

INTERNAL ISOMORPHS

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Internal Isomorphs are what I call words which can be cut into 2 or more sections, each with an equal number of letters, and with identical letter patterns with reference to the number and position of repeated letters. Vowels and consonants are not differentiated. Thus the surname of the British Prime Minister (1945-51), Clement ATT.LEE, is an internal isomorph. I have introduced a further constraint. Specifically, a particular letter cannot appear in more than one section of the word. Thus, in words cut into 2, any letter which appears in the first half of the word must not appear in the second half of the word. This sorts the wood from the trees dramatically!

In words cut into 2 sections, only the letter pattern of the first half of the word is given (see below). Thus - - 1 - 1 represents an internal isomorph with the letter pattern - - 1 - 1. - - 2 - 2. The number of possible letter patterns is given in brackets. Repeated letters are underlined.

Unreferenced words can be found in the Oxford English Dictionary, Second Edition including the text. Locations, identified by country, are taken from the United States Board on Geographical Names. Other references are: *cham* Chambers English Dictionary; *coll* Collins English Dictionary; *csd* Chambers Scots Dictionary, 1975; *dffp* A Dictionary of the Flowering Plants and Ferns by J.C. Willis, C.U.P. 1966; *hod* A Handbook of American Indians ed. F.W. Hodge, 1907; *long* Longmans Dictionary; *nz* Nomenclator Zoologicus; *ospd* Official Scrabble Players Dictionary; *sted* Stedmans Medical Dictionary; *tnwd* The New Welsh Dictionary by Evans and Thomas, 1970; *web2* Webster's Second Edition; *ww* Word Ways.

2 LIKE LETTERS IN EACH HALF

4-LETTER WORDS (1 pattern only)

In a Kickshaws item called *Double Double Trouble* (WW2001141), I listed 4-letter words composed of 2 doubled letters. Here are 3 additions to that list:

1 1 AA.BB (*Λabb* ej Jinnate - Syria), AA.RR (*Aarr* ej Jamouss - Lebanon), EE.SS (*hod*)

6-LETTER WORDS (3)

1 1 - AAL.IIS (*ospd*), CCA.NNY (*long*), LLE.DDF (*tnwd*), SSO.LLE, SSO.PPE, SSU.LLE, VVE.LLA (*nz*)

1 - 1 CIC.ADA, GIG.OLO, IBI.SES, MEM.NON, POP.EYE etc. (see *Sequential Words* WW2005003)

- 1 1 ABB.OTT, ACC.ESS, INN.ESS, OSS.ETT (in Yorkshire, UK)

8-LETTER WORDS (6)

1 1 - - LLAN.DDEW (Wales, UK), OOLE.MMAS (*sted*), SSHU.LLEN, SSHI.PPER

1 - 1 - AWAK.ENED, COCK.EREL, ODOM.ETER, SYST.EMED, TETR.ODON, UVUL.ITIS

1 - - 1 BARB.EQUE, CONC.EIVE, DRUD.GING, EXTE.RIOR, SUBS.ERVE

- 1 1 - ANNI.SEED, BEED.HOOK, COOL.WEED, ODDB.ALLS, TEEN.HOOD, WEEV.ILLY

- 1 - 1 GADA.RENE, HOLO.CENE, JAPA.NESE, PHTH.YSIS, YOKO.HAMA

- - 1 1 BALL.OTEE (*cham*), BUTT.RESS, MATT.RESS, MISS.PELL (*cham*), TALL.NESS

10-LETTER WORDS (10)

