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Entropy 2020, 22 (2), 179; Received: December 2, 2019/Revised: January 31, 2020/Accepted: February 1, 2020/Posted: February 5, 2020 is well known, from Empronic evidencies, that the distribution of the Frequency Word of almost all texts is described by the Zipfan Law, at least approximately. Following Stephens and Bialek (2010), we interpret the frequency of any word as due to the potentials of interaction between their constituent letters. In fact, the principle of Jaynesã ¢ Â® mother's entropy with the restrictions given by each two -letter marginal distribution leads to Boltzmann distribution for word probabilities, with a similar function of the energy given by the sum of the potential pair (two letters) all for all. The so -called improved iterative scaling algorithm allows us to find the potentials of two -letter empathic marginals. We considerably expanded the results of Stephens and Bialek, applying this formalism to words with six letters of the English subset of the newly standardized gutenberg corpus project. We think the model is able to reproduce edadi uo]81[augnÃl Ã o£Ã§Ãaler me etneopxe od rolav on edadilibairav amugla adartnocne ioF .siod ed onrot me etneopxe mu moc ,aicnªÃtop ed iel ed acitsÃlibaborp assam o£Ã§Ãnuf amu rop atircsed res edop sarvalap ed sopit sod aicnªÃ¼Ãqerf a euq amrifa iel ad acitsÃugnil o£Ãsrev a ,missa e ,)arvalap ad atulosba aicnªÃ¼Ãqerf a ,sarvalap sartuo me(odutse me otxet on mecerapa euq eled snekot od oremºÃn olep odad ©Ã arvalap ed opit mu ed âohnamatâ o ,amrof asseD .)sarvalap ed sopit(sarvalap sairp³Ãrp sa o£Ãs sopurg uo sessalc e ,)otxet mu me sarvalap ed saicnªÃrroco ,ajes uo(sarvalap ed snekot o£Ãs siaudividni sotnemele lauq o arap ,]71,61,51,4 ,31,21[acitsÃugnil an sâ¢ÃfpiZ ed iel a ©Ã esseretni ralucitrap eD .)ratnemelpmoc avitalumuc o£Ã§Ãiubirtsid a arap mu ed omix³Ãrp etneopxe mu odnes abaca ossi ;edadilibaborp ed assam ed o£Ã§Ãnuf a arap(siod ed omix³Ãrp etneopxe mu moc aicnªÃtop ed iel ed o£Ã§Ãiubirtsid amu rop sohnamat ed axiaf amugla me atircsed meb sonem uo siam ,ednarg etnemamertxe edadilibairav amu artsom setniutitsnoc sotnemele sues ed oremºÃn od somret me sopurg sod ohnamat o ,sosac sesse sodot mE .]11,01,9[acisºÃm ©Ãta e]8[ralulec aigoloib ,]7,3[seµÃ§Ãacinumoc ,]6,5[aigoloce an m©Ãbmat e ;]4[saserpme rop sodatartnoc sodagerpme moc ,aimonoce an ;]3[seµÃigiler s Ã odnatnuj es setnerc moc ,aigoloicos an ;]2[meviv edno aliv uo edadic Ã sodagil so£Ãdadic moc ,aifargomed an odataler iof iÃJ .]1[sopit uo sessalc setnerefid me sodapurga res medop euq siaudividni sotnemele rop sotsopmoc soxelpmoc sametsis sotium me egreme euq o£Ãrdap mu ©Ã afpiZ ed iel A .sadinifed meb sacitsÃtatse siel meuges o£Ã§Ãaretni ed laicnetop ed seµÃ§Ãiubirtsid sa otnauq sartel saud ed sacirÃpme sianigram seµÃ§Ãiubirtsid sa otnat euq somirbocsed ,otudorpbus omoC .sarvalap sad sedadilibaborp sa revercsed arap adasu ©Ã arup acisÃf-acitsÃtatse aruturtse amu ,amrof asseD .leviÃredisnoc o£Ãsrepsid artsom siaudividni sarvalap ed edadilibaborp a sam ,oditbo ©Ã ¢Ã ¢ÃfpiZ ed redop ed iel ad lareg emigr o :seµÃ§Ãatimil samugla moc sam ,iel Speakers [19], but not at the length of the text [20,21] or in the precise definition of the word (ie, word forms word) Lemmas [20]). We clarify that (what we call today) Zipfa's law was discovered more than 100 years ago by Estoup [22] and formalized mathematically by the renowned physicist E. Condon in 1928 [23]; Zipf's subsequent rediscovery and labor-intensive [24] is what made the law so well known.There are many attempts to provide a mechanism for this curious law [25,227]. Thinking about the generation of texts, we can cite the typing monkey typing, also called intermittent silencing [28] (criticized in [29]), the principle of least effort [30,31,32], the reduction of sampling space [33,34] and the optimization codification [35]. The most general mechanistic models for Zipfa's law are preferential attachment [18,36,37,38], birth and death processes [39], variations of Polya's urns [40] and random walks in networks [41]. The existence of so many models and explanations is a clear indication of the controversial origin of the law. In addition, there have also been important attempts to explain not only Zipfan's law, but any kind of power law distributions in nature [42,43,44,45].A different approach is provided by the principle of maximum entropy. In statistical physics it is well known that a closed system in equilibrium with a thermal bath presents fluctuations in its energy, but maintaining a constant average energy. As Jaynes [46] has shown, the maximization of Shannon entropy [47] with the restriction that the average fixed energy produces the Boltzmann factor, which states that the probability of any microstate has to be an exponential function of its energy (note that this does not mean that the distribution power is exponential, because the number of microstates as a function of energy is not necessarily Therefore, some authors have sought an analogy to the Boltzmann factor for power laws. For example, one can easily obtain a power law not by imposing a constant (arithmetic) average but a constant geometric mean [48] (assuming also a degeneration It is constant with the energy). Also, fixation fixation Noitazimixam eht ni deniatbo(sreilpitum eht ,yaw larugan ,yfitnedi ot ot swolla rotcaf ekkil-nnamztlob gnitluser eht .noitcnits he .)Devrep ton yrtemmys ,revoerom ,4 dna ,4 dna 2 Neewteb naht 3 dna 1 snoitosop newties neew emas eht ton nna neewteb noitcaretni eht ,.e.i(noited ehtddid sidd sidd sidd sidd sidd. Sttel(smota neewteb noitcaretni eht .smota gnipsercc eht eht eht eht dluow srettel tneutitsnoc eht dna ,Elucelom)lanoisnemided-eno(a trow a fo ktelap stelap t ,ygot t. Deredisnoc Era Sdrow DNA ,stxet of Ecnerrucco dht Krowemarf eht .snoitirtdisid lanigram ydob-owt laciripme eht yb dedivorp era sniartsnoc eht morp hrop hrop hrop hrop hrop hop Yportne Nonnahs Noitazixam â€â€âsenyaj Nwonk-Lew eht reddisnoc]5[srohtua eseht ,]05[.La te nosrep ekil .stluser rieht gnidnetxe ,] [Seiportne Renruht-Lenah Eht DNA ,]25[seilportne syllac osla ,]15[seilportne tâiÌvrahc-adrvah eht in the hcus seilportne evisnetleiy estportne edentlei essitle edecnotetlei essitle ot EUD ,tauqedani yportne nonnnahs eht Fo eht evah evah srohtua rehto Eht gnizimixam nehw sezis FO Sliat Wal-rewop ot damage ot taht noitcnuf yrene evisnetxe-non eterconc desopopp evah , na Htiw Wal Rewop a ot sdael naem citremoeg eht dna citemhti RA Rehto ni .nwon' laiceps a ot sdael hcihw ÃÂÂ¢,egdelwonk laitrap fo sisab eht no snoitubirtsid ytilibaborp pu gnittes rof noiretirc evitcurtsnoc a sedivorp yroeht noitamrofnIÃÂÂ¢.krow siht fo snoisnetxe dna snoitatimil ssucsid ew noitces lanif eht nI .detaulave si noitubirtsid laciripme eht htiw ecnednopserroc sti sa llew sa noitubirtsid drow laciteroeht eht fo retcarahc naifpiZ ehT .)tliub si noitubirtsid drow laciteroeht eht hcihw morf tuptuo eht era hcihw(slaitnetop esiwriap gnitluser eht dna)erudecorp eht fo tupni eht era hcihw(slanigram esiwriap laciripme eht Gnidulcni ,styluser eht dna ew atdad laciripme eht ew ,txen .snoitcnuf eruf foot fo tpecnoc lufesu ,srettel fo unitCaretni Esiwriap ot NOITCILAP ot not E-MUMIXAM EHT weive ew ,noitces txen eht ni.seitilibaborp eht Fo seulav eht fo rettacs elbareDisnoc htiw tub ,)wal sâ€â€â€âforeh set sroht sroht sroht sroht srouw. ot Elba Snoitcaretni Eswriap)Rettel-owt(Ydob-owt taht taht .slaitnettentnettentnettentnettentnettentnettentnettentnettentnettettot noitcaretni eht Fo seulav eht ottnetta laiceps yap sâ€Rop t tsi t trid t t t t t t t t t to ROF rotcaf ekil-nnamztlob niatbo liw ew krowemarf â€â€â€â€âsenyaj DNA Nonnahs Gniso ,wal sâ€â€â€Fpiz tnem silfluf eht sislifluf eht sisylaf ehtsitansita sisylaf ehttinsitan sisylaf ehtsylaf ehtsylaf ehttufluf ehtsitansita nga ehttufluf ehttuflufluf ehttuflufluf ehttufluf edat sisylana ket. ni Sttel 6 ot 1 morf htgnel yna Fo Sdrow Gnizylana Yb Stluser Rieht Dnetxe ylbareDisnoc .sdow Fo seicneuqerf