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IS TECHNICAL ENGLISH AN ISLAND?

"*No man is an island entire of itself; every man is a piece of the Continent, a part of the main; if a clod be washed away by the sea, Europe is the less, as well as if a promontory were, as well as if a manor of thy friend's or of thy own were; any man's death diminishes me, because I am involved in mankind; and therefore, never send to know for whom the bell tolls; it tolls for thee ...*"

This passage, which has been misquoted once and again in the history of literature and journalism as if it were a poem, belongs, in fact, to one of the reflections from the book *Devotions upon Emergent Occasions.* The book is a series of meditations written by John Donne in 1624 after a long illness. Curiously enough, he anticipates in a sense the supposedly modern idea of "globalization" (a word which Donne himself never used, as it entered the English language in 1951): every single human event is not isolated, but belongs to a wider, universal context of interrelations. Nothing happens which does not affect some other reality. Nothing, no one is independent in this world. Not even the idea contained in this reflection is new, as it picks up Terentius' Latin saying: *Humanus sum, humani nihil a me alienum puto.*

His idea concerning solidarity (another word unknown to Donne: it was first used in 1841) meant the fellowship which exists between human beings in this world: anything affecting, hurting, destroying another human being affects, hurts or destroys me, as a human being. In that sense, the death of another person anticipates and foreshadows my own death. On the other hand, anything that contributes to the growth and development of any human being makes me more human and brings me closer to my personal fulfillment. Certainly, **"no man is an island".**

But the fact or the reality of man's closeness or solidarity could be projected onto many other realms of life. A country is not an island: social and political events that take place far away can affect, shake and shatter its peaceful stability, or contribute to its development. Think, for example, of the historical consequences that the terrorist attack against the Twin Towers in New York had on the rest of world. Since September 11, not only measures of security in airports changed, but also the whole conception of Islam and the way we relate to Muslim countries suffered deep transformations**. Politics, then, is not an island**: no country can claim to have a life of its own without taking into account the evolution of the rest of the political community from

any point of view: economy, social achievements, political evolution, cultural movements and trends...

Science is not an island either, especially nowadays: the discovery and development of a vaccination or a treatment against any of the many plagues that oppress the human kind may change the way of life of thousands of people who suffer from cancer, AIDS or any other disease, bringing back hope to them and to their relatives, friends, workmates... And such a discovery cannot and will not take place without the cooperation of different branches of science: what can a medical analyst do without a simple microscope, which is the result of investigation in the field of optics, a branch itself of the world of physics? What kind of investigation can a doctor or a biologist do without the help of a computer, the result of the cooperation of engineers from different specialties? In the 21st century, we can hardly believe in the existence of a scientific or technical specialty or branch that could exist and develop on its own, without having to recur to or rely on many other branches and specialties. In that sense, too, **no science is an island entire of itself.**

Language is not an island either. We sometimes hear sociologists, intellectuals and linguists speak about language in our time: many of them quite often complain about the deterioration modern languages are suffering nowadays, and insist on the need of keeping language clean and pure, as if it were some kind of ecological reserve to be protected against pollution or deterioration. I am not against these alarmed voices which see how language, step by step, deteriorates or, at least, changes: English, French, Spanish, Italian, there is no difference as for the same evolutionary or degenerative (who knows which is the right adjective to be used in this case?) phenomenon they are all subjected to.

I do not want, right now, to take sides as to the significance of the changes we perceive: whether they are really a degrading process or they are simply a sign of vitality, evolution and improvement of modern languages deserves another type of study. Therefore, I will try to avoid any derogative terminology and limit my wording to that of a "neutral" observer. Even if that may seem some kind of lukewarm compromise, I will just speak of "changes" in language.

As for the complaints I have just mentioned, I do especially agree in several different dimensions in which those changes or such a process of deterioration, as some say, can be detected:

On the one hand, anyone approaching the most important languages in Europe may find that young men and women use the **simplest structures** (in the worst sense this phrase can have) to build up their discourse and communicate with other people. In their speech, it is often difficult to find subordinate or relative clauses, sentences where one might find anything that exceeds the structure of **subject + verb + object + complements**. Even if this may sound both radical and conservative to some people, one has to recognize

that in many cases our youngsters (and some journalists and quite a large number of politicians) have a serious problem with the way in which they can communicate.

In some cases, the structural modifications to which modern languages are subjected derive from **parallel**, but **simpler** structures taken from foreign languages and different media. Music, films released in their original version, direct recordings of artists' and politicians' statements and interviews, mistranslations... All these factors contribute to the changes that can be detected in the development of any modern language in the last fifty years. **In that sense, too, no language is an island.**

In the case of young people, we should add another factor that is on its way to create a new and unexpected language: that of the e-messages sent via i-phone, i-pad and similar devices. Ultra-simplified words and spellings, **a newborn grammar and syntax** are emerging and giving birth to a new system that could, in the long run, bring about another style of communicating whose features we can hardly suspect or foresee. And even from an evolutionary viewpoint, we could be witnessing a new development of the use and anatomical evolution of the thumb! Obviously, there might be an unsuspected link between linguistics and biology.

The **realm of lexis or vocabulary** is another dimension in which we can find changes or evolution quite easily. We all know about the number of books devoted to the study of the new words, either borrowed from other languages or artificially created, which are introduced every year in the English language (and in any other language, for that matter). This can be noticed in titles of books like "The XY Dictionary of New English", "X hundred New English Words". Curiously enough, we can find a new generation of linguists who are working on old words that were in use until a few years ago and have been put aside or forgotten. In most cases, they are **words belonging to the realm of traditional crafts, trades and professions** that, in turn, **are disappearing** in our society: the work of traditional farmers, cabinetmakers, cobblers… Very soon, the existence of such linguistic realms will be confined to the cold, deadly world of historical dictionaries...

