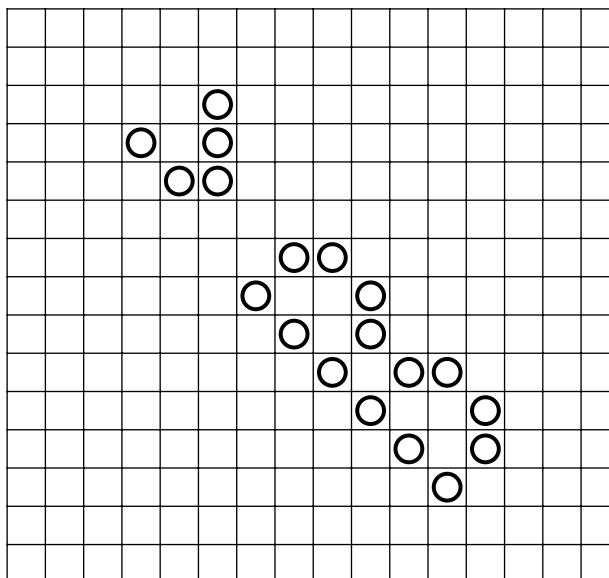


Editor and Publisher - Robert T. Wainwright
56 Old Highway, Wilton, Connecticut 06897
203-762-9939

With the large volume of correspondence I continue to receive, it is clear that the study of Life is as popular and fruitful as ever, even while my time to edit and publish this newsletter becomes ever more scarce. The creation of this issue of LIFELINE was facilitated by the many wonderful fully formed reader-submitted articles that significantly reduced the needed amount of editing work. Please continue to send more letters like these!



Doug Petrie and V. Everett Boyer's study of glider logic has led them to investigate collisions between a glider and various common objects. If the objects themselves can be constructed with gliders, then such collisions could potentially facilitate more elegant glider circuitry by more finely adjusting glider timing and parity. Through this investigation, Petrie has discovered the reaction shown above, in which a glider strikes a half-bakery. Surprisingly, after 55 generations the glider has been transported down by 4 cells and right by 2 cells, while the half-bakery has been transported 3 cells to the right and 6 cells up, leaving a dying spark as the only debris! To my knowledge, this is the only known glider collision where the output objects are exactly the same as the input objects.

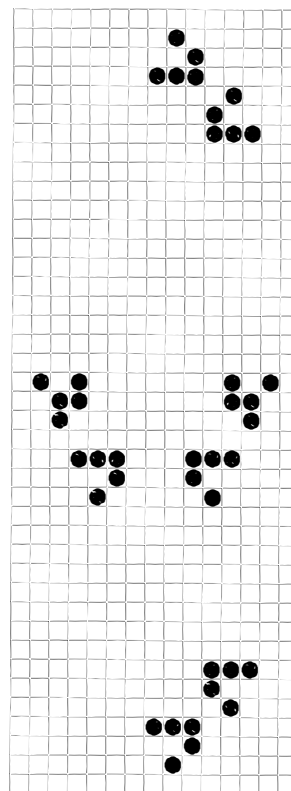
Glider collisions are a burgeoning area of interest, as many of the following reader replies will demonstrate.

Reader(s) Article . . .