laciripme ehts htiw httelw httelop ssilofrep ssilrep ssilofrep demrorep. slaitnetnettop noitcaretni eht htiw)sniartsnoc eht Fo se ulav laciripme eht entropy entropy rop adad ©Ã Ãulos a ,)ohnab moc ocimr©Ãt oirbÃliuqe me sodahcef sametsis arap acim¢Ãnidomret an ecetnoca omoc(o£Ã§Ãirtser amu omoc odasu ©Ã aigrene ad oid©Ãm rolav o odnauq ,etnasseretni siaM .otnemidnetne muhnen zart o£Ãn e o£Ã§Ãazilareneg met o£Ãn oledom esse siop ,ocitiÃrp esseretni ocuop ed ©Ã euq o ,o£Ã§Ãulos a o£Ãs sotelpmoc sodad so ,otnatroP .)j ed aicnªÃuqerf etnerap o ,©Ã otsi(j arvalap ad aicnªÃrroco ed acirÃpme edadilibaborp a)j(¯Ã moc ,)j(¯Ã = l u f j P o£Ã§Ãulos amu moc ,omsem o levÃssop ©Ã ,seµÃ§Ãirtser omoc socirÃpme serolav so sodot asu ,ossid zev me ,eS ."ratnemidur" o£Ã§Ãulos assed rapacse edop es o£Ãn euq oralc ©Ã ,seµÃ§Ãirtser sartuo revuoh o£Ãn eS .)acitsÃtatse acisÃf a moc aigolana me ,ocin´Ãnacorcim od ©Ã c ¼Ã ;o£Ã§Ãazilamron :aticÃlpmi o£Ã§Ãirtser amu otaf ed etsixe omoc(v / 1 = c ®Ã j p ,otnemapiuqe ed osac o es- m©Ãtbo ,seµÃ§Ãirtser sadicenrof merof o£Ãn es ,olpmexe roP .sosac .anaignargal o£Ã§Ãnuf a ¦Ã¬â ¢Ã '')2 egnirtser(£Ã ²Ã '' ')1 egnirtser(£Ã £Ã ±Ã' ¢Ã s = l e ,.cte ,2 rignirtser ,1 o£Ã§Ãirtser Ã sodaicossa egnargaL ed serodacilpitlum so ,.cte ,®Ã ,±Ã moc ,J sodot ed o£Ã§Ãulos a artnocne edno ,egnargaL ed serodacilpitlum sod odot©Ãm o asu ,seµÃ§Ãirtser ed eir©Ãs amu bos aiportne a razimixam araP .oipÃcnirp me ,staN me sam ,stib me adidem ©Ã o£Ãn aiportne a ,siarutan somtiragol somasu omoc ,euq evresbO .j arvalap ed opit od aicnªÃrroco ed edadilibaborp a ©Ã P edno ©Ã nonnahS ed aiportne a ,)sarvalap ed sopit ed latot oremºÃn o(oiriÃlubacov od ohnamat od v e v ¦Ã¬â ¢Ã ,2 ,1 = j moc ,j rop arvalap ed opit adac odnalutoR .sotxet me sarvalap raredisnoc somaV .).siam o£Ãn sam ,levÃssop setnarongi siam o res someved :revercse somaÃredop ,otnatroP ."aicn¢ÃrongI" ed osU o airireferp e edadeirotaela a moc aiportne ad o£Ã§Ãacifitnedi a moc etnemlatot odadrocnoc airet o£Ãn ,onaiseyab mu res ed otrep ratse ,senyaJ euq rebecrep zef son nnamtlA .G .E( ]65[siam o£Ãn sam ,levÃssop oir³Ãtaela siam o otief res eved oduT 1 s¢Ã moc ,)¢Ã s¢Ã ¢Ã ¢Ã ¢Ã 2 s¢Ã 1 s¢Ã(P = j P e } s¢Ã ¢Ã , 2 s¢Ã , 1 s¢Ã { = j ,.e.i ,sartel rop atsopmoc omoc ,sarvalap sad anretni aruturtse a moc radil ed sezapac somos aroga ,seroiretna satsilpmis soledom so moc etsartnoc me iÃtse o£Ã§Ãulos A .)aicnªÃinevnoc rop ,)2(e)1(seµÃ§ÃauqE sa ralucitrap me ,seroiretna sosac soa o£Ã§Ãaler moc lanis ues sometrevni ,otaf ed(egnargaL ed serodacilpitlum so aroga o£Ãs i àÃ edno a avel])1(o£Ã§ÃauqE[egnargaL ed serodacilpitlum sod odot©Ãm o ,m seµÃ§Ãirtser sasse moC .aireved o£Ãn i F otnauqne ,sodicehnocsed o£Ãs aºâ i f ©Ãºâ e j P euq eton ,rovaf roP .)i o§Ãart moc sarvalap ed snekot ed ocirÃpme oid©Ãm rolav o i F moc ,m ¦Ãºâ , 2 , 1 = i arap somet ,odarepse rolav ues arap o£Ã§Ãirtser amu odnizudorp amu adac ,sacitsÃretcarac m odnaredisnoC.)artel amsem a sadaredisnoc o£Ãs salucsºÃnim e salucsºÃiam ,s³Ãn arap ,euq somenocnemc(ecim o£Ãn sam tac me artel ariemirp a ©Ã c omoc , 0 =)sotar(c 1 f e 1 =)tac(c 1 f o£Ãtne ;)artel ed o£Ã§Ãnuf ed odamahc res airedop ossi ,osac etsen(c 1 = i omoc odimuser ,} 1 o£Ã§Ãisop an iÃtse c artel { = i osrucer o raredisnoc somav ,olpmexe roP .]16[sacitsÃretcarac seµÃ§Ãnuf sa rizudortni litºÃ es-anrot ,otnop esseN .âaigreneâ ed eic©Ãpse amu moc al-iÃcifitned ed raxied levÃssop ©Ã o£Ãn euq aralc o£Ãt ©Ã)nnamztloB ed rotaf od s©Ãvarta(amrof assed artnocne es euq aigolana a ,otnatne oN .arvalap amu ed aigrene Ã ogoliÃna ogla a airavel)kelaiB e snehpetS ed a ©Ã euq(megadroba asson ,otaf ed ;alaf an odnigrus omoc ,]06,95,85[,acitsºÃca(acisÃf aigrene Ã odnirefer son somatse o£Ãn euq razitafne somaV .o£Ã§Ãaterpretni ed airecerac aigrene asse ,otnatne on ;etnematiaidemi airiv edadilibaborp arvalap a ,arvalap ed opit mu ed j E aigrene a arap o£Ãsserpxe amu ,iroirp a ,roporp levÃssop essof eS . j E 2Ã Ì ¢Ã = Z moc e ,j)odatse uo(opit od aigrene Ã es-odnirefer j E ,ocin´Ãnac elbmesne o moc aigolana ad odniv n a c o£Ã§Ãaton a moc ,]75[nnamztloB ed o£Ã§ÃiubirtsiD Eton esaelp .) The fow sangis hcihw ,ttel laiceps Eb ot dereDesnoc is knalb eht(.CTE ,dnoces eht ro ,drow a fo tsrif eht s ttel eht fi gnidnep ehtew egnaho seitiht seitiht seitiht seitiht seitiht serp setilibabod ytilibaborp tnereffid a Gnivah Rettel Hcae Htaw ,modnar because I'm dgards that if gnipyt yeknom a fo kniht dluoc eno ,sdrow reht , balang eht ni noitosop spined tub The dhcae taht niat niat ,]92,82[sledt-yeknom ot detaler ylesolc dna ,deedni elpmis yrev slanigram)helgnis(tarevinu no desab ledrov EHSCIDO EHTIm yht ilalavnu. Slaitnettop rehto eht taht taht dedivorp , 1 â„â¢ lla rof 1 C + 1 â„â¢ â»âž 1 , â• have ROF ,ecalper dluoc eno dna dexifton sitnnetnetnetnetnetnetnetnetnetnetnetnetnetnetnetnetnetnetnetnetnetnet fo-broad O taht eton(,so DNA) c (1 â â â â â = 3 / 1 â'â´â´â´â C 1 â»âž m m mf snoitulos eht Ew Erehw Morf , c 1 â»âž the ÃÂ¢) c (1 ÃÂ ot evirra ew ,)5(noitauqE ,niartsnoc eht otni siht gnitutitsbuS .slanigram rettel-eno fo sniartsnoc eht morf deniatbo si noitulos eht taht tcaf eht rof gnidnats I lebal eht ,elpmaxe rettel-eerht a ROF ,evah ew ,)4(noitauqe ,seitilbaborp eht rof noisserpxe eht ot kcab gnamoc.)sneck FO rebmun latot eht yb dedivid 1 noitisop by c rettel htiw sneotot Fo rebunment eht tsuj hcihw( ) c (1 â â â â â â ULAV laciripme ot lauqe ew (I 1 p ytilibaborp Lanigram eht C1 erutaef eht fo eulav detcepxe eht taht taht niat niat ,sdrow ew C 1 = I ROF ,Etmaxe rof ,drow fo sttel laudividni eht epircsed serut AF eht taht reddisnoc ew fi .no os dna j d s. letter letter at first position ed otebafla mu raredisnoc atsab :)nips ed ordiv ed oledom mu ,etnemadauqeda siam ,uo(gnisu ed oledom mu a etnelaviuqe odnes abaca sartel ed ametsis etsed odacifilpmis otium osac mU .]55[sacit©Ãneg e sacimÃuqoib ,sianoruen seder sarap adasu iof m©Ãbmat adaerap megadroba asse ,etnemlevatoN .)C artel Ã odived ,o£Ã§Ãecxe(ranagne susrev)arger(etiderca :5 a 3 seµÃ§Ãisop san ,otnatrop ,lareg me e ,olpmexe roP ;adaerap o£Ã§Ãaretni alep sadarutpac o£Ãs o£Ãn ,sªÃlgni me sacifiÃrgotro sarger me snumoc ,sartel sªÃrt ed seµÃ§Ãaretni sa euq evresbO .)o£Ã§Ãaretni a arap etnatropmi ©Ã sartel saud sad o£Ã§Ãisop a edno e serap ertne odut arap odut o£Ã§Ãaretni moc(o£Ã§Ãaretni me sartel ed seder omoc satsiv res medop sarvalap sa ,otnatrop ,lareg me e ,olpmexe roP ;)edadinu amu ed a§Ãnadum amu moc e sonem lanis mu moc(osrucer o menifed euq sartel sa ertne etnemlaerap o£Ã§Ãaretni ed laicnetop o moc osrucer adac arap egnargaL ed rodacilpitlum o e)sonem lanis mu moc e 1' ¢Ã ed sedadinu me(aigrene a moc laicnenopxe od otnemugra o racifitnedi somedop ,)2(o£Ã§ÃauqE an omoc ,nnamztloB ed o£Ã§Ãiubirtsid a moc odnarapmoC .)sartel ed oremºÃn me(arvalap ed otnemirpmoc o k moc ,lareg me ,evercse odatluser omsem O .sartel saud ed sianigram ,©Ã otsi ,sartel saud ed sacitsÃretcarac ed setnerroced sacir³Ãet sedadilibaborp moc odnadil somatse euq ocidni euq olut³Ãr o e ,serodacilpitlum so arap)aC(21 »Ã= aC 21»Ã o£Ã§Ãaton a odnasu omoc sotircse res medop ,sartel sªÃrt ed arvalap amu ed ocifÃcepse olpmexe o arap sotirtser ,)4(o£Ã§Ãulos a ,sodad sO ocirÃpme olep adicenrof ,sartel saud ed lanigram a)aC(21 ¯Ã moc evercse)3(o£Ã§ÃauqE a ,o£Ãtne ,2 me A artel e 1 o£Ã§Ãisop an C artel met arvalap a euq acidni AC 21 = I osrucer o es ,olpmexe roP .sartel saud ed sianigram so erbos seµÃ§Ãirtser a avel euq o ,sartel saud ed sosrucer arap roiretna oledoM od o£Ã§Ãazilareneg a asu kelaiB e snehpetS ed megadroba A .etnerefid o£Ã§Ãerid amu adota]55[kelaiB e snehpetS ed megadroba a ,]74[vokraM ed soledom so arap sajes ocacam ed selpmis soledom sessed acissiÃlc" o£Ãsnetxe a arobmE o o ropmi e)b e a(sartel in general) Ã»Ã k k ¢ÃÂ²Ã (a b) = Ã»Ã k k ¢ÃÂ²Ã (b a) and Ã»Ã k k ¢ÃÂ²Ã (a a) = Ã»Ã k k ¢ÃÂ²Ã (b b) (if one wants to get rid of this symmetry in the Ising system one could consider external ¢ÃÂÂmagnetic¢ÃÂÂ fields, associated with the one-letter marginals).Substituting the solution (4) or (7) into the constrains (6), the equations we