These factors, the evolution of the syntactic or structural dimension of language, and the new words, the changes in meaning of old words, the borrowings or loans from other languages, are more apparent in our time because of a very specific phenomenon of the 20th and 21st centuries: mass communication. In other words, the development of mass media, perhaps the most influential element in the spectrum of factors that define our modern society is, to a large extent, responsible for the fast evolution of languages.

The curious thing is that we feel extremely purist as far as the changes in language take place in **our times**, but we seem to forget or we simply take for granted all the changes, modifications, adulterations, invasions, loans, etc., our modern languages have undergone since the very beginning of their existence.

In a sense, we seem to imply *"changes in language are acceptable and right... provided they take place in the past!"*

In the case of what we now call "English", we can detect two main types or dimensions of change in its historical development; some of these changes belong exclusively to the English language while others are shared with other languages, such as Spanish, as we will see later on.

The first dimension in which we find changes in what we call English is in in its **evolutionary process in** the **realm of lexis**. Roughly speaking, the vocabulary of Modern English is half Germanic or Scandinavian and half Romance (that is, with its roots reaching, mainly through French, as far as Latin, both ancient and medieval). There is, of course, a large number of words which are borrowings from other sources: Dutch or Low German, Spanish, Italian, even Greek in the field of science and technology.

Although the following synopsis may seem very rough, it may help us to understand the main historical milestones in the development with led to the language we have today.

Even if Julius Caesar invaded England in 55 b. C., the Romans did not rule effectively England until the year 43 a. C. Until then, Celtic was the common language spoken in the country and remained as such for centuries. In spite of the Roman rule, Latin did not become the language of the country (a very peculiar phenomenon when compared with what had happened in France or Spain), and of course, did not have any influence in Wales, Scotland and Ireland, which remained free from Roman administration and rule. What was spoken during that long period must have been a mixture of Germanic and Celtic, something which makes us understand the similarities we find between modern English and modern Scandinavian, German and Dutch languages. In any case, through the presence of soldiers and mercenaries and the visits of traders and merchants, a small number of words were added to the language the inhabitants of England spoke: **wine**, **cheese**, **butter** seem to have been introduced in this period. As for Celtic, very little is known to deserve any special notice in this simple lecture.

Probably, the next step was **the arrival of the Anglo-Saxons, together with their conversion to Christianity, which started in the year 597** and was accomplished within thirty or forty years. This conversion meant a reestablishment of the contacts with the Roman civilization, feeble and terminal as it was, the introduction of new Latin words and -no doubt, a most important factor from a linguistic viewpoint- the learning of the **Latin alphabet and the ability to record their speech with characters which could be read** and understood in the other regions of the Roman Empire. Until then, the two alphabets used were runic or ogam.

The **next source of words had its origins in the 9th century: the invasion of the Vikings or Norsemen** meant not only the beginning of a new period in

the history of Britain, but also the introduction or borrowing of a large number of new words in the language spoken in England. Hundreds of Norse terms became part of English, and even today, the similarity existing between Modern English and the Scandinavian languages can be noticed quite easily.

The following and **decisive step in the development and growth of English started in 1066**: as it was the case with the Norsemen, **the Norman Conquest** meant much more than a mere political change: the new "rulers" (whose origin was **Scandinavia**) had been living for years in the north of France and had **adopted French** as their language. Curiously, though they spoke French, this language did not become the language of the Isles.

The difference of this period, when compared with that of the Norse invasion, derives from the fact that this was not a "national" conquest or invasion as such: a large number of Normans came to England, but they settled there as rulers or lords, so they did not mix with the people. That is why **French was spoken in the court**, by noblemen and courtiers, but it never replaced the common language of the people. As a matter of fact, (and to a certain extent, this is a commonplace remark which can be found in any article about the historical development of English) the difference between the social classes of that time, between the conquerors and those who had been conquered, can be detected even today in something as simple as the different names of domestic animals: when they were cared for in the fold, sty or stall, their names were Saxon -**sheep**, **hog**, **bull** or **calf**-, but when they were cooked and served at the table of the noblemen, the rulers, they became Norman: **mutton**, **pork**, **beef** or **veal**.

In any case, **this historical period -which lasted, more or less, until 1362, when English was accepted as the language of the law courts**- meant not only the death and **loss of almost three quarters of the Saxon words**, but also made the basic language to be enriched **with hundreds of Norman words** and, in a roundabout way, was modified again by **Latin**...which seeped through French. Not only did language undergo a number of changes and assimilations, it was enriched and to a certain extent meant the creation of a new, entirely different language together with a different way of life. Besides those terms and realities mentioned before and which reflected the basic social structure, new concepts and words were incorporated and revealed the capacity of lexical "absorption" of the inhabitants of the Isles. The trend continued up to our own day, and manifests itself in the richness of the Oxford Dictionary as far as synonyms are concerned, due to the large number of words borrowed from almost every language that has been in touch with English speaking peoples.

