Aoccdrnig to a rscheearch at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.

Or rather...

According to a researcher (sic) at Cambridge University, it doesn't matter in what order the letters in a word are, the only important thing is that the first and last letter be at the right place. The rest can be a total mess and you can still read it without problem. This is because the human mind does not read every letter by itself but the word as a whole.

This text circulated on the internet in September 2003. I first became aware of it when a journalist contacted a my colleague Sian Miller on 16th September, trying to track down the original source. It's been passed on many times, and in the way of most internet memes has mutated along the way. It struck me as interesting - especially when I received a version that mentioned Cambridge University! I work at Cognition and Brain Sciences Unit, in Cambridge, UK, a Medical Research Council unit that includes a large group investigating how the brain processes language. If there's a new piece of research on reading that's been conducted in Cambridge, I thought I should have heard of it before...

I've written this page, to try to explain the science behind this meme. There are elements of truth in this, but also some things which scientists studying the psychology of language (psycholinguists) know to be incorrect. I'm going to break down the meme, one line at a time to illustrate these points, pointing out what I think is the relevant research on the role of letter order on reading. Again, this is only my view of the current state of reading research, as it relates to this meme. If you think I've missed something important, let me know.

Other languages:

My colleagues and I are also aware of versions in Spanish and French which I've appended below. There are, no doubt, versions in many other languages as well. If you know of any others let me know and I'll add them to the list. I would be especially interested by versions of this text in languages that (to my knowledge, at least) work very differently in their written form from English. For example:

1) semitic languages (such as Hebrew or Arabic) where vowels tend not to be written in text

2) agglutanative languages (like Finnish or Turkish) where words are dramatically longer than in English

3) languages such as Thai which do not (conventionally) put spaces between words

4) logographic languages such as Chinese in which complex symbols represent a whole word or concept.

Update (7/10/03):

Looks like at least one of my predictions seems to be correct. Thanks to Peter Eskolin and Ari Ruottu I've had a couple of suggestions for Finnish versions of the text. Both Peter and Ari suggest that the resulting scrambled text is very difficult to read. Their names are linked to their suggested scrambled versions of the text.

One interesting possibility (thanks to Rémy Viredaz, and others that mentioned this) is that one thing that makes these scramblings difficult to read is that the jumbled-letters often move across morpheme-boundaries. One way of making polymorphemic words easier to read when scrambled would to keep letters in a position close to their original location. This is apparent in some of the German versions of the text.

I've also received a Hebrew version of the text, which apparently could not be read when scrambled. However, I

couldn't read the characters, sorry! If any of you can help with converting Hebrew text into graphics files, let me know.

13/10/03:

Thanks to Samuel Wazana and John Sutton, I now have a Hebrew version of the original and scrambled text. Samuel suggets that the scrambled text is "*a REAL mess.. you can not understand it at all*". This may reflect a interesting property of the Hebrew writing system. Since vowels are not written in the text, there is a lot less redundancy in written Hebrew. It may be that readers are already using some inference processes to work out what words are written, the extra load added by jumbling letters creates an additional, excessive level of difficulty. It's also possible that written words are more confusible in Hebrew - that is, many more words are like "salt" and "slat" in which letter transpositions create other words.

Thanks to all of the various readers who offered to help with getting a Hebrew text online.

Spanish:

Sgeun un etsduio de una uivenrsdiad ignlsea, no ipmotra el odren en el que las ltears etsan ersciats, la uicna csoa ipormtnate es que la pmrirea y la utlima ltera esten ecsritas en la psiocion cocrrtea. El rsteo peuden estar ttaolmntee mal y aun pordas lerelo sin pobrleams. Etso es pquore no lemeos cada ltera por si msima preo la paalbra es un tdoo.

French:

Sleon une édtue de l'Uvinertisé de Cmabrigde, l'odrre des ltteers dnas un mtos n'a pas d'ipmrotncae, la suele coshe ipmrotnate est que la pmeirère et la drenèire soit à la bnnoe pclae. Le rsete peut êrte dnas un dsérorde ttoal et vuos puoevz tujoruos lrie snas porlblème. C'est prace que le creaveu hmauin ne lit pas chuaqe ltetre elle-mmêe, mias le mot cmome un tuot.