1 - 1 - - AWAKE.NINGS, MEMOR.ISING, RURAL.ITIES

1 - - 1 - CAMCO.RDERS, COLCH.ESTER (in Essex, UK), INFIL.TRATE, PROPH.ESIED

1 - - - 1 ENUME.RATOR, GRUDG.EABLE, HAUGH.TIEST

- 1 1 - - FOOTB.ALLER, OFFSP.INNER (in cricket), WOOD.CUTTER
- 1 - 1 - MINIS.TERED, SOJOU.RNING, TOXOP.HILIC, UNANS.WERED
- 1 - - 1 CONFO.RMISM, PALEA.RCTIC, SELVE.DGING, TURBU.LENCE
- - 1 1 - CHEER.FULLY, COMMA.NDEER, KITTE.NHOOD, PECCA.DILLO
- - 1 - 1 CHORO.IDEAE, PHOTO.LYSIS
- - - 1 1 BLURR.INESS, GUILL.OCHEE (to decorate with guilloches), STEDD.ABILL ('steadable' = helpful)

12-LETTER WORDS (15)

- 1 - 1 - - - AGAMOG.ENETIC, NONDYS.PEPTIC (*web2*), NONUMB.ILICAL (*web2*)
- 1 - - 1 - - CARCIN.OPHOBE (from 'carcinophobia - *sted*), EXCEPT.ORIOUS, SUBSCR.IPTION
- 1 - - - 1 - ALPHAB.ETISED, POSTPR.ANDIAL, UNCAUT.ERIZED
- 1 - - - - 1 CONJEC.TURIST, UNSEPU.LCHRAL
- 1 1 - - - DOORST.EPPING (*cham*)
- 1 - 1 - - CARAME.LISING, PARASI.TOLOGY
- 1 - - 1 - HENCEF.ORWARD, UNMANI.FESTED
- 1 - - - 1 CONGLO.MERATE, COTYLO.SAURIA, RACKHA.MESQUE
- - 1 1 - - CARRIO.NELLUS (*nz*), HOSSPI.TULLER (*hospitaller*), LACCOB.IELLUS (*nz*)
- - 1 - 1 - PREGEN.ICULUM
- - 1 - - 1 HAECKE.LISMUS
- - - 1 1 - BUYSSO.NIELLA (*nz* - 'aeiou' in reverse), QUIBBL.EPROOF (*web2*)
- - - 1 - 1 PYCNAN.THEMUM (a plant - *djpf*)
- - - - 1 1 SCHULL.ERMANN (Germany), SUKHOO.ZERNYY (Russia)

14-LETTER WORDS (21)

- 1 - 1 - - - - MEMBRAN.OLOGIST (from 'membranology')
- 1 - - 1 - - - EUDEMON.ISTICAL
- 1 - - - 1 - - ALTGAND.ERSHEIM (Germany)
- 1 - - - - 1 - CRATICH.NEUMONS (*nz*)
- 1 - 1 - - - MONOPHY.SITICAL
- 1 - - - 1 - URETHRO.VAGINAL (*sted*)
- 1 - - - - 1 BOGDANO.VSKIYES (2 locations called Bogdanovskiye in Ukraine and Russia)
- - 1 - - 1 - OVERDES.CANTING (*web2*)
- - 1 - - - 1 LANDOWN.ERSHIPS (*coll*)
- - - 1 - - 1 TACORIO.MBUENDE (Angola)
- - - - 1 1 SCHROTT.ENKLAMM (Austria), SCHWITT.ERKNAPP (Germany)

3 LIKE LETTERS IN EACH HALF

8-LETTER WORDS (4)

- 1 - 1 1 BOBB.EREE, TUTT.ELEE (*hod*)

10-LETTER WORDS (10)

- 1 - 1 - 1 URUGU.AIANA (Brazil)
- 1 - - 1 1 TRATT.ENSEE (Austria)
- 1 1 - 1 PUUNU.VAARA (Finland)
- 1 - 1 1 MATAA.NIHII (Somalia), XAWAA.LIHII (Somalia)

12-LETTER WORDS (20)

- 1 - 1 - 1 LIHIRI.YAGAMA (Sri Lanka), KOPOYO.MAHANA (Colombia)

14-LETTER WORDS (30)

