REFLECTIVE WORD NETWORKS

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In the February 1991 Kickshaws, Dave Morice introduced the concept of the palindrome ladder, one which starts with a word and travels to its reversal changing one letter at a time passing through a palindrome at its central rung. For example:

```
WORD-WARD-PARD-PART-MART-DART-DORT-TORT
                                   TOOT
DROW-DRAW-DRAP-TRAP-TRAM-TRAD-TROD-TROT
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Although Morice challenged the reader to form the longest possible ladder without repeating words, 1 prefer to eliminate extraneous steps such as MART and TRAM and find the shortest palindrome ladder between two reversals.
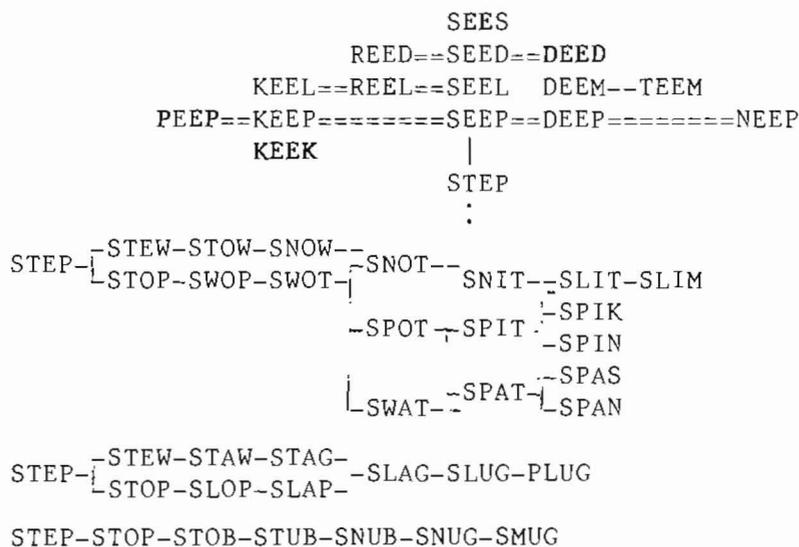
The palindrome ladder can be generalized to the concept of a reflective word network. To fix ideas, consider four-letter words. To what extent can reversal-pairs such as TIME-EMIT or STEP-PETS and palindromes such as DEED or POOP be combined into a connected network? Amplifying my collection of Websterian words with suitable OED reversal-pairs, 1 easily amassed a collection of 379 reversal-pairs and 15 palindromes (ABBA, ANNA, BOOB, DEED, ECCE, ESSE, KEEK, KOOK, NAAN, NOON, OTTO, PEEP, POOP, SEES, TOOT), about 90 per cent of which can be assembled into a single network of Byzantine complexity. 1 illustrate below a small fragment, showing half of the 20-step span of the network from DACE to ECAD through PEEP or SEES (as well as the longer paths through NOON, POOP, TOOT, BOOB, KEEK, DEED, and ESSE):

```
                         NOON
                         NOOP-POOP
                         NOOS
                         NOWS            TOOT
                         POWS            MOOT
                         PALS-PAWS-MAWS-MOWS-MOOS-MOOD-BOOD-BOOB
                         PALP
DACE-DAGE-RAGE-RAGA-SAGA-SALA-SALP       PEEP       KEEP-KEEK
                         SAIP-SEIP-SEEP--------|
                         SEES            SEED DEED
                                         SEYD
                                         SEYS-SESE-EESE-ESSE
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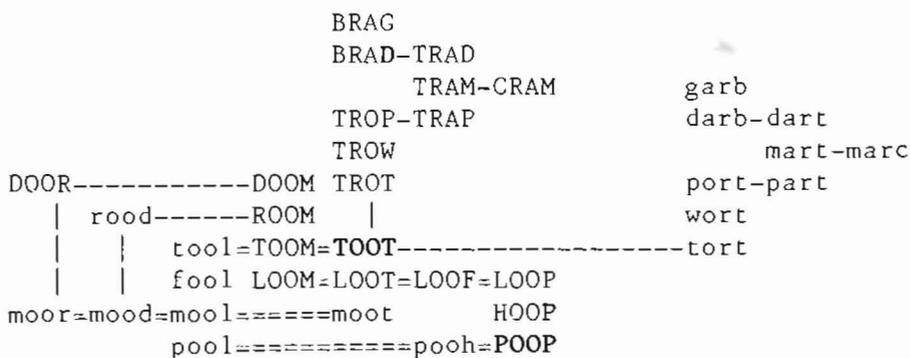
Looking for a more easily-diagrammable reflective word network, I restricted myself to words in the Official Scrabble Players Dictionary, yielding only 141 reversal-pairs and 12 palindromes (no ABBA, ESSE, or NAAN). The largest connected network, containing 110 words and including the palindromes DEED, SEES, PEEP, and