(note that the letters are jumbled and that the accents have moved with their associated letters).

Dutch:

Vlgones een oznrdeeok op een Eglnese uvinretsiet mkaat het neit uit in wlkee vloogdre de ltteers in een wrood saatn, het einge wat blegnaijrk is is dat de eretse en de ltaatse ltteer op de jiutse patals saatn. De rset van de ltteers mgoen wllikueirg gpletaast wdoren en je knut vrelvogens gwoeon lzeen wat er saatt. Dit kmot odmat we neit ekle ltteer op zcih lzeen maar het wrood als gheeel.

Thanks to Sander Jonkers for passing this on, and to the people at Onzetaal for linking to this site.

Danish:

En viskdenbaleig unsdelrøgelse lavet af et untivseriet i Enlgnad har vist, at desrom de to føsrte og de to sisdte botsvgaer i alle oredene i en tekst er ritgigt pledsaret, spllier det inge rolle hvkilen ræføkkelge de øvirge bosgvtaer i oredne kommer. Tektsen er fuldt læbsar selv om de adre bogastver kommer huilbtertlulter! Det er, fordi vi ikke læser hvert eneklt botgsav, men ser bildeler af ordet som en hehled.

Thanks to Randi Starrfelt for sending this to me.

You'll notice that a couple of these translations state that the research comes from an "English University" (which is correct), rather "Cambridge University".

German:

Die Bcuhstbaenrehenifloge in eneim Wrot ist eagl

Ncah enier nueen Sutide, die uetnr aerdnem von der Cmabirdge Uinertvisy dührruchgeft wrdoen sien slol, ist es eagl, in wlehcer Rehenifloge Bcuhstbaen in eneim Wrot sethen, Huaptschae, der esrte und ltzete Bcuhstbae snid an der rhcitgien Setlle. Die rsetclhien Bshcuteban kenönn ttoal druchenianedr sien, und man knan es tortzedm onhe Poreblme lseen, wiel das mneschilhce Gherin nhcit jdeen Bcuhstbaen enizlen leist, snodren das

Wrot als gnazes. Mti dme Pähonemn bchesfätgein shci mherere Hhcochsluen, acuh die aerichmkianse Uivnäseritt in Ptstbigurh. Esrtmlas üebr das Tmeha gchseibren hat aebr breteis 1976 - und nun in der rgchitien Bruecihhsetnafoelngbe - Graham Rawlinson in sieenr Dsiestraiton mit dem Tetil "The Significance of Letter Position in Word Recognition" an der egnlsicehn Uitneivrsy of Ntitongahm.

Thanks to Hermann Schwarting for email this to me. This appeared in the Frankfurter Allgemeine Zeitung on 24.09.03. You'll notice that this is greatly extended and includes a correct reference to Graham Rawlinson's thesis.

There's also the following translation - which is much closer to the English original (from Robert Fuchs):

Luat eienr Stduie der Cambrdige Unievrstiät speilt es kenie Rlloe in welcehr Reiehnfogle die Buhcstbaen in eniem Wrot vorkmomen, die eingzie whctige Sahce ist, dsas der ertse und der lettze Buhcstbaen stmimt. Der Rset knan In eienm völilegen Duchrienanedr sein und knan trtozedm prboelmols gelseen wreden. Gunrd ist, dsas das menchsilche Ague nicht jeedn Buhcstbaen liset.

And a cartoon on the subject from Der Spiegel (from Raymond Noë).

Czech:

Thanks to Vaclav Janca for passing this on. You can also download the czech text.

Icelandic:

Svmkmæt rnsanókn við Cmabrigde hkóásla þá stkpiir ekki mlái í hðvaa röð stfiar í oðri eru, það enia sem stikipr mlái er að frtsyi og stíasði stinaurfn séu á rtéutm satð. Aillr hniir sfitarnir gtea vireð í aöljrgu rlgui en þú gtuer smat lseið það aðvuledlgea. Áæðsatn fiyrr þsesu er að mnnashgrniuun les ekki hevrn satf friyr sig hleudr oirðð sem hiled.

Thanks to Suzanne Buerger for forwarding this.