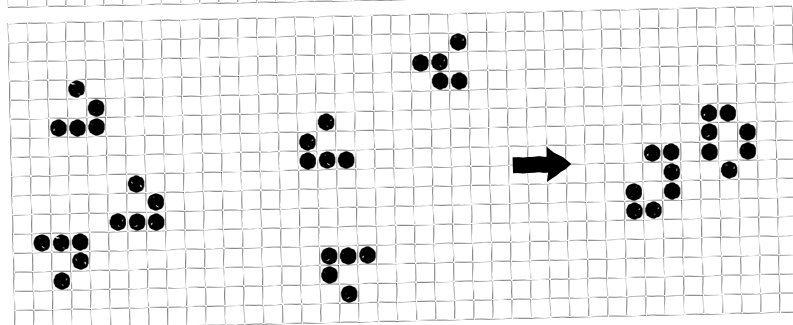
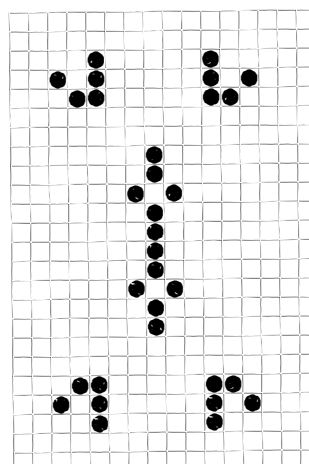
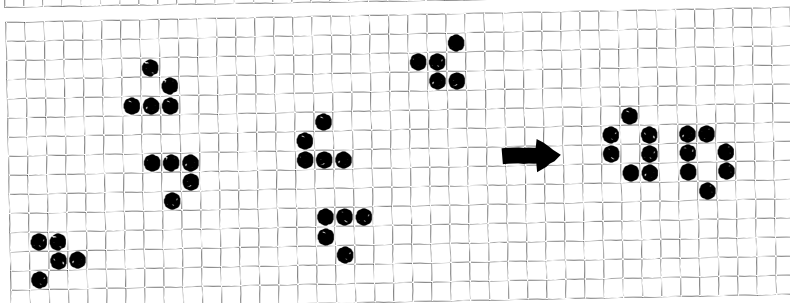
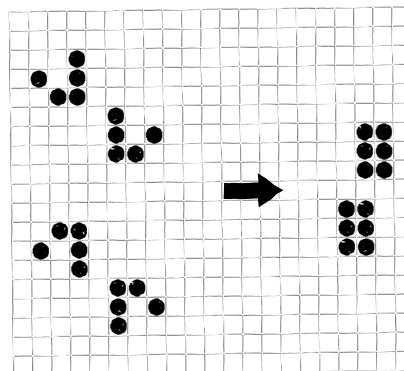
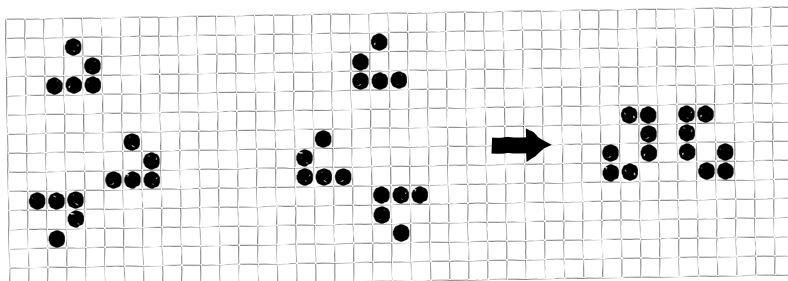
1067 Gurd Street,
Sarnia Ontario Canada,
January 14, 1974