The Renaissance and all the cultural exchanges which took place, together with the invention of printing, brought a double dimension of enrichment. First: the initial unification of language, mainly the English spoken in the London area (where most printing houses were), led to the publishing of the first English dictionary in 1604, which already included a good number of new words. Almost simultaneously, the discovery of America and the great

epoch of sea travel, the number of contacts that took place in the realm of trade, colonization of new found lands, acceptance of refugees from other countries due to the religious wars in the Continent, relationship with the aboriginals of North America and India where Britons settled… every event with an international dimension, whether in the Isles or abroad, meant that every single region, language or dialect left its "stroke" in the lexical picture of English.

The summit of all that process was the English spoken in the United States of America, which from the 17th century onwards became a real melting pot where every accent could be heard and every language could be spoken. We can certainly say that, to a large extent, the trait which distinguishes best the English language even in our time is its **ability to borrow and assimilate terms** from other languages, a feature which has remained alive for centuries and is a phenomenon that has endowed it with one of the largest vocabularies existing at present. Summing up all this pages, we could conclude that**, even though it is the language originally born and spoken in the British Isles, English was not and is not an island.**

The other dimension in which we may find peculiar traits of English is its **evolutionary process in the realm of grammar in morphology and syntax. The** main differences could be summed up in a few points:

From **a structural or grammatical viewpoint**, perhaps the most important transformation it underwent at a morphological and syntactical level was the loss of most of its inflections, a phenomenon that took place gradually along the period that is normally called "Old English". This grammatical or structural change meant something deeper in the evolution of English language, such as we know it at present. If we accept Latin or Greek as the points of reference for the study of a modern language, such as it was the rule in the Renaissance or during the Enlightenment, we must recognize that English, the English which is spoken and written in 2013, is the result of a number of serious and radical breaks with its own past.

First, from the four **cases** nouns had in Old English, (nominative, genitive, dative and accusative), **only two forms have survived**. The genitive or possessive case, which is used, in fact, in a very limited number of occasions. And the nominative case, which, relying on the use of prepositions, has assumed all the functions of the rest of the old cases. It is only in personal pronouns that we can find a third case, what could be (and actually is) termed the "objective" case, and whose syntactic role is any one (direct or indirect object, complement) but those played by the nominative or possessive cases. As for adjectives, they suffered the same phenomenon: no traces can be found of all the different forms they used to have in Old English.

The **loss of inflection or declension in nouns and adjectives** as far as "cases" are concerned, implied a reduction, too, in the **plural forms**. But for a few cases (umlauted plurals: e.g., **man / men**, **foot / feet**; plurals in **-en**: **child /**

children, **ox** / **oxen**; or plurals which kept their singular form unchanged: **sheep**), the rest of nouns formed their plurals by adding the suffixes **-s** or **-es**.

As for a**djectives**, not only did they lose the declension "endings", but **no trace**s were kept **of** suffixes where **gender or number** could be detected. And whereas nouns and pronouns still keep some cases in which masculine, feminine and common or neuter genders are apparent (e.g., **father**, **mother**, **parent**; **stallion**, **mare**, **horse**; **he**, **she**, **it**), no special mark can be found in adjectives, which are only modified with the suffixes **-er** and **-est** in their comparative and superlative forms.

"Personal" words have suffered a **reduction in their forms**, too: the old personal words **thou**, **thee**, **thy**, **thine**, are not used in modern English any more (not even in poetry or in Christian liturgy, the last resort where they could be found in the late 19th and early 20th centuries);

Another structural reduction has taken place: in the realm of verbs; when compared with other Germanic **verbal structures**, English appears as one of the **simplest systems** one may find. The verb that has the largest number of forms is "to be', with eight different forms: **be, am, is, are, was, were, being** and **been**. Regular verbs normally have four: **talk, talks, talked,** and **talking**; in the case of irregular or strong verbs, we can even find some of them with only three forms: **set, sets**, and **setting**. But for the "**-s**" ending in the Third Person Singular of the Simple Present Tense, no other personal inflexions are used in modern English. It is only in the Simple Past Tense and in the Passive or Past Participle of Regular Verbs or in the Present Participle or Gerund that tense inflections have remained up to now (the "**-ed**" or "**-ing**" endings, respectively). There is, besides, a number of modal verbs which have only two or even one form (e.g., **can, may, must**).

All these reductions in inflections meant something new: while inflected languages (Latin, Greek, or German) allow the use of hyperbaton as a common figure of speech because the inflections provide not only the lexical content of the words, but also their function in the sentence, English demands a very strict word order, as it is the position of a word in the sentence which determines not only its function but in some cases, its lexical content also: e.g.: Nurses **watch** terminal patients day and night / My **watch** is slow; She **rose** at seven / He gave her a **rose**; You are a **mean** person / What do you **mean**? / You must find a **mean** between frankness and rudeness; This structure **forms** the axis of the building/ The **forms** which you are using for the beams are too long. **Concrete** is, perhaps, the most important building material of the 20th century / Your instructions should be **concrete** and clear.

And it is this vocabulary our students are supposed to learn with a specific purpose: to master the technical language used in the field of Civil Engineering. So, the first thing to do is to define what we understand or mean when we use the word "word". Perhaps the simplest definition is **the smallest of the linguistic units which can exist or occur by itself either in speech or**

writing. In a sense, we can detect in this definition the basic distinction with a **morpheme**, which, even if it is the smallest meaningful unit in a language, cannot, in some cases, exist on its own: e.g. the final **-s** suffix which may convey the idea of "plurality" when added to a noun, or show that a verb is being used in the Third Person Singular of the Simple Present Tense.

But the definition of "word" implies more things, for the fact of "existing by itself" is, to a certain extent, ambiguous: can we say that words like **the**, **my**, **to**, can "occur on their own"? In the case of contractions, are **cannot** or **can't** one or two words?

