

# Glottochronology



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## Linguistic and Design evolutionary processes

The second and mostly intriguing result of the study of linguistics and human evolution on this paper is the understanding of the deep connection between the mathematics behind the linguistic evolution and the evolution of Design. This principles are also found in the most primordial steps of evolution, Biology confirms that hypothesis countless times.

The motor of linguistic evolution, in the end, is as simple as the phenomena of isolation, contact and adaptation, or rather, fusion, division and the adaptation modes, dominant and recessive. Everything that comes next is a declension of this principle. This logic can be applied in many levels, exactly as we do in microbiology and macrobiology, or rather, the phoneme, the word, the sentence structure, grammatical system etc.

The dominance is present, for example in the inclusion of a new element (a word) within a system. It is characterized by the adaptation to the system's language set. It's as if the word lost its identity to adopt the genetics of the system that absorbed it. The word "government" for example got introduced in English as a derivation from the Latin word "gubernatio". It's a process of fusion with the strong dominance character. The word is subordinated to the grammar and the system that embraces and alters it. The importation is in many cases, non literal, the word might be imported to perform a function different from the original. The romance versions of "realizar", "realizar", "realizzare" (Portuguese, Spanish and Italian respectively) would mean "accomplish" but the absorption of the term by the English Language took it to mutate and acquire the meaning of "to notice".

As function tool kits in genes, words may change meaning to adapt to new contexts. This recycling of terms is a natural adaptation that takes under consideration another aspect of evolution, adaptation rather than creation. Words are created recycling old ones, importing from other cultures or mixing existing words. If a word already exists in a linguistic system and is not commonly used, it may be recycled to adapt to new meanings. If the necessity for a new meaning can be performed by the fusion of two existing words it



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will probably happen. This apparently irrational way of evolving is somewhat in the basis of human evolution and it is the characteristic of the indirect and organic manner through which humans developed their culture.

It's vastly documented and theorized, the semantic distinction among different evolutionary components of a language such as form, grammar (or rather, the technique that promotes the structuring and evolution), and the expression (or rather, its function).

Considering the distinction among this different components of the process, it's more clear why evolution doesn't work in a block of yoked parallel aspects. The displacement and rearrangement of the components is poorly organized and unconscious, and that is why language is as organic as natural evolution. One of the most complete works on linguistics developed by Ullmann divided the mutations in two groups, this mutation modalities are:

The expression mutation, that happens when it changes the shape of the element but not its function, as if a word had lost its capacity to communicate a certain meaning, its capacity to perform that function or as if its functionality got used up. So there is the need for a new word to perform that function.

*"Un mutamento puñ avvenire sul piano dell'espressione senza che si produca alcun mutamento sul piano del contenuto. Quando si afferma che il francese tuer < tutare sostituisce il latino occidere nel significato di uccidere, si individua un mutamento nel senso della prima parte della definizione di Ullmann: un nuovo significante č riferito al significato. Ma al punto di vista strutturale, si tratta non di un mutamento ma di una sostituzione, di una parola ad un'altra. Il contenuto resta lo stesso, č cambiata soltanto la parola che lo significa. Anche nella semantica, come nella fonologia e nella morfologia, I mutamenti funzionali si configurano come acquisizione, perdita, o sostituzione di un tratto distintivo si č avuta nei nomi romanzi dei colori."*

"A change may occur in terms of expression without lead to no change in terms of content. When it is stated that the French tuer (tutare) replaces the latin occidere in the meaning of to kill, you spot a change in the sense of the first part

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of the definition of Ullmann: a new meaning refers to the meaning. But at the structural point of view, this is not a change but a replacement, from a word to another. The content remains the same, it has changed only the word which signifies. Also in semantics, as in phonology and morphology, the functional mutations take form as acquisition, loss and replacement of a distinctive trait as in the Romance color names. "

R. Lazzeroni  
Linguistica storica  
2002  
p.28

The second case is the meaning mutation, it happens when the a word is transformed by drift, it retains some similarity in shape, but not the function changes and the language has to adapt to follow it.

"Inverso invece č il caso seguente: il latino nigro č continuato dal italiano nero e dal francese noir. In questo caso non si riconosce, di solito, nessun mutamento semantico. In latino perñ, diversamente dalle lingue romanze, la rappresentazione dei colori era bidimensionale. Uno stesso colore si distingueva lessicalmente anche per il tratto distintivo della brillantezza: ater: niger; albus: candidus. Il passaggio dal latino alle lingue romanze comporta la scomparsa di un tratto distintivo "brillante" e perciñ la riduzione di due unitř di contesto a una sola."