Dear Bob ,

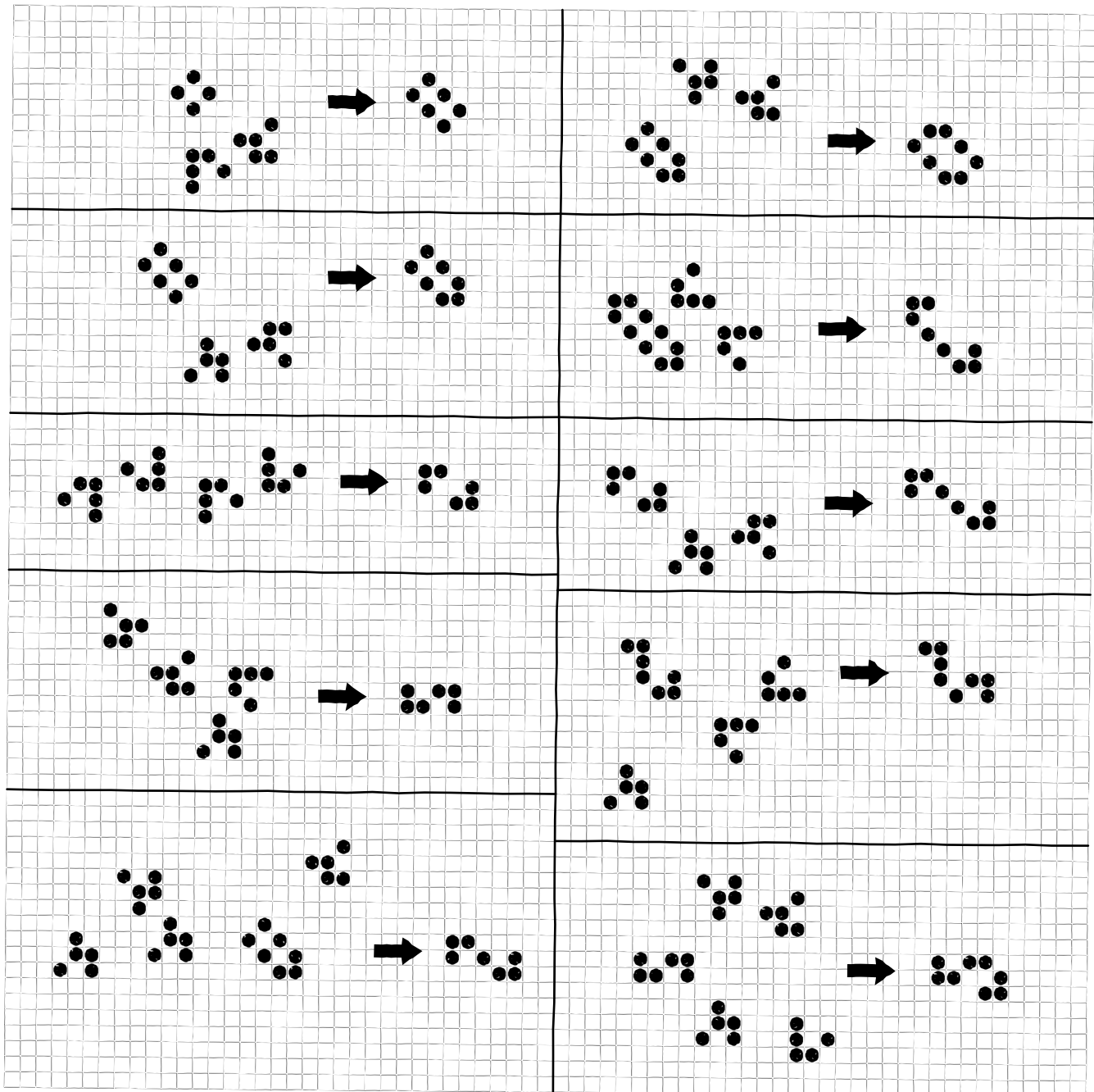
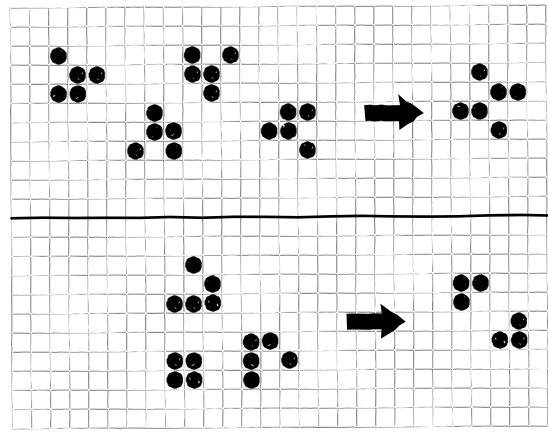
There seems to be an ever growing interest in the outcomes of glider collisions. With that in mind, here are the promised collisions producing Twin Bees, glidersomino (gen. 3), and a pair of bookends. There are in fact four pairs of bookends that can be formed by shifting the three gliders on the left down by two cells, or by flipping them over a horizontal axis. Similarly, there are four variations of the fourteen-bit still life consisting of inducting honeyfarm predecessors, but the four-glider collision shown last issue for one variation cannot be modified to form the other three. To remedy this, Dave Buckingham has managed to devise a way to form each inducting half separately from three gliders. This can also be combined with the bookend-producing collision to form hybrid still lifes. To save space, I have only included one of each type. Also included is a collision that shifts a pentadec. 9 gens. out of phase, similar to the snacker.