Difficult as it may seem, native speakers always have a special "feeling" so as to distinguish which are the words of their language. In spite of what I said in the previous paragraph, from a practical viewpoint there are at least certain formal "signs" or "marks" to distinguish a word: the boundaries constituted by blanks in a written text or the slight pauses between words in speech (the limits being more or less difficult to detect in this case, as speech is always a continuous line of sounds, and pauses do not necessarily separate words, but groups of words).

There is, anyhow, a more important factor that foreign students must take into account when dealing with English (or with other languages, for that matter). In the case of English, two basic types of words can be distinguished:

F**unction** or **grammatical words**, which have very little meaning on their own, but show the relationship existing between other words, phrases or sentences. What is the meaning of "between" if we do not have the two nouns it should join? Conjunctions, prepositions, articles, in general terms, connectors, all of them could be included in this group. In general terms, and in spite of the evolution they may be suffering or have suffered in the history of English, they have remained basically the same in form and number for centuries;

and **content** or **lexical** words, which refer, not to the relationships between other words or sentences, but convey a content: things (nouns), qualities (adjectives), actions (verbs) or the way, location, time or any other circumstances in which an action takes place (adverbs). As opposed to grammatical words, these have a lexical meaning of their own, even if they are used alone; besides, their number is not fixed or limited: it can and does grow continuously in every language by means of loans, borrowings, neologisms, or modifications of the content of old words.

In order to learn and master these two kinds of words, students have to follow two different paths:

The most unpleasant one is that of learning by heart (there is no other way to master these terms) the basic **function** or **grammatical** words. In this case, there is no other possibility but that of repetitions and drills: in the end, it is the same process learners followed when they were children and, step by

step, learned who "I", "You", or "She" were, what the difference was between "Up" and "Down", "To" and "From". No doubt, the methodology to be used may vary, but the need to master these words will always remain as a basic goal in the learning of any language. Besides, this "road" is to be followed in order to master any kind of English: technical, colloquial or literary.

As for the learning of **lexical words**, students must be aware of a very important factor: what is usually termed a **lexical** or **semantic field**, that is, the number of words and phrases in a system which show a certain kind of relationship or kinship or, to speak with plain words, which normally belong to the same "family": e.g., if we are to deal with an article on a legal process, we may rightly expect to find nouns like **judge**, **lawyer**, **evidence**, **witness**; adjectives like **guilty**, **liable**, **innocent**; verbs like **to hear**, **to plead**, **to acquit**, **to depose**... This concept of lexical field is most important, as many words have quite different meanings according to the context in which they appear or the different fields they belong to. This is particularly true of what we call sub-technical vocabulary, as we will see later on.

In the case of **technical words, their content** is usually so clear and precise that **no confusion** can arise: a **carcinoma** is a cancerous growth and cannot mean anything else; in spite of the different kinds of **thermometers** one can find, the basic meaning of the word will always be the same: an instrument or device to measure the temperature of a body; a **transistor** is nothing else but an electronic device to control electrical signals as they pass through a circuit.

But, if we find the word **tendon**, we have to be extremely careful and keen as to the context or the semantic field of such a term: in anatomy, it is a strong band or cord of tissue that joins muscle to bone; but, in building, it is a cable or wire used to prestress concrete members. Of course, there is some similarity as to the function of tendons in both cases, there has been a transfer of images from bodily functions to structural ones, but the risk of confusion remains, and it is in this realm that students have to be trained with special care. We will return to this dimension later on, for it deserves special attention.

In the first place, it is necessary to master a number of the techniques of **word formation** with which the English language functions. Even in this dimension, we can find two different levels:

The use of **affixes** is both basic and extremely important. That is the main reason why students are provided with a list of affixes to be used in their classes as a part of their personal work. In many cases, an affix can change the meaning of a common word so as to make it convey opposite or contradictory meanings: e.g.: **under-** and **over-**, when applied to terms like (to) **cure** or **stressed**, can yield expressions as diverse as "understressed and overstressed members" of a structure, "undercured or overcured concrete"... expressions which, if misunderstood, can lead to irreversible mistakes.

There is, however, something quite peculiar with affixes: in the case of **pre**fixes, no special problem may arise from the functional role the modified word may take. E.g., we can say "We have prestressed this member so that the structure may stand the impact it will receive" (as a normal verb); "Prestressing is a modern method to reinforce concrete" (as an abstract noun); "Prestressing machines should be used with great care" (as an adjective). In any of these different functions, we cannot find any particular difference as far as lexical content is concerned: in any function, the meaning will always be something concerning or related to the process, method, qualities or consequences derived from a **previous** (**pre**-) stressing of a concrete structural member.

But, in the case of **suf**fixes, students will find more difficulties, as most of these affixes can only be used in certain grammatical or structural functions: e.g.: the suffix -**less** can only be used as an adjective, in cases such as use-**less**, care-**less**; no other function can be performed by words of this kind <u>unless they are modified by other suffixes</u>: e.g., careless-**ly**, but the common rule of usage is to avoid multiple suffixes, as they normally imply an excessive number of modifications so as to be easily understood by the receiver, whether the message is spoken or read. There are, anyhow, some cases in which multiple suffixation is not only admissible, but has even entered the realm of "official" lexicons, such as care-**less-ness**, or care-**ful-ness**. But, in general terms, this is not the rule. As for technical language and its use of affixes, it certainly follows and is permeated by the rules of plain English: in this sense, **as far as affixes are concerned, technical English is not an island.**

A second dimension which must be mastered is that of **word formation**. In English, we can find about two dozens of patterns followed in the process of word formation; there is no point in being mathematically precise in this case, but it is important to be aware of the large number of possibilities a speaker or writer has when conveying a message, especially when dealing with technical terms, a lexical field which usually requires the creation of neologisms, or phrases which have to be coined ad hoc to communicate with other professionals.