Portugese (Brazilian):

De aorcdo com uma pesqiusa de uma uinrvesriddae ignlsea, não ipomtra em qaul odrem as lrteas de uma plravaa etãso, a úncia csioa iprotmatne é que a piremria e útmlia lrteas etejasm no lgaur crteo. O rseto pdoe ser uma ttaol bçguana que vcoê pdoe anida ler sem pobrlmea. Itso é poqrue nós não lmeos cdaa lrtea isladoa, mas a plravaa cmoo um tdoo.

Thanks to Zé do Rock for sending this to me.

Swedish:

En vestenkalpig unsdernöking gjord vid ett untivseriet i Enlgand har visat att utfiall de två fösrta och de två sista botskevärna i alla orden i en text är ritkigt plessarade, spelar det liten roll i viklen orgnindslöfjd de övirga boskvätrena i orden kommer. Tetxen är fullt läbsar t.o.m. om de andra bokestävrna kommer hullorebmuller! Detta eftorsem vi inte läser varje enkisld botksav, utan ser bidlen av ordet som helhet.

Thanks to Hakan Kjellerstrand for passing this on. Apparently this was first posted on the 1st September, here. Like the Danish version, this actually has the first and last two letters fixed - which is more similar to Graham Rawlinson's PhD thesis and the letter he wrote to New Scientist. It wouldn't suprise me if this switch from two to one exterior letter being fixed was a relatively late change to the meme.

Bahasa Indonesia:

Menuurt sbeauh penilitean di Cmabrigde Uinervtisy, tdaik mejnadi maslaah bgaimanaa urtaun hufur-hufur di dlaam sebauh kaat, ynag palngi pnteing adlaah leatk hruuf partema dan terkhair itu bnaer. Siasnya dpaat brantaaken saam skelai dan kmau maish dpaat mebmacanya tnpaa msaalah. Hal ini kerana oatk masunia tdaik mambeca seitap huurf msaing-msaing, tatepi kaat kesuleruhan.

Thanks to Frederik Rotty for emailing this to me.

Russian:

Thanks to Anastassia Kerr for passing this on to me. If you'd like, you can also download the Russian text as an MS-Word file.

Albanian:

Saips një siumtdi të bërë nga një utsveneiirt algenz,për lxmeiin e fajlëve nuk ka rëndësi rjtnidea e srjahknove.Maotfjn që skojnrha e parë dhe e fnduit të jenë në vndeet e trye.Të tejrat mnud të jenë në një çregrullim të poltë dhe ne mnud të loxejmë pa polebrm.Kjo spese turri ynë nuk i loxen srojahknt një nga një,por fajlët si të polta.

Thanks to Ymer Mulakaj for sending this.

Hungarian:

Thanks to Tamas Szepes for forwarding this to me. You can also download the Hungarian version as a rich text file.

Italian:

Da uno stdiuo dlela Camrbidge Urnievristy, l'oridne dllee letetre in una paorla non ha ipmotranza, la sloa csoa impoanrtte é che la pimra e l'ulmtia sinao nllea pozisione corttreta. Tttue le alrte letetre pososno esesre totamletne diosrdiante e tu sarai sepmre in grdao di legegre sezna prolbemi. Quetso é dovtuo al ftato che il cevrello umnao non lgege ongi letetra ma la paorla glolabmnete.

Thanks to Alberto Castelnuovo for emailing this.

Irish (Gaellic):

De riér tdgaihe ag Osllocil Cmabrigde is cmua cen tord atá ar na lriteahca i bhfacol má bhoínn an chaéd ltiir augs an liitr dhreineaach san áit chaert, augs an chiud elie ina bpairseach. Is fiédir an taécs a thiucsint gan dua, ós rud é go lénan an itninn gcah fcoal ina imoliáne, ní liitr i ndaiidh litearch. Inotach.

Thanks to Sean O Conaill.

Polish:

Thanks to Hanna Burdon for passing this on. You can also download the Polish text in MS-Word format.