EN:
Twin Bees
shuttle

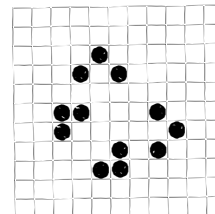


Since my last letter, Dave has made enormous progress in the realm of glider collisions. He is able to report constructions for all still lifes up to 9 bits. Many of these constructions involve incrementally adding or subtracting from already built still lifes. The aircraft carrier, snake, and clock proved especially challenging, because they do not occur naturally, and they seem extremely resistant to an incremental approach. Some of the less obvious constructions are included below.

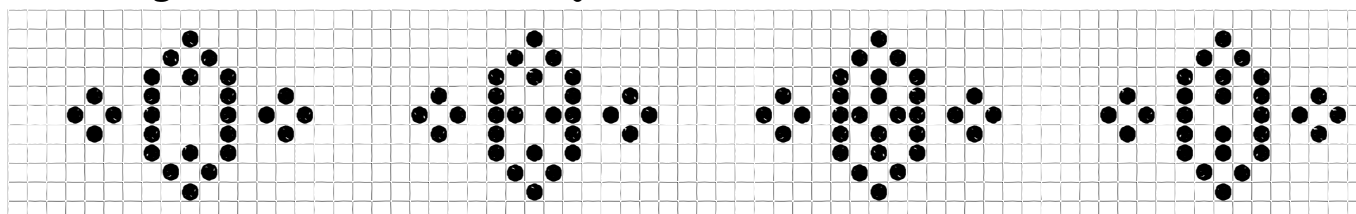
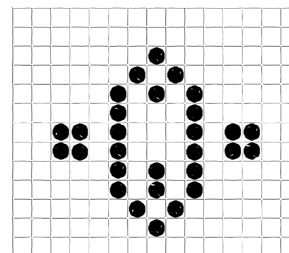


EN: Absolutely incredible constructions!

Our group has also found several interesting new oscillators. Dave Buckingham reports "mazing", the small period 4 oscillator at right, so called because when it was shown to Pete Raynham, he declared "that's a mazing". Like the pentadecathlon and figure eight, it contains only 12 bits in its smallest phase (full pop. sequence 12-18-12-18). A further similarity of these oscillators is the unusual property that none of their cells stay alive through the full period. Other oscillators with this property are the tumbler and many period 2 flip-flops. EN: and Kok's galaxy



I have found a small period 4 billiard table configuration in which the active cells turn on and off in pairs, with a change of exactly two cells each generation. I have named this 'Gray counter', as the on-off sequence counts to 3 using Gray code. Pete subsequently found a period 8 billiard table (right) by elongating Gray counter, although it loses its ability to count.



Gray 00
code:

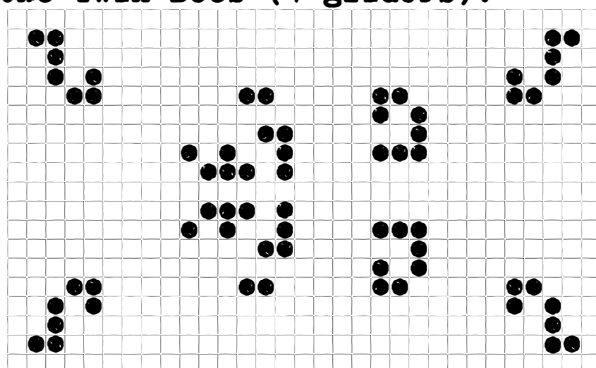
01

11

10

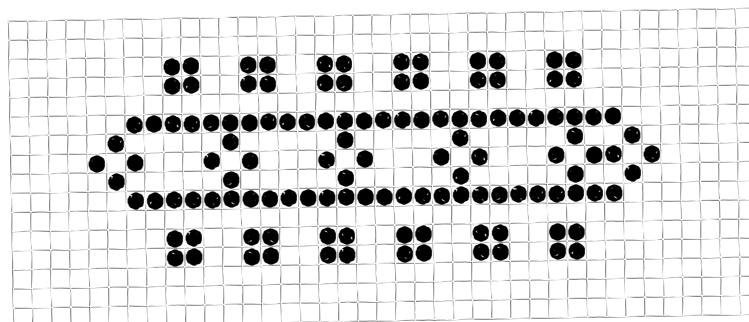
In the last issue of LIFELINE, Dave Buckingham reported the discovery of the period 28 "newshuttle". Dave has now found yet another shuttle oscillator, this time with period 54! This is another "Twin Bees" shuttle and is bounded by two pairs of fishhook eaters rather than blocks. Interestingly, a period 46 Twin Bees shuttle can be obtained by simply moving one pair of eaters outward by two cells. It can be constructed from 12 gliders by first creating the eaters one at a time (2 gliders each), and then forming the Twin Bees (4 gliders).