I will only mention a few of those "mechanisms", mainly those which seem especially productive when trying to convey a concept; curiously, most of them are related to the formation of nouns or adjectives, but very few of them are used to build up verbs.

Maybe the simplest and most "productive" combination is that of a **noun** + a **verb**: earth-quake, land-slide, rain-fall, the meaning being this: a subject "does" or "performs" some action, and the name of that action is "so-and-so".

Another combination which is perhaps one of the most productive is the pattern **verb-ing** + **noun**: compacting caterpillar, drilling probe, grading sieve, washing machine; the meaning in this case is related to that conveyed in the previous construction: in this case, the point is not the action but the machine or the device which performs or is used to perform a certain function or which is

employed with a certain purpose: "a sieve used to grade aggregates"; there are some nuances which, in some cases, can be hard to detect: the working classes, a reading lamp, a walking stick...

It is also quite common to find the structure **noun + agent of a verb** (normally with an **-er** or **-or** ending): tool-maker, road-builder, book-keeper; the content in this case is: an agent which performs an action or function; in most cases, the agent is a human being, but the structure does not exclude machines or other devices or processes: concrete-compactor, set-retarder or accelerator.

Another productive structure is that formed by **noun + verb-ing**, its function being that of a noun (and consequently, that of an adjective): road-building, film-forming, air-conditioning, window-cleaning; as an adj.: air-entraining agents; in this case, the basic meaning is: a process to make something: the process or system of building roads, or entraining air in a concrete paste or the fact of cleaning windows.

A very common structure, whose multiple and different varieties would require too much space for a class, is the combination of **noun + noun**: its content can have so many nuances that I will just mention a few of them, at least, the most usual or productive in the field on technical language: factory-work: the work which is performed **in** a factory; night-shift: the shift or period of work which takes places **during** the night; work-bench: the kind of bench which is used **to** work with timber, metal or other materials; steam-engine: an engine which is operated **by means of** steam; power-plant: a plant or factory which **produces** power; a river-bed: an element or item which **belongs** or is a **part** of something, in this case, a river; this section, I insist, is so complex, that it is practically impossible to give examples of the many possible contents the combination **noun + noun** can convey.

As I said before, most of these combinations can have other grammatical functions. In any case, the process, means and results of word-formation in the kind of English which is used in Civil Engineering do not differ from those used in "plain" or non-specific English. In that sense, as far as **word formation** is concerned **the English of Civil Engineering is not an island.**

There is, still, another dimension in which the English of Civil Engineering can show its specific traits: vocabulary, such as it is used in real engineering texts, those which students and professionals have to recur to. In this sense, the kind of English they will find is created and supported mainly on **words and images which are borrowed from other lexical fields**. I will only mention a few instances, just to give some hints of different possible paths an investigation on the English of Civil Engineering might follow and, more precisely, some helpful notes our students might use in order to grasp the meaning of an engineering text.

In the first place, an engineering text contains a good number of **words related to places**, "toponyms" is the term which classical grammars would use

to name them. In most cases, these words act as modifiers (adjectives or nominal groups that post-modify a noun). I will mention a few examples:

Trusses and bridges, perhaps the most important type of structure used to span large openings, have received a number of names related to the places where a peculiar type was originated; that is why we have "Belfast-", "Belgian-" or "French-" trusses; or "Irish" bridges; in any case, these words are never used as nouns (*a Belfast or *an Irish are meaningless utterances) but as modifiers of the words "truss" or "bridge".

In the case of minerals, rocks or building materials, a large number of them have received the name of the places where they were first discovered; there are, however, differences as to the ways employed for the creation of the words used to name them: in most of the cases, the name of the place is used as a simple adjective which pre-modifies the noun it goes with: "Portland cement", "London clay"; "English or Flemish bond"; in other instances, the name of the place has been transformed by means of a suffix which is common to most of our European languages: **-ite**, to form nouns such as "Bauxite" (from Baux, a town in Provence), or "Bentonite" (from Benton, in Montana, USA).

In other cases, it is the **name of a person** which is used to describe, qualify or modify the names of objects. Here, too, we can find a number of different mechanisms in which such names are used and modified. It is quite usual to use the name of the inventor or discoverer just as if it were a simple adjective, pre-modifying the nouns it goes with: so we speak of "Abney level", of "Beaufort scale" for wind speeds, of "Brinell hardness test" or of a "Diesel engine", or of "Atterberg limits" in the field of geotechnics. It is also quite frequent to use those names in the possessive case: that is why we speak of or "Darcy's laws", "Barne's formula"; "Poisson's ratio", or "Mohr's circle".

On other occasions, the name has been transformed into a real adjective by means of a suffix, the most common being **-an** and **-ic**, just as can be found in "Euclidean geometrical principles", in a "Voltaic cell", in "Cartesian coordinates" or in a "Gaussian curve". In other cases, the name gave rise to a generic noun to describe the theory or movement started by the scientist or author, and so we speak about "Darwinism" or "Marxism".