need to solve would be like if we restricted to three-letter words.For computational limitations, we will only treat words comprising from 1 to 6 letters. As the numerical algorithm we will use requires that the number of letters is constant (see the Appendix A), we will consider that words shorter than length 6 are six-letter words whose last positions are filled with blanks; for example, cat = cat ¢ÃÂ¡Â ¢ÃÂ¡Â ¢ÃÂ¡Â , where the symbol ¢ÃÂ¡Â denotes a blank. In this way, instead of the usual 26 letters in English we deal with 27 (the last term in the sums of some of the previous equations should be ¢ÃÂ¡Â, instead of z). This yields 6 ÃÂ 5 / 2 = 15 interaction potentials (15 features) for each word, and a total of 15 ÃÂ 27 2 = 10,935 unknown values of the interaction potential (i.e., Lagrange multipliers with minus sign) corresponding to 10,935 equations (one for each value of the two-letter marginals). In contrast, note that there are about 27 6 = 387,420,489 possible words of length between 1 and 6 (the figures turn out to be a bit smaller if one recalls that blanks can only be at the end of the word, in fact, 26 + ¢ÃÂ¦Â + 26 6 = 321,272,406). In more generality, the 10,935 equations to solve are like where the solution is not straightforward anymore, and has to be found numerically. Therefore, we deal with a constrained optimization problem, for which the Appendix A provides complete information. Here we just mention that the so-called improved iterative-scaling method [61,62] consist of the successive application of transformations as see Equation (A1) in the Appendix A, with P 12 I I (ca) calculated from the maximum-entropy solution, Equation (not (not present in linguistic) 2 ÂÂÃ¢ (21 ÃÂ ,elpmaxe rof(seitilibaborp etairavib era slanigram rettel-owt eht hguohtla ,taht ecitoN .slanigram eht fo seulav orez-non 2905 fo latot a era erehT .erudecorp noitazimitpo eht fo tegrat eht etutitsnoc hcihw ,)debircsed tsuj suproc-bus rettel-ssel-ro-6 eht morf deniatbo(seitilibaborp lanigram rettel-owt laciripme eht syalpsid 1 erugiF.)1 elbaT ees(nonemonehp ycneuqerf-hgih a si wal sÂÂÃ¢fpiZ ,sa wal sÂÂÃ¢fpiZ fo tnemlliflluf eht ecneulfni ton seod 6 ÂÂÃ¢ 01 ÂÃ 5 woleb seicneuqerf evitaler gnidragersid fo tcaf eht taht eton esaelP .tnenopxe wal-rewop tnereffid ylthgils a htiw eno hcae tub ,wal sÂÂÃ¢fpiZ llifluf aroproc-bus eseht taht ees lliw eW .stib 53.8 = S dna 1805 = V ,snekot 914,853,795,1 sdleiy 6 ot lauqe ro rellams htgnel htiw sdrow fo tesbus eht ,yllaniF .stib 54.9 = S semoceb yportne eht os dna ,240,11 ot V dna 674,976,188,1 ot snekot fo rebmun eht secuder sihT .)srettel neewteb noitcaretni yb demrof ton era yeht sa ,sesoprup ruo rof sdrow ton era eseht(slaremun namoR osla evomer ew ,yllaniF .)srettel esac-rewol dna latipac neewteb hsiugnitsid ton od ew taht eton(dedragersid era z ot a morf srettel 62 nialp eht naht tnereffid sretcarahc gniniatnoc)smarginu(sepyt drow ,oslA . 6 ÂÂÃ¢ 01 ÂÃ 5 woleb seicneuqerf evitaler gnidnopserroc eht ;000,01 naht rellams ycneuqerf etulosba htiw sepyt drow dragersid ew ,snoitatimil lanoitatupmoc rof osla dna ,).cte ,sgnillepssim(sdrow suoirups diova oT .stib 72.01 = S si noitubirtsid ytilibaborp-drow gnidnopserroc eht fo yportne ehT . 340,862,2 = V ezis yralubacov a dna 604,193,610,2 snekot fo rebmun latot a htiw ,hsilgnE ni skoob 000,04 naht erom sesirpmoc sihT .]36[suproC grebnetuG tcejorP dezidradnatS detneserp yltnecer eht ni skoob hsilgnE lla esu ew ,suproc a sA.mus eht rof eulav emas eht evig ot detfihs ylgnidnopserroc era slaitnetop rehto eht sa gnol sa , 21 C +) 2 ÂÂÃ¢ 1 ÂÂÃ¢ (21 Â»Ã ÂÂÃ¢) 2 ÂÂÃ¢ 1 ÂÂÃ¢ (21 Â»Ã ,.e.i ,tfihs a redun denimretednu era slaitnetop eht ,slanigram etairavinu fo jeweli ni you, will eth esaalp Esaalp oxiab etnemavitaler res sianigram san sodad ed oremºÃn od rasepa ,euq artsom)adreuqse(1 arugiF A .sartel ed serap o£Ãs sopit so ,sianigram seµÃ§Ãiubirtsid ed osac on ,euq es-erbmeL .sarvalap ed o£Ã§Ãiubirtsid an afpiZ ed iel ad saled aicnªÃgreme a ©Ã o£Ãn uo etnedneerprus o£Ãuq railava ed mif a ,sartel saud ed sianigram sasson arap afpiZ ed iel ad edadilibaclipa a ratset somedoP .saicnªÃ¼Ãqerf ed o£Ã§Ãiubirtsid ed somret me o£Ã§Ãatneserper amu meutitsnoc)Ã(g o otnauq)Ã(G o otnaT .))atierid(1 arugiF(sednarg sâÃ arap ,etnemacitotnissa a avel sâÃ ed edadilibaborp ed assam ed o£Ã§Ãnuf uo edadilibaborp ed edadisned ed somret me euq a omoc atircse res edop sâ¢ÃfpiZ ed iel a ,G ,ratnemelpmoc avitalumuc o£Ã§Ãiubirtsid ad somret mE .adatupmoc ©Ã o£Ã§Ãiubirtsid ajuc ,air³Ãtaela leviÃirav amu omoc Ì Ã Ã acirÃpme aicnªÃ¼Ãqerf a aredisnoc ,]42,41[fpiZ rop adasu m©Ãbmat ,]56,46,71[adamixorpa avitanretla o£Ã§Ãatneserper amU .aicnªÃ¼Ãqerf-knar o£Ã§Ãatneserper a erpmes somasu saiportne somatealer e somaluclac odnauQ .)edadilanoicroporp racidni medoP¢Ã 3Ã olobmÃs o(mu ed somix³Ãrp serolav odnamot 1 PÃ 3Ã 3Ã etneopxe o moc ,)satla siam saicnªÃuqerf sa ,.e.i ,saxiab siam sa etnemacipit(suarg ed axiaf amu arap ,r ©Ã Ã ertne aicnªÃtop ed iel ed o£Ã§Ãaler amu omoc adalumrof res edop afpiZ ed iel a ,o£ÃtnE.)r(21 ,otsop o uo adairavinu o£Ã§Ãnuf amu odaredisnoc ©Ã , 2 â ¢Ã e 1 â ¢Ã sair³Ãtaela sieviÃirav ed somret me odatneserper res ed s©Ãvni oa ,)2 â ¢Ã 1 â ¢Ã(21 â Ã ,olpmexe rop ;adairavinu amu me)lareg me ,adairavitlum uo ,osac etsen(adairavib o£Ã§Ãiubirtsid amu ed o£Ã§Ãejorp ed eic©Ãpse amu iutitsnoc e)sotsop ed o£Ã§Ãiubirtsid ,sezev s Ã ,uo(sotsop ed aicnªÃuqerf ed o£Ã§Ãatneserper ed odamahc ©Ã otsI .))adreuqse(1 arugiF(etnaid rop missa e ,mumoc siam opit odnuges oa 2 = r ,)mumoc siam opit o ,.e.i(â Ã acirÃpme aicnªÃ¼Ãqerf roiam a moc opit oa 1 = r o£Ã§Ãacifissalc a odniubirta ,o£Ã§Ãacifissalc ed leviÃirav amu odninifed odiugesnoc ©Ã otsI .sodairavinu omoc sol-ibixe etimrep sâ¢ÃfpiZ ed o£Ã§Ãatneserper a ,)]55[me a1 arugiF a m©Ãbmat ajeV In Table 1, with a theoretical maximum of 26 2 = 676), the marginal frequencies appear widely distributed, varying over 4 orders of magnitude (with the frequency being in the range of 10'5 to 10' "1). Although the double logarithmic plots do not correspond to straight lines, the high-frequency (low-rank) portion of each distribution can be adjusted to an energy law, for several orders of magnitude ranging from 0.5 to 2 and an exponent Ã®Ã3 typically between 1 and 2, as can be seen in Table 1. Thus, the marginal two-letter distributions display a particular Zipfian character (at least considering words not longer than 6 in letters), with a short line of power law, in General, and with a rather large value of Ã®Ã3 (remember that "it must be close to one for compliance with the ZIPF law). In the same way, with the only difference in the scale parameter of the frequency distribution, which is determined by the average frequency Ã¢ Â© K k k k k k q âÂ2 (generically indicated in the figure as Â© Ã¯ e m p Ã¢ÅÂa). This means, as shown in the figure, that the distribution G (Ã¯ e m p), when multiplied (resized) by "Â© Ã¯ e m p ÅÂa, can be roughly considered as a function that depends only on the resized Frequency, Ã¯ e m p / Ã¯ e m p ÅÃ¯ a, regardless of what it is considered a potential. In terms of the distribution of classifications, this property of scale translates into the fact that p / Â© Ã¯ e m p – can be considered a function of only r / v. For the adjustment we use the proposed method [66,67], based on the estimation of maximum probability and Kolmogorov-Smirnov goodness-of-fit tests. This method lacks the problems presented in the popular recipe of Clauset et al. [3,68,69]. The adjustment method is applied to Ã¯ as a random variable (rather than applied to r [16]); This choice has several important advantages, as discussed in [65]. The result of the It is an estimated value of the exponent ÃÂ´3 together with a value of Ã, denoted by a, from which the adjustment of the power law, Equations (12) and (13), is non-rejectable (with a p-value greater than 0,20 by prescription). Although distributions other than the power law can be fitted to the marginal data (e.g. lognormal [67]) our goal is not to find the best fitting distribution, but only to evaluate how much Zipf's power law depends on a possible ZipfÃ¢â'¬â"¢s behavior of the marginals. Figure 2 shows that optimization can obtain values from the theoretical marginal distributions very close to the empirical one. However, despite the fact that the target of optimization are marginal distributions (whose empirical values are the input of the procedure), we are interested in the distribution of words, whose empirical value is known, but does not enter into the procedure, because this is the quantity we seek to explain.