

CARD-SHUFFLE ANAGRAMS

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Diane sat quietly, watching the evening sunlight speckle through the trees. It would be pretty, she thought, if only it didn't show the dirt on the kitchen window so vividly. "What a mess this place is," she said, half out loud. He would be back soon, and then she would have to ask about the gun in the bedroom drawer. That it was Lent, and she was hungry, only added to her ever-growing list of disgruntlements.

--M. Keith, "Shuffling Through Life"

The paragraph above has a very special logological property. Take the four words DIRT, MESS, GUN, and LENT, which appear in this order in the story, and write their letters on a deck of 15 cards, one per card in order from top to bottom. Now cut the pack into two parts: the top seven cards (L1 ... L7) and the bottom eight (R1 ... R8). Shuffle the two halves together in the order L1 L2 R1 R2 L3 R3 R4 L4 R5 R6 L5 L6 R7 R8 L7. Note that this is a well-mixed shuffle, in which no more than two consecutive cards fall from either hand. The result is the last word in the paragraph: DISGRUNTLEMENTS. In this article we explore this phenomenon, which we call the Card- Shuffle Anagram, or Shufflegram.

SPECIAL CASES: ALTERNADES AND INTERLOCKS

Dmitri Borgmann in *Language on Vacation* (1965) discussed the special case of the shufflegram in which

- the initial text has two words
- the deck is split between the words
- the shuffle is perfect (the cards fall from the two hands in alternating fashion)
- the resulting anagram is a single word

and called it an Alternade.

The longest alternade appears to be the one given by Borgmann: TINILY + RENAL = TRIENNIALLY. Here are some shorter ones, where we have tried, as usual in an anagram, to have some semantic connection between the two parts. (As usual, punctuation may be used freely to enhance the effect.)

Gem lay, gleamy
Sold pie, spoiled

Has sol shoals?
Sued, ate, sauteed

Pro-art parrot
Lugs one, lounges

Ere land, learned Cuss ore courses Suns, ores, sourness
Blond aloë ballooned

We can make it even harder by trying to shuffle an n-letter word into a different n-letter word. The longest such pair is probably CONSOLES : COOLNESS, which can be depicted as a diagram

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C   O   N   S
  O   L   E   S

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that yields one word if read from left to right (jumping between lines) and a different word if read as top-line-then-bottom-line. Some shorter ones include FRIERS : FERRIS, GENRES : GREENS, STRAYS : SATYRS and TRISALT : STARLIT, as well as two with some semantic connection, FAULTS : FLATUS and HATERS : HEARTS.

The National Puzzlers' League employs the variant (called an Interlock) in which two words are shuffled into one by an arbitrary shuffle. In this article I use the term k-Shuffle to denote a shuffle in which no more than k consecutive cards fall from each hand. A perfect shuffle has k=1, and one generally prefers smaller values of k since they produce well-mixed shuffles. Here is a k=2 interlock (the longest one we are aware of):

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SE   NT   RI   ES
  DE   A   N   S

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and here are some shorter ones with more semantic interest (especially the last two):

BRING AGAIN : BARGAINING	SIFTS, DINES : DISINFESTS
PRINCE OMENS : PROMINENCES	HYDRIC POEMS : HYPODERMICS
ALATE MAGMAS : AMALGAMATES	REPEATS CURE : RECUPERATES
DECRIES MOATS : DEMOCRATISES	

With k=2 we can find 10-letter words that turn into a different word, such as UNMADDENED to UNDEMANDED:

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UN   MA   D
  DE   N   ED

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as well as many 8-letter and 9-letter ones:

GANTRIES : GRANITES	MURDERED : DEMURRED
MACASSAR : MASCARAS	REPOSEDLY : REDEPLOYS
MALENESS : MANELESS	POISONER : SPOONIER
ACADEMITE : EMACIATED	DESTINIES : DENSITIES

The pair ENSNARES : NEARNESS works on the semantic level as well.

THE GENERAL CASE

When shuffling two words into one using either an alternade or an interlock, the deck is required to be split at the word break. In the fully general shufflegram this is not necessary. For example, THEAT/ER + INFER, if split as indicated, can be shuffled to yield THEREINAFTER. Some two-word-to-one examples of this are:

Saltiest act: stalactites
 Forgot, bides footbridges
 Bids misread bridesmaids

Shapes unpin unhappiness
 Detains into destination
 Noted yammers: dynamometers

while the following have three or more words combining into one:

Deem it intrinsic: indeterministic
 Moron Sal douses malodorousness
 Prim ear, anal, anti: parliamentarian
 Re: sin, rasp "detain!" (predestinarians)
 Sure, eat on pelvis - superevelations!
 On read, scut 'em - sue: countermeasures
 Ten toil in rain, ay, internationally
 Pour it on plaza, is popularizations
 O, Leo! net rubs mess - troublesomeness!

So far, we have always had a single word result. The most general shufflegram anagrams a phrase into another phrase. Since this is harder to accomplish, in the examples below (all book titles) we have mostly used $k=3$. Since this is such new territory, the reader is challenged to find better or longer examples.