It is not very common, but many names of inventors or discoverers have become nouns to design the units or formulas they elaborated. In this case, it is hard to find a common pattern, as no strict or systematic rule seems to have been followed in the process; so we have an "amp" or "ampere", after André Marie **Ampère**; a "volt", after Alessandro **Volta**, the Italian physicist; or a "watt", after James **Watt**, the Scottish engineer. It is not unusual for these nouns to have become specific instruments by adding common endings, such as **-meter**: that is why we find a "voltmeter' or an "ammeter", the process followed in this latter case being a little more complicated. When dealing with units, we can also find **the use of prefixes from Greek origin**, such as "**kilo**-watt", "**micro**-volt" or "**mega**-hertz". We should add here the names given to new chemical elements,

after their discoverers or their countries: "Curium" after Marie Curie, or "Polonium", after her homeland; we could add "Mendelevium" and "Fermium", as well as "Holmium" and "Berkelium", to round up the examples.

A further step has been taken by the use of a common suffix like **-ize** to transform those names into verbs, to convey the idea of using a "patented" or "registered" method. Thus, we find "to macadamize", meaning "to construct or pave a road, following the method invented by John McAdam", or "to galvanize", that is, "to coat iron or steel with zinc", or the most common "to pasteurize", after Louis Pasteur. As usual, this type of verb gives rise to a number of derivative words (mainly with an adjective function) such as "galvanized" metals or "pasteurizing" methods; we can, of course, find well known nouns such as "pasteurization" or even compounds like, "tarmac".

Registered trademarks have also entered the realm of technical lexicons, so we can find expressions like "a guniting" machine (from "Gunite", a patented method to spray thin concrete onto the surfaces of newly bored tunnels and prevent rocks or stones from falling onto the people working there); "tarmac", a road paving system, "Styrofoam", a polystyrene foam used for thermal insulation, or "Catseyes", a type of reflecting studs used in unlit roads. In some cases, the registered trademark has become so popular it has completely displaced the reality it represents: so, it would sound most strange to hear "I think I have a cold, I will take a tablet of **acetyl salicylic acid**", instead of the common expression "an aspirin" without a capital letter. In a similar context, we could ask for a "kleenex". In some cases, when the word "puts roots", it can find its place in official dictionaries: "túrmix", in the DRA, but not "minipimer"... up to this moment.

As you may see from the previous examples, there is nothing new in these **mechanisms of word formation**, which we can find in other realms of science or technology or in everyday life: in that sense, **the language of civil engineering is not an island.**

The previous system to create words is rather simple, as it relies on existing names which are subjected to the common process of word formation and can be transformed easily into nouns, verbs or adjectives. In fact, the word as such was already there –the proper name of a person, a country or any other entity-. Admiration for a scientist, love for a place or institution, a certain amount of pride to make our ego survive in our name transformed into a usual word... that was more than enough to invent the term.

There is, anyhow, a process which involves a good dose of creativity, for it depends on a previous creative act. When someone elaborates a new theory, invents a new device, instrument or method, the "newness" of that creation needs a new word to describe it, a **neologism**. People in the 19th century would not be able to understand the meaning of a "CAT" or "computerized axial tomography", simply because those realities did not exist in their time. Nor would they even understand simple phrases like a "black hole" or "stem cells".

Both examples show the two different approaches to the creation of neologisms. (By the way, the word as such did not appear in English until 1772, and it was a loan from the French *néologisme*.) We can give a new meaning to words already existing, as it is the case with "black hole". Or else, we create new words to describe the objects or processes which were unknown until that moment. In that case, we can recur again to two methods.

We can use old words (normally taken from Greek or Latin) and combine them into a new term. That was the case of "tomography", a formation from the Greek verb *témno* (to cut), through *tómos* (something cut, a tome or volume), and *gráphein* (to draw, design, write), through *graphé* (a drawing). The meaning in (supposedly) plain English is "a method of producing a three dimensional image of the internal structures of a solid object (as the human body) by the observation and recording of the differences in the effects on the passage of waves of energy impinging on those structures". In Civil Engineering we find words, like "geomorphology", "seismotectonics", "metamorphism", which follow the same pattern and could be analyzed in the same way. To finish this section, we can mention a few familiar examples of words formed from any of the two elements in tomography: telegraph, anatomy, cryptography, dichotomy, biography.

The other method is that used in the same paragraph above: CAT, which normally acts as a noun, is the new word formed by joining together the initial letters of the whole noun phrase: *C*omputerized *A*xial *T*omography. We are already used to this system, examples of which could be "radar" (*R*adio *D*etecting *A*nd *R*anging), "laser" (*L*ight *A*mplification by *S*imulated *E*mission of *R*adiation) or "CAD" (*C*omputer *A*ided *D*esign). In Civil Engineering we find examples like SPT (*S*tandard *P*enetration *T*est), or TBM (*T*unnel *B*oring *M*achine). In the world of politics: NATO, (*N*orth *A*tlantic *T*reaty *O*rganization). I think these examples are more than enough.

In any case, once again, we are moving in a world common to other branches of science, technology and common life. We must humbly admit that in the methods we have just described **the language of civil engineering is not an island.**

There is, anyhow, a different approach to describe and give names to the objects, processes or principles we find in the world of civil engineering. And it is perhaps the deepest and richest dimension in language in general terms. Especially, when we discover that our deepest and earliest way to place, conceive and understand reality is something as simple as finding our place in the world. The child who begins to walk can give us the key to answer to the basic philosophical questions: "Where do we come from? Where are we going? Is there anything that we can hope?" The feelings a child experience when learning to walk will determine a metaphorical mental frame which will shape his mental structure for ever. To stand, rise from the crawling position to an erect approach to space, will become: "up" is positive, is power, is

independence and superiority. "Forwards", means advance, progress, future, autonomy. "Down", "backwards" imply falling back to a state of prostration and powerlessness: descending to a lower state of dependence, having to be held, supported, regression, going back to the state of a baby, and losing the condition of a big boy or girl… You can figure out quite easily all the consequences in our conception of life.