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aoccdrnig to a rscheearch at Cmabrigde Uinervtisy... According to a research (sic) at Cambridge University

There are a number of groups in Cambridge, UK doing research on language. There is the group where I work (Cognition and Brain Sciences Unit), there are also groups in the Department of Experimental Psychology most notably the Centre for Speech and Language (where I used to work). There are also language researchers in Phonetics, English and Applied Linguistics, and at Anglia Polytechnic University.

To my knowledge, there's no-one in Cambridge UK who is currently doing research on this topic. There may be people in Cambridge, MA, USA who are responsible for this research, but I don't know of them. If you know different, please let me know.

Update:

I've found a www page that tracked down the original demonstration of the effect of letter randomisation to Graham Rawlinson. Graham wrote a letter to New Scientist in 1999 (in response to a paper by Saberi & Perrot (Nature, 1999) on the effect of reversing short chunks of speech). You can read the letter here, or in a link to New Scientist, here. In it Graham says:

This reminds me of my PhD at Nottingham University (1976), which showed that randomising letters in the middle of words had little or no effect on the ability of skilled readers to understand the text. Indeed one rapid reader noticed only four or five errors in an A4 page of muddled text.

It's possible that with the publicity offered by the internet, that Dr. Rawlinson's research might be more widely read in future. For those wanting to cite this in their own research the full reference is:

Rawlinson, G. E. (1976) The significance of letter position in word recognition. Unpublished PhD Thesis, Psychology Department, University of Nottingham, Nottingham UK.

Update 2:

Graham has very kindly sent me a summary of his thesis work.

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it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae... it doesn't matter in what order the letters in a word are, the only important thing is that the first and last letter be at the right place

This is clearly wrong. For instance, compare the following three sentences:

1) A vheclie epxledod at a plocie cehckipont near the UN haduqertares in Bagahdd on Mnoday kilinlg the bmober and an Irqai polcie offceir

2) Big ccunoil tax ineesacrs tihs yaer hvae seezueqd the inmcoes of mnay pneosenirs

3) A dootcr has aimttded the maglteuansr of a tageene ceacnr pintaet who deid aetfr a hatospil durg blendur

All three sentences were randomised according to the "rules" described in the meme. The first and last letters have stayed in the same place and all the other letters have been moved. However, I suspect that your experience is the same as mine, which is that the texts get progressively more difficult to read. If you get stuck, the sentences are linked to the original unscrambled texts.

Hopefully, these demonstrations will have convinced you that in some cases it can be very difficult to make sense of sentences with jumbled up words. Clearly, the first and last letter is not the only thing that you use when reading text. If this really was the case, how would you tell the difference between pairs of words like "salt" and "slat"?

I'm going to list some of the ways in which I think that the author(s) of this meme might have manipulated the jumbled text to make it relatively easy to read. This will also serve to list the factors that we think might be important in determining the ease or difficulty of reading jumbled text in general.

There is still a very real debate in the psychology of reading, however, about exactly what information we do use when reading. I don't know how much of this literature Dr. Rawlinson was aware of at the time of his thesis, but I do think that the jumbled text provides a neat illustration of some of the sources of information that we now think are important. I'm going to review some of the research that has been done to demonstrate this.

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the rset can be a toatl mses and you can sitll raed it wouthit porbelm... the rest can be a total mess and you can still read it without problem

This sentence is, like the rest of the demonstration, strikingly easy to read despite being jumbled. As you have seen above, not all sentences distorted in the same way are as easy as this to read. What is it that makes this sentence so easy? My colleagues and I have suggested the following properties:

1) Short words are easy - 2 or 3 letter words don't change at all. The only change that is possible in a 4 letter words is to swap the order of the middle letters which doesn't cause too much difficulty (see 4).

2) Function words (*the, be, and, you etc.*) stay the same - mostly because they are short words, see (1). This really helps the reader by preserving the grammatical structure of the original, helping you to work out what word is likely to come next. This is especially crucial for reading jumbled text - words that are predictable are going to be easier to read in this situation.

3) Of the 15 words in this sentence, there are 8 that are still in the correct order. However, as a reader you might not notice this since many of the words that remain intact are function words, which readers don't tend to notice when reading. For instance, when people are asked to detect individual letters in a sentence, they are more likely to miss letters in function words.

Healy, A. F. (1976). Detection errors on the word *The*: Evidence for reading units larger than letters. Journal of Experimental Psychology: Human Perception & Performance, 2, 235-242.