- 1 - 1 - 1 - - OGORODN.AJAMAKI (Russia)
- 1 - 1 - - 1 KURUNDU.GAHAELA (Sri Lanka)
- - 1 1 - - 1 SKAAPDA.MLEEGTE (S. Africa)

2 DIFFERENT LIKE LETTERS IN EACH HALF

8-LETTER WORDS (3)

- 1 2 2 1 ILLI.ASSA (Gambia) (see *Sequential Words*)
 1 2 1 2 TITI.CACA (Peru) etc. (see *Sequential Words*)

10-LETTER WORDS (15)

- 1 2 2 1 - APPAT.ILLIE (Australia)
 1 2 - 2 1 KARAK.UYLYU (Uzbekistan). LOKOL.AWEWA (Sri Lanka) (see *Sequential Words*)
 - 1 2 2 1 BAGGA.TELLE, LERRE.IPOOP, MIRRI.NESSE
 1 2 1 2 - BUBUR.LOLON (E.Timor), TATAS.IRIRE (Guatemala), DUDUG.HAHAO (Solomon Is.)
 1 2 - 1 2 PROPR.IETIE, SICSI.BAMBA (Peru) (see *Sequential Words*)
 1 - 2 1 2 PYOPO.IESIS (*web2*)

12-LETTER WORDS (45)

- 1 2 1 2 - - MUMURI.CHCHAN (Sri Lanka), NINILV.AYAYEM (Russia)
 1 2 - 1 2 - BAMBAD.OUGOUS (2 places called Bambadougou in Ivory Coast and Guinea)
 - 1 2 - 1 2 FANTAN.BOUGOU (Malta), JEUMEU.RANGAN (Indonesia), HOTNOT.SWERWE (S. Africa)
 - - 1 2 2 1 STOPPO.GIEDDE (Norway), VUOLLO.SJAKKA (Norway)

14-LETTER WORDS (105)

- 1 - 2 2 - - 1 KALLVIK.SUDDENS (2 places called Kallviksudden in Finland and Sweden)
 - 1 2 - 2 1 - SEROREA.CTIVITY?
 - - 1 2 - 2 1 BATUPUT.IHKENEK (Indonesia)
 - 1 2 - 1 2 - PEUTEUY.CONDONG (Indonesia)

3 OR MORE DIFFERENT LIKE LETTERS IN EACH HALF

These two 12-letter locations have 3 different like letters in each half of the word:

- 1 2 3 1 2 3 PEOPEO.CHICHI (Solomon Is), SENSEN.KWAKWA (Ghana)

Although not exploring words with 16 letters, I did chance upon a word which has 4 different like letters in each half: 1 2 3 4 1 2 3 4 REBUREBU.SIWASIWA (Papua NG)

The above three examples are sequential words.

3-WAY INTERNAL ISOMORPHS

3-way internal isomorphs are only to be found amongst words having a multiple of 3 letters. This means that possible word lengths include 6, 9, 12, 15, 18, 21 etc. letters. Hence, unlike their 2-way counterparts, these include words with an odd number of letters.

Constructed of 3 doubled letters, FF.OO.TT, with the letter pattern 11.22.33, will be familiar to many readers of *Word Ways*. AGA.MEM.NON words, however, must surely be the best-known of the 3-way examples with their triple palindromic letter pattern 121.343.565.

Three-way internal isomorphs also include MCC.ONN.ELL (surname), ATT.IKK.ULL (Sri Lanka), and GAA.LOO.TII (Somalia), all with the letter pattern 122.344.566

INTERNAL ISOMORPH SHIFTS

Can the letters of internal isomorphs be shifted along the alphabet (looping from Z to A) to form other internal isomorphs? A search of the many MEM.NON words (those with the letter pattern 121.343 - see earlier in article) revealed the following example of just such an internal isomorphic shift:

$$\underline{LIL.OYO} \text{ (Tanzania)} + 6 = \underline{ROR.UEU} \text{ (Brazil)}$$