher-level. In general, higher-level languages can be either interpreted or compiled; many languages allow both, but some are restricted to one or the other. Many people do not consider machine language and assembly language at all when talking about programming languages.

Laptop: A laptop is any computer designed to do pretty much anything a desktop system can do but run for a short time (usually two to five hours) on batteries. They are designed to be carried around but are not particularly convenient to carry around. They are significantly more expensive than desktop

systems and have far worse battery life than PDAs. Calling a system a laptop implies nothing about its platform. By far the fastest laptops are the PowerPC based Macintoshes.

Lexis: The vocabulary of a language, especially in dictionary form

Memory: Computer memory is used to temporarily store data. In reality, computer memory is only capable of remembering sequences of zeros and ones, but by utilizing the binary number system it is possible to produce arbitrary rational numbers and through clever formatting all manner of representations of pictures, sounds, and animations. The most common types of memory are RAM, ROM, and flash.

Metaphor: A figure of speech in which one thing is described in terms of another

Metonymy: A figure of speech in which an attribute is substituted for the whole

Modem: A modem allows two computers to communicate over ordinary phone lines. It derives its name from **modulate** / **demodulate**, the process by which it converts digital computer data back and forth for use with an analog phone line.

Morpheme: The smallest unit of meaning in grammar

Morphology: A branch of grammar which studies the structure of words

Multimedia: This originally indicated a capability to work with and integrate various types of things including audio, still graphics, and especially video. Now it is more of a marketing term and has little real meaning. Historically the Amiga was the first multimedia machine. Today in addition to AmigaOS, IRIX and Solaris are popular choices for high-end multimedia work.

Narrator: The person (named or unknown) who is telling a story

Network: A network (as applied to computers) typically means a group of computers working together. It can also refer to the physical wire etc. connecting the computers.

Noun: A word which names an object

Onomatopoeia: A word that sounds like the thing it describes

Oxymoron: A figure of speech which yokes two contradictory terms

Paradox: A figure of speech in which an apparent contradiction contains a truth

Paragraph: A distinct passage of writing which is unified by an idea or a topic

Parenthesis: A word, clause or even sentence which is inserted into a sentence to which it does not grammatically belong

Participle: A word derived from a verb and used as an adjective or a noun

Phonetics: The study of the production, transmission, and reception of speech sounds

Phonology: A study of the sounds in any language

Phrase: A group of words, smaller than a clause, which forms a grammatical unit

Platform: Roughly speaking, a platform represents a computer's family. It is defined by both the processor type on the hardware side and the OS type on the software side. Computers belonging to different platforms cannot typically run each other's programs (unless the programs are written in a language like Java).

Point of view: A term from literary studies which describes the perspective or source of a piece of writing

Preposition: A word which governs and typically precedes a noun or a pronoun

Pronoun: A word that can substitute for a noun or a noun phrase

Punctuation: A system of marks used to introduce pauses and interruption into writing

Received pronunciation: The regionally neutral, prestige accent of British English

Semantics: The study of linguistic meaning

Semicolon: A punctuation mark which indicates a pause longer than a comma, but shorter than a colon

Sentence: A set of words which form a grammatically complete statement, usually containing a subject, verb, and object

Simile: A figure of speech in which one thing is directly likened to another

Slang: Informal, non-standard vocabulary

Speech: The oral medium of transmission for language

Spelling: The convention governing the representation of words by letters in writing systems

Standard English: A dialect representing English speech and writing comprehensible to most users

Structure: The arrangement of parts or ideas in a piece of writing

Style: Aspects of writing (or speech) which have an identifiable character generally used in a positive sense to indicate 'pleasing effects'

Stylistic analysis: The study of stylistic effects in writing

Symbol: An object which represents something other than its self

Synonym: A word which means (almost) the same as another

Syntax: The arrangement of words to show relationships of meaning within a sentence

Tense: The form taken by a verb to indicate time (as in past-present-future)

Text: Any piece of writing or object being studied

Tone: An author's or speaker's attitude, as revealed in 'quality of voice' or 'selection of language'

Verb: A term expressing an action or a state of being

Vocabulary: The particular selection or types of words chosen in speech or writing

Vowel: The open sounds made in speech – as (mainly) distinct from consonants

Word Processor: A program designed to help with the production of textual documents, like letters and memos. Heavier duty work can be done with a desktop publisher. Some common word processors include MS-Word, OpenOffice Write, WordPerfect, AbiWord, AppleWorks Write, and GeoWrite.

Writing: The use of visual symbols to represent words which act as a code for communication.



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Preface

English is a very important language in business. Many people study English as a foreign language, because they want a better job. English is also very important in education. Many pages on the internet are in English. English as a second language is the single most popular subject in the world, after mathematics. Many people who can not go to English language classes study on the internet, using websites like BBC Learning English. Many people study English in a country where the people speak English. This way, many students learn listening and speaking English better. Learning English is what people do when they want to learn how to speak and listen to the English language. People who want to learn English usually also learn to read and write at the same time. A lot of people learn English at school, where English is a common subject. A lot of people also want to spend their own personal time to learn English. They might know no English when they start, or they might have learned some English at school. There are some ways to learn English outside of school:

- *Institutional learning*: Many people join lessons like school lessons but at learning centers where any people can go, no matter their age. In such a centre they will join a class fitting their existing level of learning of English, so that they will be in a group for the teacher to help them learn.
- *Individual learning*: Other people try to learn English on their own, or in a less formal setting

than in a group of people with a teacher. People might meet with others who are trying to learn English, in order to practice their standard of English when speaking. People can also listen to radio broadcasts in English, or watch television programmes in English to help them improve their listening ability. A popular channel to listen to the radio on is broadcast by the BBC, called the BBC World Service. People can also study English by reading books, or listening to English courses on recorded CDs or cassettes.

- *Online learning:* A popular way to learn English in the modern world is to make use of the internet where there are many websites that can help learners. The BBC World Service has a free website for people who are learning English as a second or foreign language called BBC Learning English. There are many online community forums such as English forums, where many people meet to learn English. Questions are answered quickly even with help from volunteer teachers from all over the whole world.

This publication titled, “Computers and English Language Learning” provides readers with an introductory overview of English orthography, types and English as a foreign or second language. An introduction to computer-assisted language learning and e-learning is made. Focus lies on computer-based learning management systems. Besides, focus also lies on computer assisted language learning. The subject areas of communicative language teaching and educational programming languages are covered. This publication titled, “Computers and English Language Learning” is completely user-friendly as it also gives readers a glossary, bibliography and index.

—Editor

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Computers and English Language Learning