âÂâââ€TMs representation of the frequency-classification of Zipfa allows us to display in a single dimension the six-dimensional nature (from our point of view) of word frequencies; for the frequencies of the empirical words is shown in Figure 3. We find that the distribution is best fit in terms of an upper truncated power law [66,71], given, as in Equation (13), by g (Ã) Ã¢ 1 / Ã Ã ÃÂ³ + 1 but over a finite range a Ã¢Â¤ Ã Ã¢Â¤ b < Ã¢ Ã¢ (the non-truncated case would be recovered by taking b Ã¢ Ã¢ Ã¢). This corresponds, in the case of the continuum, to a cumulative distribution G (Ã) âÂa ÃÂoÂ3 ÃÂoÂ3 ÃÂoÂ3 ÃÂoÂ3, and to a rank-frequency relationship that coincides in its mathematical expression with the so-called Zipf-Mandel distribution brot (although the continuous adjustment makes a continuous variable; remember that V is the number of types). The adjustment procedure is essentially the same for the unruncated power law described in the previous subsection, with the maximization of probability a little more involved [66,67]. In Figure 3 we also present the result P I, equation (8), resulting from (10). We see that, qualitatively, P I I has a shape rather similar to the empirical one. Both distributions fulfill Zipf¢ÃÂÂs law, with exponents Ã³Â equal to 0.89 and 0.81, respectively. We also see in the figure that the quantitative agreement in the values of the probability (P I I and ÃÂ w o r d) is rather good for the smallest values of the rank (r < 10); however, both curves start to slightly depart from each other for r > 10 . In addition, the rank values are associated with the same word types for r ¢ÃÂ¤Â 6 (the, of, and, to, a, in), but for larger ranks the correspondence may be different (r = 7 corresponds to i in one case and to that in the other). If we could represent ÃÂ w o r d and P I I in six dimensions (instead that as a function of the rank) we would see more clearly the differences between both.Zipf¢ÃÂÂs law is, in part, the reason of this problem, as for r ¢ÃÂ¥Â 10 the difference in probabilities for consecutive ranks becomes smaller than 10 %, see Equation (11), and for r ¢ÃÂ¥Â 100 the difference decreases to less than 1 % (assuming Ã³Â ¢ÃÂÂ 1). Therefore, finite resolution in the calculation of P I I will lead to the ¢ÃÂÂmixing of the ranks.¢ÃÂÂ However, the main part of the problem comes from the unability of the algorithm in some cases to yield values of P I I close to the empirical value, ÃÂ w o r d , as it can be seen in the scatter plot of Figure 4 (in agreement with [55]). The entropy of the theoretical word probabilities turns out to be S = 9.90 bits, somewhat larger than the corresponding empirical value 8.35 bits. If we truncate this distribution, eliminating probabilities below 10,000/1,597,358,419 ¢ÃÂÂ 6 ÃÂ 10 ¢ÃÂÂ 6 (as in the empirical distribution) we get S = 8.88 bits, still larger than the empirical value, which simply means that real language has more restrictions than those imposed by the model. Existing (empirical) words for which the algorithm yields the lowest theoretical probabilities are enumerated in the caption of the figure. fo witchcraft witchcraft o£Ã§Ãareg ed omsinacem mu ©Ã o£Ã§Ãaicnenopxe a ,edadrev aN .s¢ÃfpiZ ed iel ad megiro a erbos zul amugla raªÃnal arap otaf esse rasu ratnet es-edoP .)adreuqse Ã(5 arugiF an odartsom omoc ,adugaitnop e adaseivne o£Ã§Ãiubirtsid amsem a meuges ,ajes uo ,sodÃubirtsid etnemlaugi)sonem siam(o£Ãs setnerefid siaicnetop 51 so euq somirbocsed ,etnemasoiruC .sodÃubirtsid o£Ãs).cte ,)b a(21 âÃ ,)a a(21 âÃ(amot euq serolav setnerefid so omoc ,)21 âÃ ,olpmexe rop(rodacilpitlum uo laicnetop mu odad ,ragitsevni etnasseretni ,Ã . I I P edadilibaborp ad rolav o manimreted)egnargaL ed serodacilpitlum sod serolav so uo(siaicnetop sod serolav so ,etnemetne¼ÃqesnoC .)aiportne-amixiÃm megadroba asson me(arvalap a meutitsnoc euq sartel sies ed seµÃ§Ãisop sa ertne o£Ã§Ãaretni ed siacinetop so ad o£Ã§Ãaicnenopxe ad mev I P aicnªÃrroco ed edadilibaborp aus ed rolav o ,arvalap adad amu arap ,euq somecelebatsE .)alebat an o£Ãn(§Ã ¢Ãaunsns ,untns ,lieoeo ,lieouo ,tuntns :omoc ,saselgni sarvalap sievÃssopmi esauq o£Ãs ,§Ã 03 §Ã â 01 4â1 â I I P edadilibaborp moc ,sarar siam sarvalapoduesp sa ,odal ortuo roP .)saselgni sarvalap sariedadrev mecerap sale(ÃleviÃozarâ otium ecerap sarvalapoduesp sassed aifargotro a euq somev s³ÃN . I I P acir³Ãet edadilibaborp aus rop sadanedro ,sarvalapoduesp sassed 52 sariemirp sa atneserpa 2 alebaT A .)aiportne amixiÃm ed oir©Ãtirc o odniuges ,oxiaba uo sies otnemirpmoc a arap ,sªÃlgni me mumoc siam arvalap a-04 a res eved(04 = r acir³Ãet o£Ã§Ãacifissalc amu moc ,ehw ©Ã)ocirÃpme suproc on etneserp o£Ãn acir³Ãet arvalap(mumoc siam arvalapoduesp a ,amrof asseD .)etnemacirtoet(sarar meres ed egnol sartuo metsixe ,otnatne on ;saneuqep otium sedadilibaborp met sarvalapoduesp sassed airoam A .)sarvalapoduesp sarvalap(310,471,2 = V a avel acir³Ãet o£Ã§Ãulos a ,)sarvalap ed sopit ed oremºÃn(1805 = V met ocirÃpme suproc o otnauqne ,otaf eD .sarvalapoduesp ,etnematerroc siam ,uo ,sarvalap savon ed âatrebocsedâ Ã avel ,)8(o£Ã§ÃauqE ,aiportne amixiÃm ed o£Ã§Ãulos a euq ©Ã etnasseretni o£Ãtseuq amU Potan Law [44,68]. [44,68]. It can be argued that the sum of 15 random numbers extracted from the same spiked distribution must approximate, by the central limit theorem, a normal distribution and, therefore, the exponence of the sum would produce a lognormal distribution for p i (that is, a lognormal form for g ((p i)). However, this may be true for the central part of the distribution, but not for its extreme values more to the right, which is the part of the distribution that we are most interested in – high values of Pi I, that is, the most common words. Note also that in practice, to calculate the probability of a word, we are not adding 15 equally distributed independent random numbers, because not all words are possible; that is, there are potentials that have a value equal to infinite, due to prohibited combinations, and these infinite values are not taken into account in the distribution of potentials. An additional problem with this approach is that, although most of the potentials values convert to a correction value (and the distribution of potentials shown in the figure is stable), there are unique values that do not converge, related to words with very low probability . These issues need to be further investigated in future research. In addition, Figure 5 (right) shows, as a scatter graph, the dependence between the value of each potential and the marginal probability of two corresponding letters. Although equation (10) seems to indicate an approximate proportionality between the two, the figure shows that this proportionality is not maintained (of course, the rest of the terms of the equation play their role). We generalized a previous study by Stephens and Bialek [55]. Instead of restricting our study to four-letter words, we consider words of any length from one to six, which leads to greater computational difficulties and we also employ a much larger English corpus. We carry out a compliance analysis ed ed ahnil an ,otnatne on ,o£Ãtse siareg siam sodatluser sossoN .atnop ed sacitsÃtatse satnemarref odnasu FPIZ ed iel ad detalerroc dna xelpmoc ni raeppa taht snoitubirtsid ykips dna deweks rehto ot noitubirtsid siht ,tey sseccus tuohtiw ,etaler ot deirt evah eW .detubirtsid yllauqe eb ot mees yeht tub ,emas eht ylraen era ekat slaitnetop eht taht seulav eht ylno ton ,dnoceS .gnidaelsim si seulav etulosba rieht fo nosirapmoc dna ,tnatsnoc evitidda eno tcepser htiw denifednu era slaitnetop eht rebmemer ,sselehtreven ;tnatropmi yllauqe era slaitnetop eht lla taht etacidni ot smees))tfel(5 erugiF(meht fo lla rof emas eht ssel ro erom era slaitnetop noitcaretni 51 eht taht seulav eht taht tcaf eht ,tsriF .snosaer owt rof tluser gniugirtni na si rettal ehT .)tfel(5 erugiF ees ,emas eht ylraen era slaitnetop noitcaretni tnereffid 51 eht fo snoitubirtsid eht taht dna ,)thgir(1 erugiF ees ,epahs denifed llew a yb deziretcarahc lla era snoitubirtsid ecnerrucco)rettel-owt(esiwriap eht taht dnuof evah ew ,stcudorp-yb owt sA.4 erugiF ees ,sdrow nommoc tsom eht rof tpecxe ,)seitilibaborp laciripme nwonk eht htiw nosirapmoc ni(seitilibaborp laciteroeht eht fo rettac elbaredisnoc sdleiy dohtem eht ,sdrow etercnoc fo seitilibaborp eht gnidrager ,revewoH .edutingam fo sredro ynam gnola yrav taht ytilibaborp ecnerrucco fo seulav)laciteroeht(lacitehtopyh htiw ,ÂÂÃ¢derevocsidÂÂÃ¢ neeb evah)detcartxe evah ew suprocbus eht ni esle yltcaxe ,ro(suproc eht ni tneserp tub ,sdrowoduesp ro ,sdrow hsilgnE elbissop wen ,revoeroM .3 erugiF ni nwohs sa ,sdrow nommoc tsom eht rof level evitatitnauq eht ta doog ylbanosaer dna ,level evitatilauq eht ta doog yrev si trapretnuoc laciripme sti dna noitubirtsid drow eht rof noitulos yportne-mumixam eht neewteb tnemeerga eht ,snoitubirtsid eht fo epahs eht gnidrageR.hsilgnE ni secnerrucco drow fo seitilibaborp eht niartsnoc ,)ssenmodnar elbissop mumixam eht htiw noitubirtsid eht sedivorp hcihw(elpicnirp yportne-mumixam eht htiw rehtegot ,)snoitubirtsid lanigram esiwriap eht(sdrow ni srettel fo sriap fo ecnerrucco fo ycneuqerf eht woh ees eW .]55[fo sartel 62 sad amu reuqlauq ed o£Ã§Ãaretni a odnavresbo ,)"o£Ã§Ãaiverba" a(arvalap ad otnemirpmoc od o£Ã§Ãanimreted an sodaerap o£Ã§Ãaretni ed siacnetop sod lepap o racifitnauq somaÃredop ,ossid m©ÃlA .amixiÃm aiportne ed o£Ã§Ãulos a arap sodiliÃv o£Ãs m©Ãbmat]67[me sodartnocne sotsubor seµÃrdap so es ,e seronem sacir³Ãet sedadilibaborp mªÃt sagnol siam sarvalap sa otnop euq ©Ãta racifirev somaÃredop ,otnatroP .)]77,67,57[fpiZ ed o£Ã§Ãaiverba ed iel ed adamahc m©Ãbmat(edadiverb ed iel a e]67,57[arvalap ad otnemirpmoc o ,ralucitrap mE ;sacitsÃugnil siel sartuo erbos zul raªÃnal edop)]55[ed a ©Ã euq(megadroba asson es ©Ã etnasseretni o£Ãtseuq amU .sodadutse res meved m©Ãbmat sªÃlgni od m©Ãla samoidi sortuo ,etnemlarutaN .setrap sassen suproc on sarvalap sad o£Ã§Ãisopmoced a recenrof a]36[me suproc od serotua so somatsnI .sarvalap sad setniutitsnoc sartel ed zev me sabalÃs uo samenof rasu aires etnerefid o£Ã§Ãerid amu a o£Ã§Ãerid me o£Ãsnetxe amU .sarutuf sasiuqsep arap odaxied ©Ã ossI ;seroip mitos sodatluser a maravel sele euq ramrifnoc e lanigiro oledom o moc seµÃ§Ãacifidom sasse rarapmoc etnasseretni aireS .odut arap odut osac on siaicnetop 5 ;ohniziv od amix³Ãrp siam o£Ã§Ãaretni ed osac on(laicnetop mu sanepa a avel ossI .).cte ,32 »Â= 21»Ã ,olpmexe rop ,seµÃ§Ãisop ed sa£Ãerefid se sanepa ,artel ad seµÃ§Ãisop sad medneped o£Ãn sele ,ajes uo(siaugi majes siaicnetop so sodot euq ropmi aires lanoicida o£Ã§Ãuder amU .lanoicatupmoc o£Ã§Ãacifilpmis etneuqesbus a moc ,)otreba onrotnoc ed seµÃ§Ãidnoc moc(5 a 51 ed siaicnetop ed oremºÃn o zuder ohniziv od omix³Ãrp otnemalpoca O .)oruturf ohlabart mu ed otejbo res eved o£Ãn uo sa§Ãnahlemes sievÃssop sad odutse o ,otnatne on ;vokraM ed oledom mu a etnahlemes recerap edop issoi(ohniziv od amix³Ãrp siam otnemalpoca ed o£Ã§Ãoda e o£Ã§Ãaretni a adoT -arap odot o ranodnaba edop es adnia ,sodatluser sosson odnepseP.]47,37[vonrimS-vorogomloK ed o£Ã§Ãiubirtsid a uo modiW-ycarT ed o£Ã§Ãiubirtsid a ,]27[ )PHB(notniP-htrowsdloH-llewmarB ed o£Ã§Ãiubirtsid adamahc a omoc aicnªÃuqerf arvalap a radutse es- edop ,avitanretla omoC .ocnarb me o§Ãapse o soditbo res medop amixiÃm aiportne ed sortem¢Ãrap so euq otnatrop ,e ,asiev-cive e gol ed edadilibaborp a mazimixam m©Ãbmat seµÃ§Ãirtser sa merpmuc euq»Â sortem¢Ãrap so euq acidni ossI .)3(o£Ã§Ãauqe ad osu oa avel euq ,)3(o£Ã§Ãauqe ad ,i f =)j(i f)j(¯Ã jâ ¢Ã moc ebecer mu ,)j(i f i»Â `iâ âÃ e jâ Ë¢Ã = z moc z /)j(i f i »Âiâ ¢Ã e = j p omoc atircse ,)4(acir³Ãet edadilibaborp ed o£Ã§Ãauqe pela o£Ã§Ãauqe aiportne-amixiÃm a o£Ã§Ãulos a odniutitsbuS .j arvalap ed opit o arap acirÃpme edadilibaborp A)j(¯Ã e)m »Â¦â¬â ¢Ã ,2»Ã ,1 »Â(=' Ã»Ã ®Ã rop odad ©Ã)'»Ã sortem¢Ãrap ed otnujnoc od rolav od aicnªÃdneped a odnazitafne( )' '»Ã»Â(j P oledom od)' »Â»Â(otad rop sodad ed gol ed edadilibaborp A .avitareti ed alacse ed odaromirpa odot©Ãm o arap ,]26[me salumr³Ãf siapicnirp sa iuqa somimuseR .sesseretni ed otilfnoc iÃh o£Ãn euq maralced serotua sO .adielL ,ÃriboS srallaP ,gruB ed aidabA me odÃulcnoc etnemalpma iof ohlabart etsE .serodazinagro soa sotarg somoS ;)7102 ed ohluj ,aiv³ÃsraV("samoidi sod sacitsÃtatsE" pohskrow on sodatneserpa marofa asiuqsep atsed seranimilerp sodatluser snuglA .]26,16[arap o£Ã§Ãaneta asson ramahc por etnemlaicepse ,ale a sotarg somoS ;otejorp etsed siaicini soigiÃtse sod uopicitrap ojepsE anirI .]36[me odairc sodad ed ocnab o ,o£Ã§Ãacilbup ed setna ,odnecenroF arap hcalreG .M e solc-tnof .F a e]55[ed aicnªÃtsixe a ralevera sod roc nesdivaD .J a sotarg somoS .onretxe otnemaicnanif muhnen uecebercer o£Ãn asiuqsep atsE .otircsunam od adacilbup o£Ãsrev a moc maradrocnoc e marel serotua so sodoT .M.D.G.M ,o£Ã§Ãide e o£ÃsiveR - o£Ã§ÃadeR :.£Ã ,lanigiro ohnucsaR - atircsE ;.M.D.G.M ,noitagitsevnI ;.£Ã ,lamrof esiliÃnA ;.£Ã ,aigolodoteM .megadroba assed edadiranilpicsidretni atla a amrifnoc)saicnªÃrefer sa e]55[(amica sadanoicnem sacit©Ãneg e sacimÃuqoib ,sianoruen seder san seµÃ§Ãacilpa sa moc etnematnuj ,ossI .]87[acisºÃm Ã adacilpa iof m©Ãbmat iuqa adatneserpa megadroba a euq ranoicnem somav ,etnemlaniF .sarvalap ed sotnemirpmoc setnerefid arapâà sieviÃtse o£Ãs siaicnetop so es euqifirev e]67[oxif otnemirpmoc moc edadilibaborp .edadilibaborp amixiÃm It showed that for a change in the values of the parano, the increase in the log-verselhass should be seen (7) in [7] in [62] , with n (j) = ãferences of traction present in the word j. Now you should look for the values of Âž ™ ™ ¥ which maximize the lower limit (right side of previous inequality). Interestingly, [62] does not provide the end solution, but it is [61] time. Differentiating with relative to a ãž ´ i obtains using that n (j) = constant = n, if the size of the word is constant (15 = 6 ã˜ 5/2 in the case of size 6 Letters, considering that blank spaces complete shorter words). The improved iterative scaling algorithm is only: initialize it, calculate p j (ãžâ € ™ ™ ¥) [equation (4)], update € i [Equation (3)], calculate the equation (A1)] and the new € i as € i + ãž 'I, and so by In the face of the equation to resolve, equation (10), it is a sum of exponentials, when a marginal value is not present in the empathic data, ie when the right side of the equion £ o (10) is zero, the left side of the equation can not verify the equality unless some lagrange multiplier is less infinite, than a value than the numbered algorithm no. It can reach. Therefore, we take from the innio that the corresponding multiplier is equal to less infinite (ie, potential for interaction equal to infinite). To be concrete, if, for example, â € "12 (Z z) = 0, we take € 12 (Z z) = â–º â–º â –º, which leads to P j = 0 for any j = {Z z Â–º 3 â - 4 â - °}. This means that we can restrict our headwords of possible words that with all pairs of letters corresponding to marginals in null, as the rest of the words has zero probability. The way to perform these boards was programmed in Fortran 77. The resulting way was very much to be to be readers; Instead, we provide a forgetfulness in figure A1. Please note that when we indicate that the letters from the to z, the blank space od od olucliÃc o artsuli euq ogid³ÃcoduesP .1A arugiF .iÃl odÃulcni res euq met potentials between pairs of letters. Figure A1. Pseudocode illustrating the calculation of the potentials of interaction between pairs of letters.