4) Transpositions of adjacent letters (*e.g. porbelm* for *problem*) are easier to read than more distant transpositions (e.g. *pborlem*). We know from research in which people read words presented very briefly on a computer screen that the exterior letters of words are easier to detect than middle letters - confirming one of the ideas present in the meme. We also know that position information for letters in the middle of words is more difficult to detect and that those errors that are made tend to be transpositions.

McCusker, L. X., Gough, P. B., Bias, R. G. (1981) Word recognition inside out and outside in. Journal of Experimental Psychology: Human Perception and Performance, 7(3), 538-551.

One explanation of this property of the reading system is that it results from the fact that the position of an exterior letter is less easily confused with adjacent letters. There is only direction in which an exterior letter can move, and there are fewer adjacent letters to 'mask' an exterior letter. Both of these properties emerge very naturally from a neural network model in which letters are identified at different positions in an artifical retina.

Shillcock, R., Ellison, T.M. & Monaghan, P. (2000). Eye-fixation behaviour, lexical storage and visual word recognition in a split processing model.Psychological Review 107, 824-851.

The account proposed by Richard Shillcock and colleagues, also suggests another mechanism that could be at work in the meme. They propose a model of word recognition in which each word is split in half since the information at the retina is split between the two hemispheres of the brain when we read. In some of the simulations of their model, Richard Shillcock simulates the effect of jumbling letters in each half of the word. It seems that keeping letters in the appropriate half of the word, reduces the difficulty of reading jumbled text. This approach was used in generating example (1) above, but not for (2) or (3).

5) None of the words that have reordered letters create another word (*wouthit* vs *witohut*). We know from existing work, that words that can be confused by swapping interior letters (e.g. *salt* and *slat*) are more difficult to read. To make an easy to read jumbled word you should therefore avoid making other words.

Andrews, S (1996) Lexical retrieval and selection processes: Effects of transposed-letter confusability. Journal of Memory and Language, 35(6), 775-800.

6) Transpositions were used that preseve the sound of the original word (e.g. *toatl* vs *ttaol* for *total*). This will assist in reading, since we often attend to the sound of the words even when reading for meaning:

Van-Orden, G. C. (1987) A ROWS is a ROSE: Spelling, sound, and reading. Memory and Cognition, 15(3), 181-198.

7) The text is reasonably predictable. For instance, given the first few words of the sentence, you can guess what words are coming next (even with very little information from the letters in the word). We know that context plays an important role in understanding speech that is distorted or presented in noise, the same is probably true for written text that has been jumbled:

Miller, G. A., Heise, G. A., & Lichten, W. (1951). The intelligibility of speech as a function of the context of the test materials. Journal of Experimental Psychology, 41, 329-335.

Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe... This is because the human mind does not read every letter by itself by the word as a whole.

There are two ideas that are being suggested in this sentence. Essentially, the author is correct, people do not ordinarily read each letter in a word individually - except in a relatively rare condition following brain injury known as *letter-by-letter reading*, as described in the following:

Warrington, E.K., & Shallice, T. (1980). Word-form dyslexia. Brain, 103, 99–112.

There is also evidence to suggest that information in the shape of an entire word plays an important role in reading. For instance, "CaSe MiXiNg" substantially slows down reading:

Mayall, K., Humphreys, G.W., & Olson, A. (1997). Disruption to word or letter processing? The origins of case-mixing effects. Journal of Experimental Psychology: Learning, Memory, & Cognition, 23, 1275–1286.

However, since "word shape" includes information on the position of internal letters (especially where they contain ascending and descending elements), word shape will be disrupted by transpositions.

Following brief presentations of written words, people are often better at guessing what word they saw, rather than guessing individual letters in that word (the "Word Superiority Effect"):

Reicher, G. M. (1969) Perceptual recognition as a function of meaningfulness of stimulus material. Journal of Experimental Psychology. 81(2), 275-280.

However, this demonstration does not imply that reading does not involve any process that occurs at the level of individual letters. A recent paper in Nature presents a new piece of evidence for letter-level processes in word reading:

Pelli, D. G., Farell, B., Moore, D.C. (2003) The remarkable inefficiency of word recognition, Nature, 423, 752-756.