"The opposite case is the following: The Latin "nigro" is continued by the Italian "nero" and by the French "noir". In this case, you can't usually recognize any semantic mutation. Yet, in Latin, differently from the romance languages, the representation of the colors was bidimensional. The same color would be lexically distinguished also by the distinctive brightness trait. Ater; niger: albus; candidus. The passage from Latin to the Romance Languages took it to the disappearance of the distinctive brightness trait, and thus, the reduction from two meaning unities to just one."

Latin: Ater = black; niger = bright black  
Italian: nero = black

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French: noir = black

R. Lazzeroni

Linguistica storica

2002

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This phenomenon of functionality loss on a single word might represent a better functioning of the system as a whole. If the same color had to have two different words to distinguish the bright and the opaque variants, the overall linguistic system would unnecessarily increase in complexity. By defining a complementary word "bright" in the Romance Languages, the gamut variants were simplified in fifty percent, as for yellow, bright yellow, red, bright red, orange, bright orange, and so on.

The opposite happened from the Latin "puer" to the Italian "bambino, ragazzo", and the French "enfant, garçon". The single word that signified "young person" was divided in meaning, as child and kid, two different steps of growth of the man. Possibly, as the life expectancy increased, the adulthood was held over, there was the practical necessity to distinguish more stages before the fully grown stage (R. Lazzeroni, p.30).

## **Non Function Based Evolution - Drift**

Languages, like any other existing entity, may evolve regardless of the overall functionality, based on aspects as drift (physical, geographical, political isolation), loss of identity (lack of instruction of a people), fusion (influence from other cultures) etc. The most important example is the fragmentation (division by reduction) of the Latin after the decay of the Roman Empire. The Latin speaking countries had a long period of geographical isolation and governmental separation that led every small human settlement to drift Latin in a different way. This comprehensive mutation of the Romance languages is characterized by mutation patterns, or rather, fragments of phonetic

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structure that changed gradually and slowly like the replacement of the suffix “to” by the “do” in Spanish and Portuguese participle.

Another clue about the progress of evolution is the analysis of a number of words present in most languages that by the intensive use, are more exposed to mutations, like genes that have more relevance on an individual, skin color, hair aspect, body proportions etc. This method takes under consideration two hundred words and their variation from one language moment and another.

“Il metodo considera le sostituzioni lessicali. Principio basilare è il presupposto che il “decadimento” (la sostituzione dei significanti) delle unità del “lessico fondamentale” di una lingua segua un ritmo esteticamente costante. Il lessico fondamentale di ogni lingua sarebbe costituito da un elenco di 200 parole, associate a “universali culturali”: pronomi, numerali più bassi, parti del corpo, azioni basilari, parole come “uomo”, “donna”, “uccello”, “albero”, “sole”, “luna”. La tecnica di misurazione è simile a quella del carbonio 14 per la datazione dei reperti archeologici. L'indice di conservazione del lessico fondamentale sarebbe una costante, corrispondendo all'81% per millennio.”

“The method considers the lexical replacements. The basic principle is the premise that the “decay” (word form replacement) in the unities in the fundamental lexicon of a language follows a rhythm aesthetically constant. The fundamental lexicon of any language would be composed by a list of two hundred words, associated to “universal cultural”: pronouns, lower numerals, body parts, basic actions, words like “man”, “woman”, “bird”, “tree”, “sun”, “moon”. The measuring technique is similar to Carbon 14 for the dating of archeological findings. The conservation rate of the basic lexicon is constantly approximately 81% per millennium.”

R. Lazzeroni  
Linguistica storica  
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As in genetics, the more relevant functionings of an individual undergo mutations faster than secondary less relevant ones. Examples of this