Metaphors, yes, configure our life from its very beginning. And they will be present and shape language, including, of course, the language of civil engineering. Building techniques are quite close to nature. As a matter of fact, besides the quest for food and reproduction, the second aim of animals and of primitive human beings was, no doubt, the search for a shelter for them and for their young, in order to feel protected from weather conditions which were a permanent menace to their existence on the planet. In the summer, the sun and the heat could bring about death because of dehydration; in the winter, rain, frost, and wind could provoke death, too. Besides, climate changes forced both humans and animals to change their habitat, to migrate, to travel in search of better conditions and resources. No wonder, then, "organic" terms, taken from the animal and human milieu are used and shared, to a large extent, in the lexicon of building and civil engineering even today.

That is why in Civil Engineering we can find a large number of terms whose origin is "organic", "biological" or, to be more general, belong to the lexical field of "life". It is not my intention to be exhaustive in this part of my lecture, so I will just mention some of the different fields where Civil Engineering has found a source to increase and enrich its vocabulary by means of loans and metaphors.

Before we go on, we must take into account and keep in mind a basic detail. In the examples we are going to review in the following paragraphs, there is a common trait: they all have the same **metaphorical** character. In some cases, an object is compared to another with which it shares its <u>form</u> or <u>function</u>: an **alligator** wrench, for example, resembles the mouth of the animal and, besides, shares the function performed by that oral opening: grasping things with its **teeth** (another word with a metaphorical slant). In other cases, it is the <u>activity</u> as such which is taken as a point of reference, and so we can say that fine sand **drinks** a lot of water when it is mixed with cement in a concrete batch. In the same field, a technique which is extremely important is **curing** the concrete, so as to make it stronger and more resistant to erosion, just like food is cured to prevent it from rotting. There is even a, so to speak, <u>human</u> dimension of the language of Civil Engineering: a structure can be **stressed**, or suffer **fatigue** or collapse... We will develop these elements and functions in the following pages.

There is, in the first place, a **"zoological" field**. In Civil Engineering we may find (besides the **alligator** I mentioned before) "cranes", "snakes" (a tool to unblock drains), "caterpillars", "butterfly valves" (a special type of valve to prevent fluids from changing the sense of their course), "dogs" (a pair of hooks

to hold and lift stones)... and even "bitches" (devices that have the same function as that of "dogs"). We use "elephant trunk chutes", special hoses to deliver liquid concrete; or "sheep feet" to compact soil; or say that the asphaltic surface of a road has suffered "alligator" or "crocodile" cracking when subjected to excessive loads. A "mouse" is a basic device when using a desktop computer…

There is, besides, what we could call an **"anatomical" dimension**, normally found in similar contexts. Once again, I will just mention a few examples in which, as in the previous cases, it is the metaphorical aspect (concerning form or function) what determines the content of the words. In that sense, the field of Building and Civil Engineering can offer us many of the terms we could find in a textbook for students of Medicine or Biology.

We can use "claws" (a special type of hammer to draw out nails, an anatomic word, by the way).Vaults can have "ribs" and "tendons", and "groins". Columns are most anatomical, as they have "heads", "waists" and "foots" or "footings"; when dealing with roofs, we can find "hips" and "joints". "Cranes" (a name taken from the zoological field) have "arms and legs"; pipes have "elbows" and tunnels have "faces" and "backs"; frames have "knees" to provide flexibility. Doors, as well as draw-bridges, have "leaves", and the wheels of a mechanical device have "teeth"; some crushers have "jaws"; and many devices stand on "legs". Roads can be considered similar to "arteries"; they have "shoulders" where you can stop your car in emergency cases; in case of repairs, we can use "by-passes", a term also used in cardiology. As for dams, they have "toes" and "heels" on either "face" of the "feet" of their retaining wall. We could go on and on without leaving the realm of zoology or biology. On a few occasions we can even find words laden with humor, like "auricle" o "ventricle" in cardiology, or with compassion, like Spanish "murciélago".

The words from **anatomy, physiology and medicine** play a very important role. We have a specialty called "pathology of stresses", which can use "auscultating" devices to verify or "diagnose" the vulnerability of a structure against earthquakes. As we saw before, materials can be "fatigued" by repeated changes in "stresses". Concrete can "bleed" in case the amount of water in the mix is excessive. Under some conditions of humidity, we can put "weep holes" at the base of walls to allow water to go out. Or we can provide a building with "breathers" to allow "natural" ventilation. In some cases, if the structure has suffered some "injuries", it can be subjected to "rehabilitation". In case of a final "collapse" or "breakdown" we can certify the "death" of a building and proceed to the "autopsy" of the "defunct" structure. (Note: when writing these pages, I happened to find a distressing note on the screen of the computer "The page you were consulting has expired"…)

When we consider the number of terms that have been taken from other lexical fields, once again with deep humility we have to admit that **the English used in Civil Engineering... is not an island!**

And this lecture is not an island either, because what could be considered a theoretical lecture on the Language used in Civil Engineering has been in fact a walk through the realm of linguistics both in English and Spanish

Any colleague of mine would rightly criticize a serious omission in these words of mine. I have not said anything about two dimensions of extraordinary importance: the development of a universal language such as mathematical and chemical formulas, and context.