"On He A-Trod" = "On The Road" ($k=2$)
 "Oh, Manage Fun Bod" = "Of Human Bondage"
 "Hide...Past Is So Far...Die" = "This Side Of Paradise"
 "He-Wolf: Stay, Fall, Eh?" = "The Way Of All Flesh"
 "Celt Alt.wit Odes" = "Twice-Told Tales"

HOW DIFFICULT IS IT?

Experientially, it's pretty hard to concoct a good, long shufflegram. But exactly how much more restrictive is this form of wordplay than the ordinary anagram? A little combinatorial mathematics can be used to answer this question.

Suppose we have a 12-letter phrase. There are $12! = 479,001,600$ ways to permute the letters for a regular anagram, but if we limit ourselves to shufflegrams with $k=1$ or 2, then it turns out only 486 permutations are possible. If we also allow $k=3$, there are 1854; if we allow any value of k , there are still only 4084. These are very small numbers compared to $12!$, thus clearly indicating that the shufflegram is a beast that's fairly hard to tame.

Here is a table of the number of different permutations of an n-letter string that can be accomplished using a k-shuffle.

n= 2	2												
n= 3	2	5											
n= 4	2	10	12										
n= 5	2	16	25	27									
n= 6	2	26	48	56	58								
n= 7	2	42	88	111	119	121							
n= 8	2	68	162	216	238	246	248						
n= 9	2	110	298	416	471	493	501	503					
n=10	2	178	548	802	928	982	1004	1012	1014				
n=11	2	288	1008	1546	1824	1951	2005	2027	2035	2037			
n=12	2	466	1854	2980	3586	3872	3998	4052	4074	4082	4084		
k=	1	2	3	4	5	6	7	8	9	10	11		

The total number of shuffle permutations for $n=2,3,4\dots$ is given by the numbers running down the diagonal, which are just $2^n - n$.

The values in the $k=2$ column are 2,5,10,16,26, etc. It can be shown that this sequence, excepting the first two terms (which are special cases) is just the Fibonacci sequence (5,8,13,21...) times two.

Finally, note that the total number of shuffle permutations is approximately $2^n n$, whereas $n!$ (the total permitted in a general anagram) is proportional to n^n . The ratio of these approaches zero as n increases. This shows that card-shuffle anagrams are harder to construct, relative to a regular anagram, as the string gets longer. In the limit, they are infinitely harder!

CARD-SHUFFLE REVERSALS

Another simple variation is to shuffle then deal out the cards of the result in reverse order. The perfect shuffle

M	O	A	T
	O	R	E

has MOAT and ORE, but if read backwards, alternating lines, it gives TEAROOM.

For arbitrary splits, the longest two-words-to-one example we found is ENRAGE + PETAURUS [genus of the flying squirrel] = SUPERGUARANTEE. Others with two or more words combining into one are:

Evened road: endeavored
 "Yahoo!" rests soothsayer
 Moo, sincere economiser!
 Goad, thunder: dreadnought

Resort, stir: terrorists
 Diectic sir criticised
 Note circle electronic
 Settles deal, tessellated

Stingier soil: religionists	Coma staid, spin antispasmodic
Sire, I'd notable deliberations	Ear incited son: inconsiderate
Saw thirty agas, straightaways	Notate: "firs need defenestration"
Sit, tin-man! oar, Sid! (administrations...)	

The word pair STRAYS-SATYRS is quite remarkable. STRAYS becomes SATYRS via a perfect shuffle forward shufflegram, and SATYRS turns back into STRAYS by a perfect shuffle reversal.

Here are some phrases that turn into movie titles when shuffled and reversed. All use $k=3$:

"Rob A Tan, Sirs" = "A Star Is Born"
 "Dip End Meal, Raw-Tone Dad" = "Dead Men Don't Wear Plaid"
 "Rut Ere Ten Reach Fog Eve" = "Return Of The Creature"
 "Tell Not 'Ave, Vain'" = "National Velvet"

POSTSCRIPT

These entire proceedings can be further generalized, by permitting the deck to be cut into p piles (not just two) and then shuffled, with no more than k cards falling consecutively from any given pile. (To physically perform this requires p hands, but no matter.)

A fully general (p,k) -shuffle with unrestricted k and p is, in fact, equivalent to an arbitrary anagram. By taking $p=n$, so that one card is distributed to each of n hands, we can, by shuffling, make an arbitrary permutation. Thus, small cases like $p=3$ are the most interesting. Borgmann gives some $(3,1)$, $(4,1)$ and $(5,1)$ examples:

$(3,1)$ DOT, ERE, CAD = DECORATED
 $(4,1)$ PAN, ALE, NOR, TOY = PANTALOONERY
 $(5,1)$ PIG, ATI, ROC, ALA, SOL = PARASITOLOGICAL

Exploration of the fully general shuffle anagram with $p>2$ is left as virgin territory for the reader.