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phenomenon are color skin in human beings. In linguistics, the phenomenon is manifested by the frequency whereby a word is used. The more the word is used, the more likely it is to suffer mutations over time. In design the phenomenon is exactly the same. When a product has a simple structure and simple functionings, the velocity of the mutations is a lot faster than the mutation on complex structures, Examples, the chair and the car. Due to the complex engineering and high investment costs evolved in the production of cars, the creativity of designers is limited, the evolution is so slow that two cars separated by 40 years of evolution may be differentiated merely by mechanical performance and minor style components. The complexity set up is so intense that not even concept cars, that are not even supposed to work properly or to be produced, diverge much from the current standards. Chairs, in the other hand, have a much less complex set of demands. It has to support the weight of a human being (<110 Kg. approximately), it must have a seating support, a back support, a number of proportion rules, and most importantly, it's not as expensive as a car to be designed. The consequence of this relative simplicity is the huge amount of variants found in chair designs. Back to the linguistic analysis, some other evolution principles regarding the velocity of mutation was stated by Bartoli, in his fundamental rules of linguistic evolution, there are four characteristics that would determine which one of a linguistic group is oldest. According to Bartoli, the older language would be the one: in the areas less exposed to communication, in the peripheral areas (unless the central area is more isolated), in the larger area (only if the smaller area is not the more isolated and not made of lateral areas) and in the subsequent area (or rather, in the area colonized, in comparison to the center, from which the colonization started).

“il metodo della ricostruzione interna si applica quando, dati due mutamenti A e B, l'uno implica l'altro e viceversa. Se A crea o allarga il campo di applicazione di B, A sta in ordine di incremento rispetto a B; se A riduce il campo di applicazione di B, A sta in ordine di depauperamento rispetto a B. Conseguentemente, se A ha avuto effetto su B, A è più antico di B; se A non ha avuto effetto su B, B è più antico di A.”



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“The method of internal reconstruction works when, given two mutation A and B, one implies the other and vice versa. If A creates or expands the application range of B, A is impoverishment process compared to B. Consequently, if A influenced B, A is older than B; if A didn't influence B, B is older than A

R. Lazzeroni  
Linguistica storica  
2002  
p.43

Although the mutation over a long period of time may seem constant, the variations in a short term basis are equally important, and must not be neglected. It has been noticed that languages evolve a lot faster during moments of crisis. Again the parallelism with design evolution and biology emerges. Like the deep technological advances during war periods, or the radical evolution leaps that occurs just after geological or chemical catastrophes, evolution in a language is empowered by crisis. The English suffered the most profound mutations after the Normand Conquest that for two centuries reduced it from dominant to subordinated language, fragmented in dialects without an unifying core. This is an example of division caused by reduction, followed by fusion with a very clear dominance component. In the old Greek case, most of the innovations happened during the “Hellenic Middle Age”, in the obscure centuries that followed the decay of the Mycenaean Civilization and preceded, anticipating; the blooming of the Ionian Civilization. The phenomenon also in this case is clear, a period of reduction followed by expansion, in general those two phenomena combined are responsible for the most radical evolutionary leaps.

Both in the English case and the Old Greek one, the mutations were not just phonetic, but also lexical, or rather the whole structure of the languages were altered (R. Lazzeroni, 2002, p.32). The mutation of a language in a short term is a very heterogeneous and non linear, but the long term process paradoxically looks simpler and more homogenous. This fact reinforces the mathematical theory that, notwithstanding the irregularity of the minor

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phenomena, there is a bigger general trend. It also reinforces the idea that the evolution of the language is as incidental as the natural evolution.

The mutation in a language is not linear, but in large scale it follows a tendency. It's like any other mutation in human behavior. You could say that Fashion has changed linearly from the Eighteenth century till today, but during the process there are evolutionary irregularities. The natural selection of mutations performs in linguistics a phenomenon mathematically identical to the biological natural selection. One variation may replace the previous form, may coexist or fail, depending on its adaptability.

*"Fra l'insorgere di una novità ed il suo generalizzarsi, prima che una comunità l'accetti e la senta come norma, sta un periodo più o meno lungo, in cui il nuovo coesiste con il vecchio. I risultati di questo processo non sono prevedibili. La novità può trionfare, ma può anche abortire e regredire; e può anche arrestarsi nella sua diffusione, fissandosi in un sistema in cui la coesistenza delle varianti viene normalizzata."*

"Between the emergence of an innovation and its generalization, before the acceptance from a community as a rule, there is a shorter or longer period of time, where the new coexists with the old. The results of this process are not foreseeable. The novelty can triumph, but can also abort and regress; and can even stop in its dissemination, fastening on a system where the instance is normalized coexistence. "

R. Lazzeroni  
Linguistica storica  
2002  
p.41

The complexity of the language structure is also remarkably organic, the structures of all known languages follows the same scheme, despite the unconnected origins. The distinctions that separate one language from another, or one dialect from another can be as relative and deceiving as the classification that determines the distinction among living creatures as

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domain, kingdom, phylum, class, order, etc. If archeologists or biologists found a fossilized framework of a German Sheppard and a Basset Hound, they would intuit they are different species (Dr. David Kingsley, 2005). The same would happen with dialects. The attempts to draw dialect maps in Multilanguage Countries like Germany led linguists to verify that in most cases the dialects of a Country don't have very clear boundaries among them. There are no culture cores from which radiate the essence of a parlance, many aspects can be found in more than one dialect, and it's difficult to form linguistics subgroups.