Li, W. Zipf, the law of all places. GLOTTOMETRICS 2002, 5, 14 - 21. [Google Scholar] MALEVERGNE, Y.; PISARENKO, V.; SORETTE, D. Testing the Pareto against Longorial Distributions with the uniformly most powerful impartial test applied to the distribution of cities. Phys. Rev. And 2011, 83, 036111. [Google Scholar] [crossref] [VersÃ £ o Green] Clauset, A.; SHALIZI, C.R.; NEWMAN, M.E.J. Distributions of the Pottery Law in Emphasis on. Siam Rev. 2009, 51, 661 - 703. [Google Scholar] [crossref] [VERSÃ £ o Green] Axtell, R.L. ZIPF distribution of US companies' sizes. Science 2001, 293, 1818 - 1820. [Google Scholar] [crossref] [PubMed] [green versions] Pueyo, S.; JOVANI, R. Comment "a mutualism Keystone drives the pattern in a function of power." Science 2006, 313, 1739c - 1740c. [Google Scholar] [crossref] [PubMed] [green versions] Camacho, J.; Sun Â ©, R.V. Scale in ecological size spectra. Europe. Lett. 2001, 55, 774 - 780. [Google Scholar] [crossref] Adamic, L.A.; HUBERMAN, B.A. The ZIPF law and internet. Glotometrics 2002, 3, 143 - 150. [Google Scholar] Furusawa, C.; KANEKO, K. ZIPF LAW OF THE ENPRESSION GENE. Phys. Rev. Lett. 2003, 90, 088102. [Google Scholar] [Crossref] [VERSÃ £ o Green] ZANETTE, D.H. Zipf Law and the creation of the musical context. Mus. SCI. 2004, 10, 3 - 18. [Google Scholar] [crossref] [green versions] Haro, M.; Serrã £, J.; HERRERA, P.; Corral, A. Zipf's Law in Coding Short Time Time, Mother and Signs of Environmental Sound. Plos One 2012, 7, E33993. [Google Scholar] [crossref] [Verst Green] Serrã £, J.; Corral, A.; Bogunu ± £, m.; HARO, M.; ARCOS, J.L. Measuring the evolution of contemporary western popular mother. SCI. REP. 2012, 2, 521. [Google Scholar] [Crossref] [PubMed] [Green Version] Baayen, H. Word frequency distributions; Kluwer: Dordrecht, Netherlands, 2001. [Google BARONI, M. Distributions in text. In the corpus lingastatic: a Manual; LÃ£Deling, A., KytÃ£, M., Eds.; Mouton de Gruyter: Berlin, Germany, 2009; Volume 2, pp. 803 – 821. [Google Scholar] Zanette, D. Statistical standards in written language. ARXIV 2014, ARXIV: 1412.3336V1. [Google Scholar] Piantadosi, S.T. The ZIPF law in natural language: a critical review and future directions. Psychon. Bull. Rev. 2014, 21, 1112 – 1130. [Google Scholar] [CrossRef] [Green Version] Altmann, for example; Gerlach, M. Statistical Laws in Linguistics. In creativity and universality in language; Class notes on Morphogenesis, Esposti, M.D., Altmann, for example, Pachet, F., Eds.; Springer: New York, NY, USA, 2016. [Google Scholar] Moreno-SÃ£onchez, I.; Font-Clos, F.; Corral, A. Large-scale analysis of the ZIPF law in English texts. PLoS One 2016, 11, E0147073. [Google Scholar] [CrossRef] Zanette, D.; Montemurro, M. Dynamics of text generation with realistic distribution of ZIPF. J. Quant. Linguist. 2005, 12, 29 – 40. [Google Scholar] [CrossRef] Baixeries, J.; ElvevÃ£, b.; Ferrer-i-Cancho, R. The evolution of the exponent of the ZIPF law in the ontogeny of language. PLoS One 2013, 8, E53227. [Google Scholar] [CrossRef] [Green Version] Font-Clos, F.; Boleda, G.; Corral, A. A law of scale beyond the ZIPF law and its relationship to Heaps's law. New J. Phys. 2013, 15, 093033. [Google Scholar] [CrossRef] [Green Version] Corral, A.; Font-Clos, F. Dependence on exponents on text length versus finite-length scale for word frequency distributions. Phys. Rev. E 2017, 96, 022318. [Google Scholar] [CrossRef] [Green Version] HernÃ£ndez, T.; Ferrer I Cancho, R. Cuantitative Linguistics; El PaÃ£s Ediciones: Madrid, Spain, 2019. [Google Scholar] Condon, U.S. Vocabulary statistics. Science 1928, 67, 300. [Google Scholar] [CrossRef] ZIPF, G.K. Human Behavior and the Principle of Least Effort. An Introduction to Human Ecology, 1st ed.; Addison-Wesley Press, Inc.: Cambridge, MA, USA, 1949. [Google Scholar] Mitzenmacher, M. A Brief of generative models for the Energy Law and Logenormal Distributions. Internet mathematics. 2004, 2004, 226ã ours „251. [Google Scholar] [crossref] [green versions] Newman, M.E.J. Energy Laws, Pareto Distributions and Zipfã Â ¢ cont. Phys. 2005, 46, 323ã ¢ Â ¢ Â ¢ Â§351. [Google Scholar] [crossref] [green versions] Loreto, v.; SERVICE, V.D.P.; STROGATZ, S.H.; TRIA, F. Dynamics in expansion spaces: Modeling the emergence of news. & Nbsp; In Creativity and Universality in Language; DEGLI, E.M., ALTMANN, E., PACHET, F., EDS.; Springer: Cham, SUÃ§a, 2016; PAGS. € 59 â € ™ 83. [Google Sudanary] Miller, G.A. Some effects of intermittent silã. AM. L. J. Psychol. 1957, 70, 311 € € 314. [Google Scholar] [Crossref] [PubMed] Ferrer I CANCHO, R.; ELVEVÃATION ¥ G, B. Texts randoms do not exhibit the real distribution of classification such as zipfan law ¢ € ™ s. PLOS ONE 2010. [Google Scholar] [Crossref] [PubMed] [green versions] Ferrer I CANCHO, R.; SOLÃ ©, R.V. Less effort and the origins of scaling in human language. Proc. Natl. Acad. SCI. USA 2003, 100, 788 € 791. [Google Scholar] [crossref] [PubMed] [green versions] Prokopenko, M.; AY, N.; OBS, O.; POLANI, D. phase transactions in the communication of lower effort. L. J. Stat. Mech. 2010, 2010, P11025. [Google Scholar] [crossref] [green versions] Dickman, R.; Moloney, N.R.; ALTMANN, E.G. Many of a model of the information for communication. L. J. Stat. Mech: Theory Exp. 2012, P12022. [Google Scholar] [crossref] [green versions] Corominas-Murtra, B.; HANEL, R.; THURNER, S. Understanding the sizing through history dependent processes with the collapse of the sample space. Proc. Natl. Acad. SCI. USA 2015, 112, 5348 € 5353. [Google Scholar] [crossref] [green versions] Corominas-Murtra, B.; HANEL, R.; THURNER, S. The extreme robustness of sizing process dimensioning processes explains the zipfan law in the diffusion in directed networks. New J. Phys. 2016, 18, 093010. [Google Scholar] [crossref] Ferrer-i-Cancho, R. Compression and the origins of the Zipfã ¢ â € ™ s laws for words of words. Complexity 2016, 21, 409 € 411. [Google elgooG[elgooG[.044â524 ,24 ,5591 akirtemoiBâ .acirt©Ãmissa o£Ã§Ãiubirtsid ed seµÃ§Ãnuf ed essalc amu mE .A.H ,nomiS]edreV o£ÃsreV[]feRssorC[.W.P ,notruB ;.G.I ,niaM]feRssorC[ ]ralohcS elgooG[.107811 ,501 ,0102 .teL .veR redliuB .syhP .alacse me setnairavni sossecorp ed aiportne ed samixiÃm seµÃ§Ãiubirtsid .E ,dooW ;.L.R ,sarB ;.J ,gnaW ;.V ,seveiN]edreV o£ÃsreV[]feRssorC[ ]ralohcS elgooG[.324â973 ,72 ,8491 .J .hceT .tsyS lleB .o£Ã§Ãacinumoc ad acitiÃmetam airoet amU .CE ,nonnahS]feRssorC[ ]ocimªÃdacA elgooG[.036 â026 ,601 ,7591 .veR .syhP .acitsÃtatse acin¢Ãcem e o£Ã§Ãamrofni ad airoeT .T.E ,senyaJ]feRssorC[ ]ralohcS elgooG[.44â3 ,891 ,6102 .veR .icS ecapS .saisr©Ãvortnoc e sotiecnoc :adazinagro-otua edadicitirc ed sona 52 .J.H ,nesneJ ;.B.N ,ybsorC ;.C.S ,nampahC ;.G ,rensseurP ;.W.N ,sniktaW]ralohcS elgooG[.4002 ,ahnamelA ,milreB :regnirpS ;.de dn2 ,secneicS larutaN ni anemonehP lacitirC .D ,ettenroS]edreV o£ÃsreV[ ]feRssorC[ ]ralohcS elgooG[.052 ¢Ã ¢Ã¢Ã¢Ã¢Ã¢Ã242 ,014 ,1002 azerutaN .etnatiperc odÃuR .R.C ,sreyM ;.A.K ,nemhaD ;.P.J ,anhteS]ralohcS elgooG[.6991 ,AUE ,YN ,kroY avoN :ocinr©ÃpoC ;adazinagrO-otuA edadilacitirC ad aicnªÃiC A :anoicnuF azerutaN a omoC .P ,kaB]feRssorC[ ]ocimªÃdacA elgooG[.1215 ,5 ,4102 .nummoC .taN .seder me soir³Ãtaela soiessap arap alacse ed iel amU .R ,sdrawdE ;.L ,ssalG ;.E ,llaxoF ;.J.T ,snikreP]edreV o£ÃsreV[]deMbuP[ ]feRssorC[ ]ralohcS elgooG[.09850 ,4 ,4102 .peR .icS .sadanoicalerroc sedadivon ed acim¢Ãnid A .H.S ,ztagortS ;.P.D.V ,oidevreS ;.V ,oteroL ;.F ,airT]ralohcS elgooG[setoN erutceL satoN ;¢Â ¢ÃtarbiG ed lanoicroporP otnemicserC ed ieL a moc seµÃ§ÃiubirtsiD redoP ed lareG ieL ad e Ì ¢ÃfpiZ ed ieL ad airoeT .D ,ettenroS ;.Y ,engrevelaM ;.A ,vehciaS]edreV o£ÃsreV[ ]feRssorC[ ]ralohcS elgooG[.600120 ,3 ,3102 X .veR redliuB .syhP .siarutan saugnÃl me oiriÃlubacov od otnemicserc o arap ocitsiÃcotse oledoM .G.E ,nnamtlA ;.M ,hcalreG]edreV o£ÃsreV[]deMbuP[ ]feRssorC[ ]ralohcS elgooG[.4641â1641 ,401 ,7002 AUE .icS .dacA .ltaN .corP .avitarobaloc o£Ã§Ãacram e acit³Ãimes acim¢ÃniD .L ,orenorteiP ;.V ,oteroL ;.C ,otuttaC]feRssorC[Sismol. Soc. I am. 1984, 74, 1409 – 1426. [Google Scholar] Peterson, J.; Dixit, P.D.; Dill, K.A. A maximum entropy structure for non-emonential distributions. Proc. Natl. Acad. Sci. USA 2013, 110, 20380 – 20385. [Google Scholar] [CrossRef] [PubMed] [Green Version] Havrda, J.; CharvÃ£, F. Method for quantifying classification processes. Concept of structural A entropy. Kybernetika 1967, 3, 30 – 35. [Google Scholar] Tsallis, C. Statistics not topics: Evidence and theoretical, experimental and computational connections. Braz. J. Phys. 1999, 29, 1 – 35. [Google Scholar] [CrossRef] Hanel, R.; Thurner, S. A comprehensive classification of complex statistical systems and an axiomatic derivation of their entropy and distribution functions. Europhys. Lett. 2011, 93, 20006. [Google Scholar] [CrossRef] Hanel, R.; Thurner, S. When do generalized entropies apply? How the volume of the phase space determines the entropy. Europhys. Lett. 2011, 96, 50003. [Google Scholar] [CrossRef] [Green Version] Stephens, G.J.; Bialek, W. Statistical mechanics of letters into words. Phys. Rev. E 2010, 81, 066119. [Google Scholar] [CrossRef] [Green Version] Broderick, T.; DudÃ£k, M.; Tkacik, G.; Schapireb, R.E.; BIALEK, W. Faster solutions to the inverse problem of pairs in pairs. Arxiv 2007, Arxiv: 0712.2437. [Google Scholar] Chowdhury, D.; Stauffer, D. Principles of equilibrium statistical mechanics; John Wiley & Sons, Ltd.: Weinheim, Germany, 2000. [Google Scholar] Rossing, T. Springer Handbook of Acoustics; Springer: New York, NY, USA, 2014. [Google Scholar] Luque, J.; Luque, B.; Lacasa, L. Scaling and University in the human voice. J. R. Soc. Interfaces 2015, 12, 20141344. [Google Scholar] [CrossRef] Torre, I.G.; Luque, B.; Lacasa, L.; Luque, J.; HernÃ£ndez-fernÃ£ndez, A. Emergence of linguistic laws in the human voice. Sci. Rep. 2017, 7, 43862. [Google Scholar] [CrossRef] [Green Version] Berger, A.L.; Pietra, S.A.D.; Pietra, V.J.D. A maximal entropy approach to the processing of elgooG[elgooG[.17 - 93 ,22 ,6991 .atsiugniL .o£Ã§ÃatupmoC .larutan] Ralohcs Elgoog [.7473â "Â € Ã ¢ 4473, 48, 0002 .ttel .syhp .smetsys detalerroc ni snoitautCulf lasrevinu .m, ottilles; .f-., notnip; .m, imedocin; ƒl; .s, esil; .j.h, nesnej; .w.c.p, htrowsdloh; .Y- .j, nitrof; .K, nesnetsirhc; .t.s, llewmarb] Ralohcs Elgoog [.757â "€ ¢ 147 , 851, 1002 .SYHPOEG .LPPA Erup .smetsys Larutan Ni Swal Regop Detacnurt-Reppu .f.S, Snebbbet; .tcarf Notilos soahc .stneve emertxe fo gnimit eht ni gnilacs .a, larroc] noisrev neerg [] ferssorc [.430330, 1, 9102 .ser .ser .ver .syhp .enod allwe. ; .R, datsfoh Red Nav; .p, Nrooh Red Nav; .i, Volatiov] Noisrev neer [] ferssorc [] ralohcs elgoog [.301660, 38, 1102 e .SYHP. Non .j, ohcamac; .f, tnof; .a, larroc] noisrev neerg [] ferssorc [] ralohcs elgoog [.796. Rewop .a, zelâiÃƒznog; .a, larroc] noisrev neerg [] ferssorc [] ralohcs elgoog [.4931â "Â € Ã ¢ 1531, 16, 3102 .SYHPOEG ATCA .snoitubirtsid Wal-Regop Detacnurt-Non Fo TSET TIF-FO-SSENDOOG DNA GNITTIF .A, LARROC; .a, Aculed] Ralohcs Elgoog [.89310.8091: VIXRA, 9102 VIXRA .gnittif Doohilekil-Mumixam Sti DNA, SNOVATATNESTNESTNESTNESTUTSID-EAHTT NYTNYT Sâ Â Â € Ã ¢ FPIZ fo srovalf tcnitsid eht .r, ohcnac-i-rerref; .i, ares; .a, larroc] Ralohcs elgoog [.912â "€ € Ã ¢ 091 .pp; 1691, ASU, Ir, ecnedivorP :yteicoS lacitamehtaM naciremA ;.dE ,.R ,nosbokaJ ;stcepsA lacitamehtaM sti dna egaugnaL fo erutcurtS nI .esruocsid fo sledom naivokraM detaler no dna seicneuqerf drow fo yroeht eht nO .B ,torblednaM]noisreV neerG[]feRssorC[ ]ralohcS elgooG [.621 ,22 ,0202 yportnE .scitsiugnil evitatitnauq dna egaugnal larutan fo sisylana lacitsitats rof suproC grebnetuG tcejorP dezidradnats A .F ,solC-tnoF ;.M ,hcalreG]ralohcS elgooG[.tnirperp ;7991 .noitcudortni eltneg A :mhtirogla gnilacs e Vitareti devorpmi eht .a Version]Font-Clos, F.; Moloney, N.R. Tree Percolation as Brownian Tour: From Gaussian to Kolmogorov-Smirnov to exponential statistics. Phys. Builder Rev. E 2016, 94, 030102. [Google Scholar] [CrossRef][Green Version]Corral, A.; Garcia-Millan, R.; Moloney, N.R.; Font-Clos, F. Phase transition, moment scaling and order parameter distributions in Brownian particles and branching processes with finite size effects. Phys. Builder Rev. E 2018, 97, 062156. [Google Scholar] [CrossRef][Green Version]Torre, I.G.; Luque, B.; Lacasa, L.; Kello, C.T.; On the physical origin of language laws and lognormality in speech. L. R. Soc. Open Sci. 2019, 6, 191023. [Google Scholar] [CrossRef] [PubMed][Green Version]Corral, A.; Serra, I. The law of brevity as a law of scale, and a possible origin of Zipfa's law for word frequencies. arXiv 2019, arXiv:1912.13467. [Google Scholar]Bentz, C.; Ferrer-i-Cancho, R. ZipfÃ¢âÂ s abbreviation law as a universal language. Proceedings of the Leiden Workshop on Capture of Phylogenetic Algorithms for Linguistics, Leiden, The Netherlands, 26th October, 2015. [Google Scholar]Sakellariou, J.; Tria, F.; Loreto, V.; Pachet, F. Maximum entropy models capture melodic styles. Sci. Rep. 2017, 7, 9172. [Google Scholar] [CrossRef] [PubMed]

Figure 1. Two-letter empirical marginal distributions (for word length not greater than 6 letters). Left: The distribution is? 12 is represented in terms of the classification frequency graph [corresponding to Equation (11)]. The most common values of Ã? 12 correspond to the following pairs: th, an, of, to, he, in, ha, wh, wa, âââ¦ The adjustment of the power law of Table 1 is shown as a straight line, with the exponent 1 / ÃÃ˜3 = 0.78 . Right: All 15 two-letter marginals are represented in terms of the distributions of the marginal odds value, Ã˜ 12, Ã¨ the distributions were shifted (logarithmic scale) by means of a resizing by their average Ã¢ ¢ ¢ ¢¢ ►a This causes that Evitaler eht laciripme eht fo noitcnuf a sa nwohs si ytilibaborp lanigram eht fo seulav htob neewteb rorre evitaler ehT .]26,16[erudecorp noitazimitpo gnilacs-evitareti devorpmi eht morf deniatbo o e h t ÃÂ seno laciteroeht eht dna p m e ÃÂ snoitubirtsid lanigram rettel -Owt laciipme eht Neewteb nosirapmoc .2 eht â³ãž + 1 snenopxe fo seulav eht htw ,swalk rewop yb dettif llew he) p m eht .) â‰ã¢ â€â€ã¢ â€â¢hyãž 1 Tnenopxe Htiw ,wal rewop detcinf dettif eb nac) âªâœâ â . (âªâœâ m m e â â â©âœâœâ seulav naem rieht yb gnilacser yb)elacs-gol ni DETFIHS NEEEB EVAH snoitirsidsid , Lareneg â¢¢€â€â â€â , 31 â 1 â , Seitilaborp lanigram eht Fo Eht Fo Snoitsid Eht Fo Smret of Detneserper Era Slanigram Rettel-Owt 87.0 = â¢£ž / 1 Tnenopxe htiw ,en thgiarts a sa Nwohs si 1 Elbat Morf Tif Wal-Rewop Eht â¢€â€â€â ,HW ,Ah ,e ,e fo ,na ,ht :sriap gniwollof eht ot dnopserroc 21 ÃÂ fo seulav nommoc tsom ehT .])11(noitauqE ot gnidnopserroc[tolp ycneuqerf-knar eht fo smret ni detneserper si 21 ÃÂ noitubirtsid ehT :tfeL .)srettel 6 Naht Regral ton htgnel drow rof(snoitirtsid lanigram rettel-owt laciripme 1. Ediganf â2³ãž 1 snenopxe fo eht ltaf lle llet llet llet llet llet llet llet llet llet llet lle llep lle llep llep llep llep llet ,)Seltbat eht by Detroper ton(9.0 â‰â â€â€â€â â€â â€³ãž 1 tnenopxe ,wal rewop dettif Eb Eb nac) P the the similarities between all the two-letter marginal Between the two values of marginal probability, it is shown as a function of the empirical value, for the 15 marginal ones.