EN:
(!)



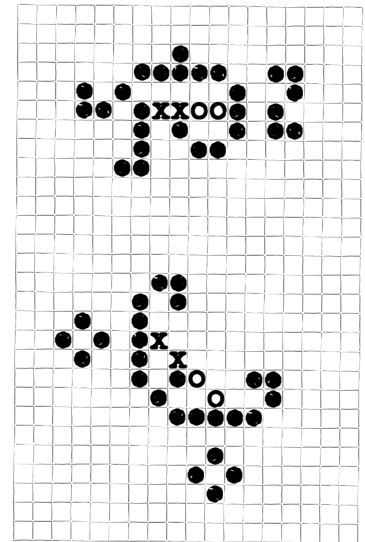
We have so far been unable to find a combination of two shuttles that produces a glider, but the large number of position and timing combinations still makes the prospect likely.

Pete notes that if the dominoes are removed from the group of dying cells behind the Twin Bees, then the remaining cells evolve into a tumbler.

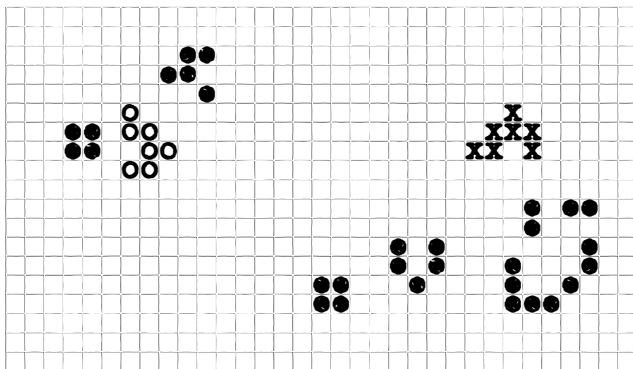


The bottom of the previous page shows an extension of Gray counter as a wick. Our group was unable to find a similar extension for Pete's related period 8 billiard table.

Dave has found the interesting period 4 oscillators shown at right. In each case there are only four active cells, all lying on a strip one cell wide. In the top oscillator this strip is oriented horizontally, while the bottom oscillator has a diagonal strip. Surprisingly, as they each evolve, the relative positions of their active cells remain the same. When represented as binary numbers, both active regions follow the sequence 1100-0101-0011-1010.



Dave postulates that 4 is the minimum number of active cells for a period 4 oscillator and wonders for what periods N do there exist oscillators with exactly N active cells? There are already known examples of periods 2 (beacon, spark coil), 3 (see LIFELINE #1 p.5), 4 (Gray counter and above oscillators), 5 (technician), 6 (\$rats), and 8 (see previous page). At period 7 all known oscillators have a multiple of 5 active cells, and for periods above 8 all known oscillators require significantly more active cells than their period.



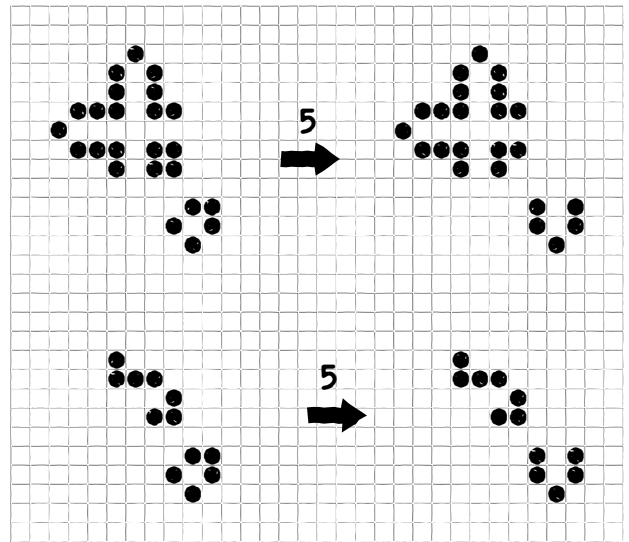
I have been exploring the evolution of common objects to see if the original object reoccurs somewhere else. Such occurrences have been the basis for all shuttle oscillators found to date. One promising example is in the evolution of a B-heptomino, where another B-heptomino is produced at gen. 64, turned 90-degrees. The figure on the left shows the original B-hep. marked by 'o's, and the new B-hep. marked by 'x's.