“La distribuzione geografica dei tratti linguistici non è omogenea, ogni tratto segue il suo percorso e non tutti irradiano dal medesimo centro. Non esistono confini dialettali netti. Ogni dialetto è definito da fasce di isoglose che appartengono anche ad altri dialetti.”

“The geographical distribution of linguistic traits is not homogenous, every trait follows its own course, and not all of them radiate from the same center. There are no clear dialectal boundaries. Every dialect is defined by layers of isoglosses that belong also to other dialects.”

R. Lazzeroni  
Linguistica storica  
2002  
p.33

## Cultural Fusion

Regarding the cultural blending in the evolution of languages, there are documented phenomena that support the rule of contact: the more contact a system has to other system, the less isolated, the faster it will absorb a mutation. The influence of a new trait can be more evident in areas where there is more interaction among elements. In linguistics, the spread of a phonetic change may match with the points of connection among peoples.

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Said that, we can attest that urbanized areas, cities close to ethnical borders and regions structurally connected to others through rivers, railroads etc would evolve faster. Again the opposition between isolation and contact plays a relevant role.

## Structural Deviation

As the evolutionary opposite to the blend, the isolation may be manifested as a gradual phonetic deviation. The recurrent phonetic changes among languages is the linguistic equivalent to what we could call drift. An accent that becomes dialect and later a language by isolation. This phenomenon is presented by the repetition of the same variance in various words with the same sound pattern.

latin – planeta; Italian – pianeta | latin – flamma; Italian – fiamma

## Adaption Necessity

For adaption necessity principle, the evolution manifests in areas that are less adapted to an environment. In the linguistic case, mutation in a language will most likely occur in the less adapted part of the system, or rather, the lower classes of a society. The richer an individual, the more likely to use the traditional unaltered language. This simple rule, just like any other rule described so far, is very susceptible to exceptions, like the influence of foreign cultures, particular cultural movements etc. In other words, changes may occur from the top downwards or from the bottom upwards as well.

## Natural Selection

The linguistic evolution happens, just like any other, when one of the variations created succeeds and spreads over the environment. If a neologism created by a sub community performs efficiently a function, from a simple

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expression of a group, the mutation will spread and influence the whole group, becoming a general parlance trait, as a more adapted element in an environment. The creation process in this case is also uncontrolled and casual, the variations and neologisms are created and get extinct repeatedly till some highly efficient and mostly adapted option reproduces itself and becomes a generalized part of the system.

“Ogni mutamento fonetico, inquanto procede meccanicamente, si compie second leggi senza eccezioni, cioè la direzione del mutamento fonetico, eccetuato il caso di una scissione dialettale, è sempre la stessa presso tutti gli appartenenti ad una comunità linguistica, e tutte le parole in cui compare in uguali condizioni il suono sottoposto al mutamento sono afferrate dal mutamento senza eccezioni”

“Each phonetic change, as inasmuch it proceeds mechanically, happens according to laws without exception, or rather, the direction of phonetic change, except for a case of a dialect split, is always the same inside a linguistic community, and all the words in which it appears in equal conditions the sound submitted to the change, are gripped by changing without exception ”

H. Osthoff e K. Brugmann  
Morphologische Untersuchungen  
1878  
p. XIII

## Environment adaption and functioning loss

The parlance is also connected to social functions, once a function gets extinct, the parlance gets extinct too. (p.38). It's ultimately a communication functionality that stops existing in the moment it becomes useless. A word that described a haircut that is not used for decades will eventually be forgotten. This dynamics of a parlance is again related to isolation and contact. Variations can be created internally or imported. The language is not an indivisible unity, it has different functionalities and substructures just like any other evolutionary

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element. The substructures established by the speakers or groups of speakers may internally overlap or even conflict.

## **Reproduction in the indivisible element**

The irreducible element on linguistic evolution, the speaker, follows an evolutionary process as the big systems, but in this case, just like in simpler structures, the evolution may be so intense that the mutation rate that reaches horizontality. An individual may alter the way of speaking during his lifetime according to the contact with other speaking elements. The only possible stagnation phenomenon is the psychological or physical isolation.