In this paper, Pelli and colleagues show that when reading words that have been distorted by presenting each letter in visual noise (like an out of tune television), readers do not perform as well as an 'ideal observer' who can recognise words based on their shape alone. Instead, their participants only perform as well as they could if they were recognising words based on their individual letters.

Clearly, the debate about whether we read using information from individual letters or from whole words is far from over. Demonstrations of the ease or difficulty of reading jumbled texts seem likely to play an important role in our understanding of this process. For instance:

Perea, M., & Lupker, S. J. (2003). Does jugde activate COURT? Transposed-letter confusability effects in masked associative priming. Memory and Cognition.

Another extremely relevant paper that just caught my eye is this:

Perea, M., & Lupker, S. J. (2003). Transposed-letter confusability effects in masked form priming. In S. Kinoshita and S. J. Lupker (Eds.), Masked priming: State of the art (pp. 97-120). Hove, UK: Psychology Press.

What Perea and Lupker did was to present words for lexical decision (is this a real word?) and measure response times to press one of two buttons (yes/no). These target words are preceeded by very brief presentations (50msec) of another letter string, which is masked, and so invisible to participants. However, the influence of this masked word can be shown on response times. For instance, response times are faster if USHER is preceded by "uhser" than if preceded by "ushre". That is, middle letter transpositions "prime" a neighbouring word more than extrerior letter transpositions. The same phenomenon that is at the heart of the earlier demonstration.

I would be grateful for any comments and suggestions that people have on this page, whatever your level of expertise. I will try to update this page with more information on the internet meme, and on related work on

reading, if people are interested. Maybe one day, there will be a group of researchers at Cambridge University who will make a scientific break-through by studying the reading of jumbled text...

Other comments:

1) Ted Warring posted a link to an algorithm that is much better than humans at deciphering scrambled text. This is perhaps unsurprising - I'm sure I'm not the only person out there who has used a computer program to solve a particularly taxing anagram.

2) Bruce Murray from Auburn University, Alabama, USA points to the following quote as representative of a line of research showing that misspellings (and letter transpositions) do disrupt the reading process:

"Regardless of semantic, syntactic, or orthographic predictability, the eye seems to process individual letters ... Disruptions in adult readers' eye movements indicate that the visual system tends to catch the slightest misspelling."

(from Adams, M. J. (1990) Beginning to Read: Thinking and Learning About Print. Cambridge, MA: MIT Press, p. 101)

There's an interesting issue here which is that the subjective impression of difficulty that one gets from reading a jumbled text may be quite different from a more objective measure of reading difficulty obtained using an eye-tracker (a device that measures the pattern of eye movements made when people read printed text).

Bruce also pointed out that the original text and some discussion has been been posted on the "Urban Legends Reference Page".

3) Peter Hebels has made a Visual Basic program for generating jumbled texts. As he says:

I've made a nice open source program in Visual Basic, this program can do the letter randomiztion automatticly for you. It randomizes only the middle letters of a word, it doesn't change the place of the first and last letters, also special characters like commas and periods arent affected. You can download the program and source here:

http://home.zonnet.nl/hebels13/letterreplacer.zip

You'll need the Visual Basic runtime files to be on your system if you want to run the executable, the installation for this files can be found here:

http://download.microsoft.com/download/vb60pro/install/6/Win98Me/EN-US/VBRun60.exe

4) Clive Tooth has found what may be most ambiguous jumbled sentence (using words like "salt" which becomes "slat" when transposed)

"The sprehas had ponits and patles"

This might come out as...

The sherpas had pitons and plates.

The shapers had points and pleats.

The seraphs had pintos and petals.

The sphaers had pinots and palets.

The sphears had potins and peltas.

Clive lists some of the more obscure words in this set of possible readings:

palets: paleae (a part of a grass flower)

peltas: shields

pinots: grapes

potins: copper alloys

sphaers, sphears: both old form of 'spheres'

5) Stephen Sachs has written a CGI script to jumble text. Simply enter your text into the www page and press the button for a newly scrambled text.

Acknowledgements:

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Last modified 30/10/03, Matt Davis