Until the 17th century, scientists were convinced that English, French or any "modern" languages had few chances of surviving in the scientific world, whose common *lingua franca* was precisely Latin. That is why we find many of the capital scientific works which have shaped our Western academic milieu were originally written in Latin: Copernicus' *Comentariolus* in 1514 and *De revolutionibus* in 1524; Galileo's *Sidereus nuncius* in 1610; Newton's *Philosophiae Naturalis Principia Mathematica* in 1687; and as late as 1738, Bernouilli's *Hydrodynamica,* and together with Goldbach, *Exercitationes* in 1724… Besides, a number of Latin words have been kept in the fields of science and technology: *thesis, stratum, alga, radius, index, phenomenon...* Not only that, they have even kept their Latin plural forms; *theses, strata, algae, radii, indexes and indices, phenomena…*

But, more important than the use of Latin, later abandoned by the new languages, was the creation of a universal system of symbols used in mathematics and physics, which could be used and understood by scientists and scholars, no matter which his native language might be. This trend would not reach its apex until the 20th century, with the adoption and common use of the *Système International*, SI, which unified the Metric System, the Physical Units and the Chemical formulation into one common means of scientific expression and communication. It is important to take into account that the basic mathematical symbols we use historically started their life very late: + and – for addition and subtraction were introduced in 1489; = for equation in 1557; x for multiplication in 1631; and **:** for division in 1657.

In that sense, mathematical formulae can offer an incredible way to communicate, no matter the epoch or the background of the person approaching them. We could see the difference between the simplicity implied in classic theorems or principles expressed with symbols when compared with their "verbal" definitions. For example, see the difference between Pythagoras' Theorem expressed verbally, "In any right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the two other sides", and its expression in the simple formula of a mathematical equation: $\mathbf{a^2 = b^2 \times c^2}$. Or Newton's First Law of Motion: "Every body perseveres in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed thereon" as contrasted with $d\mathbf{v} / dt = 0$.

The other dimension I mentioned was context. According to structural linguistics, *Un texte sans contexte est un prétexte*. I mentioned that when dealing with "sub-technical" English, and one of the examples I offered was that of "set", whose meaning was completely different when used in civil engineering, mathematics, or electronics. It is remarkable to assess that the principle can be rightly applied when dealing with classic formulas to see how their content, their significance (not only its meaning), can be utterly and dramatically different.

Let us take the most important formula of 20th century's physics, Albert Einstein's Equation **$E = mc^2$**. In just a small, limited combination of characters and figures, we can find the seed, the revolutionary foundation of modern physics. In Einstein's own words, "E is equal to m c-squared, in which energy is put equal to mass, multiplied by the square of the velocity of light, showed that very small amounts of mass may be converted into very large amount of energy and vice versa". Now, let us set that formula, clear as it is, in different contexts and try to infer its meaning or significance according to its environment.

Imagine now the meaning that formula must have had for Einstein himself, for Oppenheimer, Bohr, Fermi, Lawrence or the rest of physicists, scientists and technicians from different fields who were working together in the "Manhattan project", and preparing a weapon able to counteract and overcome the dreadful plans that Hitler and his régime had in mind to impose a global dictatorship; and how they finally opted for Hiroshima and Nagasaki as the target of their project which was completed on August 6th, 1945…

Imagine now the meaning that formula must have had for Wernher von Braun and the physicists, scientists and technicians from different fields who were members of his Peenemünde team and were studying the possible sources of energy for the spacecraft elaborated in their NASA projects; and how they finally opted for a Radioisotope Thermoelectric Generator used in Apollo XI, the spaceflight which took the first men to the moon on July 26th, 1969…

I will introduce now a new character: Michiko Kodoma. She belongs to the group of the "Hibakusha", a name given by the Japanese to the victims of atomic bombings. Mishiko lived in Hiroshima and in 1945 she was a 7 year old girl. On the 6th of August of that year, at 8:15 a.m., she was in her school. Her classmates were playing outside the school, but she went into the building to take her seat in the classroom. Suddenly, she saw a light. "I saw a bright blast, a yellow and silver and orange and all sorts of colors that I can't explain. Those colors came and attacked us, and the ceiling beams of the wooden school along with the glass from the window pane all shattered and blew away at once." What she saw next are horrors that no child should ever experience. I will not repeat them here. I will instead repeat what I did in the two previous paragraphs. I invite you now to imagine, not the meaning but the significance that **$E = mc^2$** must have had for Michiko Kodoma…

We must return to the beginning of this lecture. Obviously, no man is an island, no language is an island, no scientific discovery or creation is an island, no engineering project is an island. Whenever you hear the bell toll, whenever you start working on an engineering project, do not forget Michiko Kodoma.

This lecture of mine is not an island, of course. Today, there is a very special group of people here, in this continent of ours which is the School of Civil Engineering, and which is a part of the largest continent of our society. A number of students have just finished their period of education, and are leaving the School, ready to start their professional life. Another, smaller number of professors is also leaving to begin their retirement. In both cases, this is probably our last academic activity. But we all belong to the same continent. You, the new professionals, will face the future. You are the future. Do not waste it and do not let anyone or anything rob you of that treasure. And do not forget those who have worked for you along these years. Be sure that we have offered you the best we had: the fruit of our knowledge and our experience. And be sure also that we will not forget you. None of us is an island!

Mariano Perrón,
Professor of this School since 1978.