KEEK, is still too complex to diagram clearly because of the den-
sity of the network of the 47 SCVC-CVCS reversal-pairs (C stands
for consonant, V for vowel). However, a sense of the network is
given below. Only half of the network need be diagrammed because
of the obvious symmetry around the palindromes (given in boldface).
Below STEP, a selection of ladders leading to the most distant words
is given. The span of the network is 18, from SLIM to MILS via
the palindrome SEES.

```
                        SEES
                REED==SEED==DEED
            KEEL==REEL==SEEL   DEEM--TEEM
        PEEP==KEEP=======SEEP==DEEP=======NEEP
        KEEK                  |
                             STEP
                              :

      -STEW-STOW-SNOW--
STEP-[                  -SNOT--
      -STOP-SWOP-SWOT-[         SNIT--SLIT-SLIM
                     -SPOT-+SPIT .-SPIK
                                  -SPIN
                     |         .-SPAS
                     L_SWAT--SPAT-[
                                 L-SPAN

      -STEW-STAW-STAG-
STEP-[                -SLAG-SLUG-PLUG
      -STOP-SLOP-SLAP-

STEP-STOP-STOB-STUB-SNUB-SNUG-SMUG
```

plug scam seam slab slag slap slim slit slop slug smug snap snaw
snib snip snit snot snow snub snug span spar spas spat spay spik
spin spit spot stab stag star staw stew stob stop stow stub stum
stun swam swap swat sway swob swop swot

The second-largest connected network has 38 words including
the palindromes TOOT and POOP. It differs from the first network
in that there are non-palindromic crossings between reversal-pairs
as well as palindromic ones. To illustrate this phenomenon, the
entire network is shown with each reversal-pair appearing once
in capitals and once in lower case:

```
                    BRAG
                    BRAD-TRAD
                        TRAM-CRAM        garb
                    TROP-TRAP            darb-dart
                    TROW                     mart-marc
DOOR----------DOOM  TROT                 port-part
   |  rood------ROOM   |                 wort
   |   |   tool=TOOM=TOOT----------------tort
   |   |   fool LOOM=LOOT=LOOF=LOOP
moor=mood=mool=====moot       HOOP
        pool==========pooh=POOP
```

The span of the network is 16, from BRAG to GARB via TOOT.

All other networks are very small, and do not include their own
palindromes or reversal-pairs: SNED-SLED-FLED, GRUB-DRUB-DRIB-

DRAB-DRAY-DRAW, TANG-RANG-RANK, RAJA-RAGA-SAGA, and LAIR-LAID-LAUD-LEUD.

Five-letter words generate far sparser reflective word networks. The following words can all be found in either Webster's Second or Third Editions:

```
TIMID-TIMED-TIMER--TILER-TELER-SELER-SEDER
                                      SEDES
dimit-demit-remit--relit-relet-reles-redes
```

LEPER-LEVER-**LEVEL**-revel-repel

SAGOS-**SAGAS**-sogas

```
KNUTS=KNITS=KNATS-KNAPS
          GNATS SNAPS-STAPS-STOPS
          GNAWS-SNAWS-STAWS-STOWS
                                STOTS
          swang-swans-swats-swots
          stang spans-spats-spots
stunk=stink=stank-spank
```

DEFER-**REFER**-refed

SOLON-**SOLOS**-nolos

OBoy!   *Morice*