

## OUR MOVE

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Kickshaws editor David Silverman's book Your Move (McGraw-Hill, 1971) consists of 100 problems "designed to challenge your insight" in bridge, checkers, chess, tic-tac-toe and other games, some well-known and some not so well-known. Though only four of the puzzles are called word games, these provide an amazing amount of recreation for the word puzzle enthusiast. We discuss below two of these word puzzles -- Ghost and The Last Word.

In the two-player version of Ghost, players build sequentially toward a word by adding a terminal letter on their turn, the objective being to force the other player to complete a word (uncapitalized, and having at least three letters). If a player adds a letter which results in a sequence with which no word begins, then that player loses a point, assuming, of course, he (or she) has been challenged by the opponent. Let's consider a game of Ghost between two mythical players, Smith and Jones. Smith opens by putting down the letter V. The best response that Jones has is to follow with a Y. Smith is now forced to complete the only word beginning with VY, VYING. Accordingly, the opening player should never begin with a V.

David Silverman suggests in his book that two-player Ghost can be completely analyzed, determining all safe and unsafe openings. We have responded to his suggestion, and offer our results here. As suggested in Your Move, we used Webster's Third New International Dictionary as our authority. Because of the blanket decapitalization of proper names in Webster's Third, it is necessary to assume that all words labeled cap, usu cap, often cap and sometimes cap are in fact capitalized. According to our research, there is only one safe opening letter. The 25 other letters are all unsafe; the second player can ensure himself a win by knowing the correct responses to make to various letters played by the first player. We list in the table below the response that the second player (Jones) should make to the 25 unsafe opening letters. No matter what valid letter Smith adds to the word, Jones can always play in such a way that Smith is forced to complete one of the words listed at the right in the table. For example, if Smith opens with an M, Jones responds with a B. Smith

can validly reply with either an A or an O. If A, Jones follows this with an L, forcing Smith to complete the word MBALOLO. If O, Jones follows this with an R, forcing Smith to complete MBORI.

Smith's Opening	Jones's Response	Endwords that Jones will use in order to force Smith to add the final letter
A	Z	AZAFRAN, AZEDARACH, AZIDE, AZIDO, AZLON, AZTEC, AZULENE, AZULITE, AZYGOTE
B	W	BWANA
C	S	CSARDAS
D	V	DVANDVA
E	Q	EQUERRY, EQUES
F	J	FJALL, FJELD, FJORD
G	J	GJEDOST, GJETOST
H	H	HHETH
I	U	IUS
J	Y	JYNGINE
K	T	KTHIB
M	B	MBALOLO, MBORI
N	J	NJAVE
O	Q	OQUASSA
P	W	PWE
Q	R	QRE, QRI
R	T	RTA
S	R	SRI, SRUTI, SRADDHA, SRADH, SRAMANA, SRAVAKA
T	C	TCHAVICHE
U	W	UWAWORITE
V	Y	VYING
W	R	WRACK, WRECK, WRIST, WROTE, WROTH WRUNG, WRY
X	E	XEBEC, XED, XENYL, XERIC, XES
Y	C	YCLEPED
Z	H	ZHO

The only safe opening letter, of course, is the one missing from the above table -- L. Assuming that the first player knows all the right responses to the second player's moves, the first player has a guaranteed win when L is the starting letter. Let us demonstrate. If Smith starts with L, Jones can respond with any one of seven letters -- A, E, I, L, O, U and Y. If one is restricted to uncapitalized words of three or more letters in Webster's Third, there are no other letters that follow an initial L. Let us examine Smith's response to each of the seven possible responses of Jones.

- If Jones adds an A, Smith adds another L (giving LAL). Jones can now add an A (giving LALA, leading only to LALANG, causing Jones to lose), an I (giving LALI, and losing immediately), an O (giving LALO, and losing immediately) or an L. How should Smith respond to LALL? He must add a Y, giving LALLY, which is in the dictionary only as a proper name and so doesn't count as a word. Jones is now forced to make LALLYGAG and loses.
- If Jones adds an E, Smith adds another L (giving LEL). Jones is now forced to make the only word beginning with LEL, LELWEL, and loses.
- If Jones adds an I, Smith adds a Q, forcing Jones to add a U. Smith then adds an O, forcing Jones to complete the word LIQUOR.
- If Jones adds an L, Smith adds the letter Y, forcing Jones to complete the word LLYN (this strategy was discussed in Your Move).
- If Jones adds an O, Smith adds a Q, forcing Jones to add a U. Smith now puts down an I, forcing Jones to follow the fateful path toward LOQUITUR.
- If Jones adds a U, Smith adds the letter E (giving LUE). Jones can now add an N (giving LUEN, which leads only to LUENEBERGITE, and which makes him lose), an S (giving LUES, and losing immediately), or a T (giving LUET, leading only to LUETIC, also making him lose).
- If Jones adds a Y, Smith adds the letter X, giving LYX. Jones is now forced to complete either LYXOSE or LYXOFLAVIN, both losers. Voila!

In summary, Smith can guarantee himself a win by opening with an L, and Jones can guarantee himself a win if Smith opens with any other letter but L. The interested reader may care to see what the safe and unsafe openings are if a dictionary other than Webster's Third is allowed. How do the necessary responses alter when another dictionary is used? We want you to tell us.

Let us now turn to an analysis of The Last Word. Two players, each equipped with a copy of the same dictionary, proceed as follows: the first player (Smith) announces a three-letter word beginning with A. The second player (Jones) modifies Smith's word to a new word in which just one of the letters has been altered, and which must appear later in the dictionary. The players alternately modify each other's words according to the above rules until one of them is stumped for a word -- and loses the game. For example, Smith may start with ALE, Jones replies with ALL, Smith continues with ILL, and Jones loses when he cannot find a later dictionary word with only one letter changed.

After seeing this game in Your Move, we set out to analyze it. We were surprised to find that the game can always be won by the first

player on the very first move! Let us suppose that our two worthies are using the Merriam-Webster Pocket Dictionary as their authority. If Smith starts off with any of the three words ADZ, ANY or AUK, he wins immediately. Jones has no reply to any of these. We thought it might be possible to make the game last longer by turning to more extensive dictionaries. Not so! Using Webster's Seventh New Collegiate Dictionary the situation is exactly the same. Smith can still win with ADZ, ANY or AUK. How about using the Third Edition of Webster's? Two of the three words are no longer safe. If Smith opens with AUK, Jones can reply with AUL, AUM or AUS; if Smith opens with ANY, Jones can reply with ARY, ONY or SNY. However, the first player still has an immediate win if he uses ADZ. If we let our two adversaries use the Second Edition of Webster's, none of the three words are safe; to ADZ, Jones can reply ARZ or ODZ. Smith has no reply to either of these and loses. Isn't it strange how a change in dictionaries causes a complete reversal in the outcome of the game?

However, Smith should not despair. A quick check of both the Second and Third Editions reveals that the word AYU is an instant win for the opening player. There are probably other words in the two unabridged dictionaries that will give Smith an instant win -- would the reader care to search for them?

In summary, the first player is guaranteed to be an instant winner when any one of these four major Merriam-Webster dictionaries are used. Question: can the reader find a dictionary that will not guarantee an instant win for the first player?