Figure 3. The probabilities of empirical occurrence (Ã¯ W o r d) and the maximum entropy (P I I) in the classification frequency representation, together with the adjustment of the power law of frequency distribution for the empirical case. The same distributions are shown on two different scales. Left: it's only under 10,000. Right: Only odds (frequencies) above 10'13. Figure 3. The probabilities of empirical occurrence (Ã¯ W o r d) and the maximum entropy (P I I) in the classification frequency representation, together with the adjustment of the power law of frequency distribution for the empirical case. The same distributions are shown on two different scales. Left: it's only under 10,000. Right: Only odds (frequencies) above 10'13.

Figure 4. Maximum theoretical probability-entropy p i i for each type of word in the sub-corpus as a function of its empirical probability (relative frequency). A straight line would signal a perfect match between P i i and Ã¯ W o r d. Values of P i I below 10 Ã˜ '10 are not shown. Words with the lowest p i (in the range 10 '17 Ã¢ ¢ â â â â â ¢ 10â 15) are shaggy, Isaiah, Leslie, feudal, Caesar, Yankee, Opium, yields, Phoebe, Sydney. Figure 4. Maximum theoretical probability-entropy p i i for each type of word in the sub-corpus as a function of its empirical probability (relative frequency). A straight line would signal a perfect match between P i i and Ã¯ W o r d. Values of P i I below 10 Ã˜ '10 are not shown. Words with the lowest p i (in the range 10 '17 Ã¢ ¢ â â â â â ¢ 10â 15) are shaggy, Isaiah, Leslie, feudal, Caesar, Yankee, Opium, yields, Phoebe, Sydney.

Figure 5. Left: empirical probability densities of the 15 individual potentials (with a negative sign) and the probability density of the 15 aggregated datasets. Right: Value of oa oa ednopserroc euq(egnargaL ed each pair of letters (and positions) as a function of the corresponding marginal probability. Figure 5. Left: Empirical probability densities of the 15 individual potentials (with a negative sign) and the probability density of the 15 aggregated data sets. Right: Value of the Lagrange multiplier (which corresponds to the interaction potential with a negative sign) for each pair of letters (and positions) as a function of the corresponding marginal probability.

Table 1. Results of power-law fitting of the form g (ÃÂ) ¢ÃÂÂ 1 / ÃÂ Ã³Â + 1 (for a ¢ÃÂ¤Â ÃÂ ¢ÃÂ¤Â b) applied to the 15 empirical two-letter marginal distributions (with b = ¢ÃÂÂ), to the empirical word frequency ÃÂ w o r d and to the theoretical maximum-entropy solution P I I . The empirical distribution for words of any length, ÃÂ a l l w o r d , is also shown, in order to compare it with ÃÂ w o r d . V is the number of types (pairs of letters or words); ÃÂ m a x is the highest empirical frequency; j m a x is the corresponding type (pair of letters or word type; the next highest-frequency types appear in brackets); o.m. is the number of orders of magnitude in the fit, log 10 (ÃÂ m a x / a) ; v is the number of types that enter into the power-law fit; ÃÂ is the standard error of the fitted exponent; and p is the p ¢ÃÂÂ value of the goodness-of-fit test. The ratio v / V ranges from 0.09 to 0.3. Only words of length from 1 to 6 are taken into account. Blanks are not considered in the marginals. 50 values of a and b (when b is not fixed to ¢ÃÂÂ) are analyzed per order of magnitude, equally spaced in logarithmic scale. p ¢ÃÂÂ values are computed from 1000 Monte Carlo simulations. Fits are considered non-rejectable if p ¢ÃÂ¥Â 0.20 . Table 1. Results of power-law fitting of the form g (ÃÂ) ¢ÃÂÂ 1 / ÃÂ Ã³Â + 1 (for a ¢ÃÂ¤Â ÃÂ ¢ÃÂ¤Â b) applied to the 15 empirical two-letter marginal distributions (with b = ¢ÃÂÂ), to the empirical word frequency ÃÂ w o r d and to the theoretical maximum-entropy solution P I I . The empirical potential potential with a negative sign) For words of any length, it is also shown in order to compare it with Ã¯ W o r d. See the number of types (pairs of letters or words); X is the highest empirical frequency; J M A X is the corresponding type (pair of letters or word type; the next higher frequency types appear in brackets); O.M. is the number of orders of magnitude in the adjustment, log 10 (Ã¯ m to x / a); v is the number of types that go into the power law setting; It is the default error of the set exponent; and P is the value p Ã¢¬ of the fit quality test. The v/v ratio varies from 0,09 to 0,3. Only words of length from 1 to 6 are taken into consideration. Blanks are not considered in marginals. 50 values of A and B (when B are not fixed for Ã¢Å¾4) are analyzed in order of magnitude, evenly spaced on a logarithmic scale. The values in P are calculated from 1000 Monte Carlo simulations. Adjustments are considered not rejected if p Â¥ 0,20. Distributionv Ã¯ MAX J MAX A (Ã£ 10 Ã¢ '4) Bo.M.V Â3 Â± Ã¯ Ã¯ Ã¯ Ã¯ 12 2230.143th (an, de, ele) 63.1 Ã¯Å¾41.36401.282 Â± 0,2130. 21 Ã¯ 13 4710.146te (i -, o, a, a Ã¢âââ 391 Â± 0,1560.23 Ã¯ 15 3910.043t – Âi (aÃ¢ âââ¢, O' -Âi, i -, HÃ¢ -) 36.3 ËÃ˜Å¾41.07781.433 Â± 0,1750,28 Ã¯ 16 2850.042T Âi (aÃ¢ â˜, o' -i, wÃ¢ -, eu -) 69.2 ËÃ˜Å¾40.78452.110 Â± 0,3240,23 Ã¯ 23 3090.160He (FÃ¢ – FÃ¢ âââ, o -, ÃÃ˜, Ã¢), e) 57.5 ËÃ˜Å¾41.44421.207 Â± 0,1970,29 Ã¯ 24 3610.049 hÃ¢ – Âi (n Ã˜ -, o -, fÃ¢ -, e -Âi) 60.3 Ë˜Å¾40.91501.466 Â± 0,2100.24 Ã¯ 25 3340.057hÃ¢ – Âi (o -, n, e, a, a, 2,1830.52.5. 26 2400.055H Ã¯ – âÃ˜¢ – âÃ˜¢ – âÃ˜¢ – âÃ˜Âi, tÃ¢ -) 83.2 Ë˜Å¾40.76361.764 Â± 0,3400,41 Ã¯ 35 3710.039 âÂiâââââ ¢ – (e – i, dÃ¢ -, s -, rÃ¢m – ^) 50.1 Ëââ˜Å¾40.89571.359 Â± 0,1900.28 Ã¯ 36 2730.045 –¯ 36 –¯ ^ âÂi (e -, dÃ¢ -, rÃ¢ -, T' -Âi) 75.9 Ë˜Å¾40.7841.935 Â± 0,2980. 32 Ã¯ 45 2780.051 Ã¯M – 87.1 Ã¯¯ 46 2440.044 – Ã¯ 45 2780.051 Ã¯ 87.1 Ã˜Å¾40.77351.579 Â± 0,2700.33 Ã¯ 46 2440.044 – ^ â â â â˜ e, tÃ¢ -, n, n, n, n, n, n, n, n, n, n, 28 Ã¯ 56 1540.115 Ã¨M – ... 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