## **A Parlance's Cycle**

A parlance may undergo cycles, like an evolutionary being that varies according to its necessity or by pure chance. There is also the exhaustion phenomenon that is one of the main motors of the cycle larger phenomenon. A word that is too used for an intense meaning would lose its communicational capacity leading the speakers to start using some other, the lack of use would bring back the integrity and meaning of the word.

“Nella lingua, come in ogni altro prodotto del comportamento umano, ciò che la generazione precedente usa come arcaismo può essere definitivamente abbandonato (ma anche ripristinato!) dalle generazioni successive.”

“In a language, as in any other product of human behavior, what one generation uses as archaism may be completely abandoned (but also restored) by the successive generations”

R. Lazzeroni  
Linguistica storica  
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## Complexity Overlap

As a system grows in complexity, the mutations become less frequent. A bacterium mutates a lot faster than a multicellular organism. This fact is often explained in biology. This phenomenon happens also in linguistics.

In linguistics, however, differently from the biology case, the fusion of tongues is as possible in complex structures as it is in the simpler ones. The critical point here is the dimension of the influence. As the language gets more widely studied and documented by its population, the grammar structure, or rather, the skeleton of the system remains unaltered, but the foreign minor elements will easily infiltrate and infect the vocabulary. Until a few centuries ago, the literate were a minority and as a consequence, the written tongue was a minor reference of a parlance,. Due to this rarely used support on physical material, the identity of a language was a very fluid concept, varying from a city to another and often over time. Due to this structural simplicity, languages evolved systematically a lot faster than they do today.

## The rotation of functions in a language

A phoneme mutation can provoke the mutation of other functions avoid redundancy. The same happens with words, if cup starts to represent also the object "mug", the word "mug" will mutate to signify something else or stop being used. And another word will replace the original meaning of "cup", as to signify the object "cup". In Portuguese, Spanish and Italian, the rotation of the words: "copo", "copa", "taça" "tazza", "caraffa", "garrafa", "jarro", "jarra", "giarra", alternate so that no word accumulate meanings and no object remains unnamed. The rotation of meaning or function

This rotative mutation, that is ultimately connected to meaning exhaustion is also responsible for the cycles in the manifestation of functions. When a curse word is overused and loses its capacity to perform the function of insulting, a

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new offensive word must emerge. When this new word loses its capacity to insult, a new word or the old one will take its place.

## Gravity versus spread

There are in linguistics, the representation of the same main forces that determine the evolution of every existing thing, the need to evolve and grow, and the tendency to eliminate every possible superfluous excess, that limits the development.

“Il mutamento linguistico è generato dall'antagonismo fra le necessità della comunicazione che tendono ad aumentare i mezzi distintivi e la tendenza al minimo sforzo che tende a ridurli. Un fonema *č*, *cosě*, sottoposto a una doppia pressione: una pressione sintagmatica (pressione nella catena) da parte dei fonemi contigui nell'enunciato e una pressione paradigmatica (pressione nel sistema) da parte delle unità che avrebbero potuto figurare al suo posto. La pressione nella catena tende ad assimilare il fonema al contesto e, perciò, a ridurre le opposizioni; la pressione nel sistema tende alla massima differenziazione, perciò, a conservarle.”

“The language mutation is generated by the antagonism between the needs of communication that tend to increase the media unities and the tendency to minimal effort that tends to reduce them. A phoneme is, thus, subject to a double pressure: syntagmatic pressure (pressure in the chain) by contiguous phonemes in the utterance and paradigmatic pressure (pressure in the system) on the part of the unit that could appear in its place. The pressure in the chain tends to assimilate the phoneme to the context and, therefore, to reduce oppositions; the pressure in the system tends to maximum differentiation, therefore, to preserve them.”

R. Lazzeroni  
Linguistica storica  
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There are fields of study that interpret the most logic aspects of linguistic evolution such as Universal linguistics. It is a set of rules that determine statistically the evolution of a language. Those tendencies, based on logic, follow the parameters of the natural evolution. If one function can be performed by one subsystem, the other systems that performed that function will stop performing it. Although, the cultural component in the development of languages performs a very distinct role. It influences the linguistic systems to develop non functional structures, notwithstanding the basic evolutionary tendencies and the relevant functional aspect of speaking.

The analysis of evolution becomes less logic and more humanistic on a larger scale, but the principles of the system are always the same. Evolution is a natural process and its expression can be read as a model notwithstanding the genre or subjects under consideration.

This fact explains all the incoherencies in linguistic structures, the same principle that we are going to address later in this paper.

