Word Ways readers are familiar with Lewis Carroll’s word ladders. As a variation, Dave Morice suggested in the August 1989 Kickshaws a game which he called Stepladders. Two words join only if the letters which are exchanged are adjacent to each other in the alphabet.

Unfortunately, Morice’s rule does not allow enough joins for an interesting analysis. If one is restricted to words from the Official Scrabble Players Dictionary, the largest four-letter word network contains only 14 words of the form (KLMN)(KLMN)(DE). Three other networks have 10 to 12 words apiece: (BCD)(RST)(RST), (RSTA)(KLMN), and (BCD)(RST)(RST). For details, see the November 1989 Kickshaws and the February 1990 Colloquy.

To get around this limitation, I investigated word ladders in which the mandated distance between exchanged letters is other than one step. The one system that seems to work very well uses six steps and goes around the world through ZA (hence, Chinese Stepladders). This results in letters dividing into two groups of size 13, one with the vowels and the other without (call them V and C, respectively):

Vowels (V) -A-G-M-S-Y-E-K-Q-W-C-1-O-U-
No Vowels (C) -B-H-N-T-Z-F-L-R-X-D-J-P-V-

These parcel all four-letter words into 16 disjoint networks; there is no way (for example) that WORK can be transmuted into PLAY even if all four-letter strings were words. By far the most fecund network is the one formed from words with the pattern cvcv (such as TILE or FARM).

The largest connected network with pattern cvcv, with 98 words, is diagrammed on the next page. Its span is 20, PUNK-junk-dunk-dune-done-dote-doty-dots-jots-juts-puts-paty-pate-pane-vane-bane-bate-hate-haze-HAZY.

The second largest network has 42 words, followed closely by one with 39. The span of the former is 13 (HULK or BIRK to MARK), and of the second, 14 (LAZY, FAZE or RAZE to LATS). Next in size are three fragments with 18 to 21 words apiece; all are shown on the next two pages.

Can these networks be joined into a single network? ZONE can be joined to FINK (uniting the 98-word and 39-word networks) via ZONK (in 12000 Words) and ZINK (obsolete variant of zinc in Webster’s Second). Similarly, RIFE can be joined to LONE (uniting the 39-word and 18-word networks) via RIZE (reformed spelling
It appears very difficult to join the 42-letter network to any other one; a suitable word with F in the third position is the stumbling-block.
What happens to the network if words not in the Official Scrabble Players Dictionary are allowed? Augmenting the OSPD list with words taken mainly from the Oxford English Dictionary to form a list of 7053 words, my computer found a network of 648 words with pattern cvcv; a portion of that network is given on the next page. The network has a span of 43, from pavy to dods or pavy to five. A key shortcut, bode-boxe-bore, is not shown. The OED gives boxe as an alternate for box; without it, the bode-bore distance is 8, and the span 49. Perhaps the reader can find other shortcuts.

Consider what happens if the mandated distance between letters is four instead of six. The alphabet again divides into two groups of size 13, with all the vowels in one group:

Vowels (V) -A-E-I-M-Q-U-Y-C-G-K-O-S-W- 
No Vowels (C) -B-F-J-N-R-V-Z-D-H-L-P-T-X-

If only OSPD words are used, the largest network with pattern cvcv has a size of 37 (two pages ahead) and a span of 15: TIRE-tine-pine-line-line-hire-here-hare-have-lave-pave-pare-peri-peri-peri-term. However, using the augmented list, the largest network contains 277 words, a part of which is shown below. The link nele-nehe-nede is not shown, but is used as part of the span of 25, from bite to term. Nipe-nile, ripe-rile and pipe-pile links are also not shown, but they are not part of the span.

Finally, consider what happens if the mandated distance between exchanged letters is twelve instead of six. The two alphabet groups:
ble
ith
ers
lipS

dods pods
duds-juds-pods
dads | pads
judy |
dady-jady-pady
dade-jade-pade-vade-bade-hade
dude bude-hude-nude
dode bode-hode-node-tode
dide pide-vide-bide-hide-nide-tide-zide-side-tide-side
pixe
dire pire-vire-bire-hire tire fire

dore pore-vore-bore-nore-tore-zore-fore-lore-lore-lore

düre-jure-pure bure-jure-nure-ture sure-lure-rure lure

dare pare-vare-bare-hare-nare-tare-fare-lare-rare lare

dale-jale-pale-vale-bale-hale-nale-tale fale-lale-rale lale

hafe lafe-rafe

daze vaze-baze-haze-saze faze-laze-raze raze

date pate-vate-bate-hate-nate-tate fate-late-rate rate

dane-jane-pane-vane-bane-hane-name-tane fame-lane-rane rane

done-jone-pone-vone-bone-hone-none-tone-zone-fone-long-rone rone

pony pons pons
pohs pohs pohs
jobs-pobs jobs-lips pobs

ble with
bore

bible

form

ords

next

ively

OED

pirels

supps

term

teerm-

link

mks

green

ds:

bens dods

duds-juds-pods
dads | pads
| judy |
dady-jady-pady
dade-jade-pade-vade-bade-hade
dude bude-hude-nude
dode bode-hode-node-tode
dide pide-vide-bide-hide-nide-tide-zide-side-tide-side
pixe
dire pire-vire-bire-hire tire fire

dore pore-vore-bore-nore-tore-zore-fore-lore-lore-lore

düre-jure-pure bure-jure-nure-ture sure-lure-rure lure

dare pare-vare-bare-hare-nare-tare-fare-lare-rare lare

dale-jale-pale-vale-bale-hale-nale-tale fale-lale-rale lale

hafe lafe-rafe

daze vaze-baze-haze-saze faze-laze-raze raze

date pate-vate-bate-hate-nate-tate fate-late-rate rate

dane-jane-pane-vane-bane-hane-name-tane fame-lane-rane rane

done-jone-pone-vone-bone-hone-none-tone-zone-fone-long-rone rone

pony pons pons
pohs pohs pohs
jobs-pobs jobs-lips pobs

bible

form

ords

next

ively

OED

pirels

supps

term

teerm-

link

mks

green

ds:
Vowels (V) - A-M-Y-K-W-I-U-G-S-E-Q-C-O-
No Vowels (C) - B-N-Z-L-X-J-V-H-T-F-R-D-P-

The largest network based on the augmented list contains 263 words and the span is 21; e--s links are significant. There are more cyclic links in this network than in the others, hence the shorter span. Nats, bahs, vats, hots, hahs and vate are all 21 links from lade.

These networks are related to letter-shift words, discussed in earlier Word Ways. "Letter-Shift Words in the OSPD" (February 1990), based on a smaller database, noted that shift distances of 4, 6 and 12 produced the largest number of shifted pairs. Here are a few ideal (minimum) stepladders between shifted word pairs:

4-step: fang-fank-fenk-ferk-jerk, luna-puna-pure-pyre, swan-sewn-sear-sear, open-open-spin-spir-spir


12-step: zips-lips-libs-lubs-lube, gobs-gons-gone-sane, boats-baas-bams-bame-name