

SUDOKU PATTERNS

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The sudoku puzzle form has enjoyed a meteoric rise. Books of sudoku puzzles and its variants fill the shelves of bookstores. Often overlooked by sudoku devotees is the fundamental fact that sudoku is not inherently arithmetic. The nine symbols in a standard sudoku puzzle could be shapes or colors or letters instead of numeric digits. One example of an alphabetic sudoku puzzle was the Word Ways article "Eckler Sudoku" (February 2007).

Yet the sudoku phenomenon is too recent to have established a solid wordplay history. This paucity of sudoku-inspired studies is logology's loss. The sudoku form offers sufficient basis for a rich variety of wordplay. I will suggest a few areas of potential interest below. Others will see yet further possibilities.

We should first distinguish between sudoku as **puzzle** and sudoku as **pattern**. The essence of the puzzle is the incompleteness of the grid laid before the audience. With less than a quarter of the sudoku squares filled in, the remainder may be strictly deduced. Satisfaction for the constructor lies in providing as few clues as possible to guide the solution. Also in the puzzle, the choice of specific digits is generally insignificant. No one looks at the completed sudoku grid for meaningful multi-digit patterns, such as long prime numbers.

The essence of the standard sudoku pattern is threefold: (a) a 9-by-9 grid of squares is divided into nine square sub-grids; (b) a set of nine distinct symbols is used, be they digits, letters, colors or shapes; (c) each row, each column and each sub-grid must contain each of the symbols exactly once.

If we look on an alphabetic sudoku as pattern, the obvious merit of a given sudoku will lie in the patterns visible in the completed sudoku. The particular patterns of interest to us are words. For English language sudoku patterns, we will count only words which occur left-to-right, top-to-bottom, or diagonally from top-left. Variations on this rule are discussed in the "relaxed-rules" section below. Several areas for future study are longer-word sudokus, theme sudokus, and relaxed-rule sudokus.

Longer Word Sudokus.

To reiterate, the primary pleasure of an alphabetic sudoku lies in the words in the completed form. This fact can be used to advantage in transforming alphabetic patterns into puzzles. The filled-in squares below would not determine a unique sudoku. However, when the solver is additionally told that the completed pattern contains three 9-letter words in separate rows or columns, then the solution is unique. The solution will be found at the end of this issue.

						I		
O						R		
N		B				O		
		A				N		
S	I	G	N					
D								
I						G	A	R
G	B	O	A	S				

One direction for future study is sudoku patterns with higher word-counts. Can anyone find a pattern with four 9-letter words? Utilizing diagonals, this should be feasible. When completed, the above pattern contains ten words of length at least 4, not counting words wholly imbedded in longer words. Can anyone extend that count to fifteen? twenty?

Theme Sudokus.

The article "Eckler Sudoku" was a theme sudoku. The aim of a theme sudoku is to include as many words related to a given theme as possible. The two (partial) sudoku patterns below contain number names. The first contains at least seven number names. The grid on the right contains the consecutive integers FORTY-NINE and FIFTY, as well as three other integers and three non-number words, all written diagonally. For greater amusement, both patterns are presented as simple puzzles to complete. Additional letters are supplied to make the solutions unique. Solutions are provided at the end of this issue. Actually, the patterns interfere with the puzzles to some extent. The complete number names are pleasant to see, but some letters could have been withheld to create purer puzzles. Two natural questions for further study concern (a) the maximum number of number words which fit in a sudoku pattern, and (b) the highest possible sum in a pattern.

F				N				
	O	N	E		I			F
T		U				N		O
W			R				E	U
O	N	E		T				R
U				W	E			
			I	O		E		W
							N	I
								T

F				Y				
T	O			E			Y	
	E	R	F		T			O
		N		T	I	O		U
				E	Y	F	N	
					R	N	T	E
	T				E	I	Y	
		E					N	
			N					E

Other obvious sudoku themes might be color names, Presidents (or Prime Ministers), cities, or pets. The restriction to a set of nine letters makes itself felt. For example, one natural theme would be compass directions. Unfortunately for sudoku purposes, NORTH, EAST, SOUTH and WEST use ten different letters among them. Other imaginative theme sudokus are welcomed.

Relaxed rules.

The particular rules of interest are (a) the order in which words may be read.; (b) whether words may continue beyond an edge; and (c) whether to consider sub-grids as equivalent to rows or columns.

(a) Generally we do not consider DAER, UKODUS, or THGIR as words. However word-search puzzles routinely include words written right-to-left, bottom-to-top, or reverse diagonally. Since sudoku grids appear similar to word-search squares, it is only fair to allow an investigator to study sudoku patterns built under that relaxed condition.

(b) Some crosswords and other puzzles have allowed words to continue past an edge, generally by having the word continue at a right angle to its previous direction. An alternate method for continuing is *boustrophon*, discussed below. If we allow words to turn at edges, then a longer word like MASTOIDECTOMIES could be incorporated into a sudoku pattern, as below. I have added the word DOMESTIC as a bonus, and shown extraneous letters in lowercase.

M	A	S		T	O	I		D	E	C
o	d	c		m	e	a		s	i	T
i	e	t		s	c	d		a	m	O

s	t	o		d	i	e		c	a	M
e	c	d		a	m	o		t	s	I
a	m	i		c	t	s		o	d	E

c	i	a		o	d	m		e	t	S
t	s	e		i	a	c		m	o	d
D	O	M		E	S	T		I	C	a

Some questions for further study:

- (1) What is the longest word which can be incorporated into a sudoku pattern, under edge-turning rules?
- (2) Can two words, each longer than 9 letters, be incorporated into a sudoku, using edge-turning rules?
- (3) the ancient Greeks had a writing style called *boustrophon*. In this mode, the characters were read left-to-right and right-to left on alternating lines. Sudokus incorporating *boustrophon* seem to offer additional opportunity for longer length words. What long words can be incorporated into sudoku patterns by using *boustrophon*? TRICHOAESTHESIA and METRODYNAMOMETRY are 15- and 16-letter medical words, found in an electronic version of Stedman's Medical Dictionary, 25th Edition. . Each word could be placed by *boustrophon*. Each would have to be placed so the final letters are in separate sub-grids from the prior letters.

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T	R	I	C	H	O	A	E	S
.	.	.	A	I	S	E	H	T

M
E	T	R	O	D	Y	N	A	M
.	.	.	Y	R	T	E	M	O

Can longer *boustrophon* be found?

(c) If we treat sub-grids as equivalent to rows or columns, we would read each sub-grid from right to left and from top line to bottom. In the sudoku pattern below, the top left, the middle and the bottom right sub-grid each is a 9-letter word: EDUCATIONS, SUCTIONED, and SEDUCTION. The pattern also includes two of the same the 9-letter words, EDUCATIONS and SEDUCTION, across the entire first and last rows. Thus the pattern includes five 9-letter words, as well as the separate 8-letter word DUCTIONS! In order to highlight the words of interest, extraneous letters are shown in lower case.

E	D	U	C	T	I	O	N	S
C	T	I	o	n	s	e	d	u
O	N	S	e	d	u	t	i	c
n	i	e	S	U	C	d	t	o
D	U	C	T	I	O	N	S	e
t	s	o	N	E	D	c	u	i
u	c	t	i	o	n	S	E	D
i	o	n	d	s	e	U	C	T
S	E	D	U	C	T	I	O	N

Conclusion.

The paragraphs above have introduced sudoku patterns as a wordplay form. I have suggested areas for further study. I have also described some relaxed interpretations of pattern-forming rules. These relaxations would serve to expand the universe of results. Finally, I have also posed several challenges in the form of questions. Happy hunting!