If some arrangement of still lifes can be found to eat the remaining cells, then four copies of the mechanism would return the B-heptomino to its original location after 256 generations! Since the B-heptomino naturally emits a glider, this would also give a new type of gun. Unlike previous shuttle oscillators which travel back and forth, this hypothetical shuttle would travel in a circular loop. By placing two or four B-heps. in the loop, oscillators and guns of periods 128 and 64 could be produced.

Bill Gosper's puffer train shows how a B-heptomino can be moved along a straight path with the help of supporting lightweight spaceships. If the spaceships could instead be replaced by still lifes or oscillators then this, along with the hypothetical 90-degree turn, would function like a model train set. Dave speculates that there may be train tracks that convert between common objects or that turn in different directions depending on whether a railroad switch is flipped.

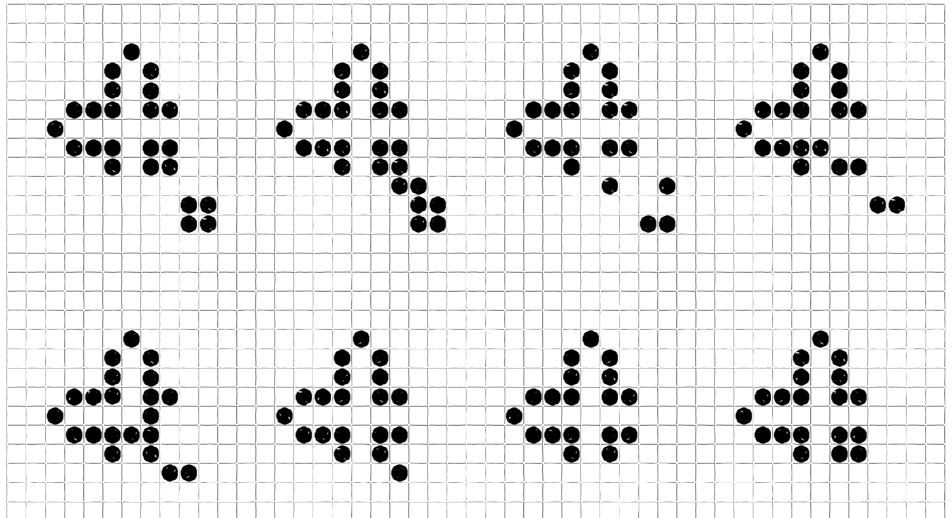
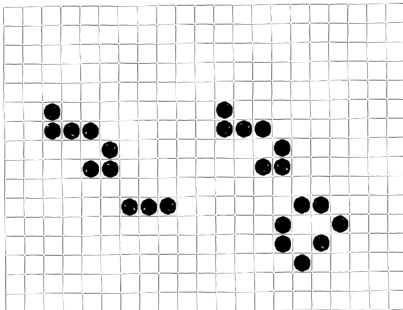
These model train oscillators are still very speculative, but Dave has found a new type of eater that he believes will help with their construction (shown on the next page). The new eater is composed of a block and two intersecting hats, making it larger and more symmetrical than the familiar fishhook eater. So far, Dave's attempts to form this still life using glider collisions have failed.

The new eater consumes similar prey to the fishhook, but where the fishhook takes only 3 generations to consume its prey and return to its initial state, the new eater requires 6 generations to fully recover. The difference in time is important in cases where the object being eaten leaves some transient debris near the eater. If the eating mechanism reforms too quickly, this debris could kill the eater. This is clearly demonstrated when each eater attempts to eat a boat. After 5 generations, a piece of fading debris interacts with the fully recovered fishhook. Since the larger eater takes 6 gens. to recover, it narrowly avoids this fate.

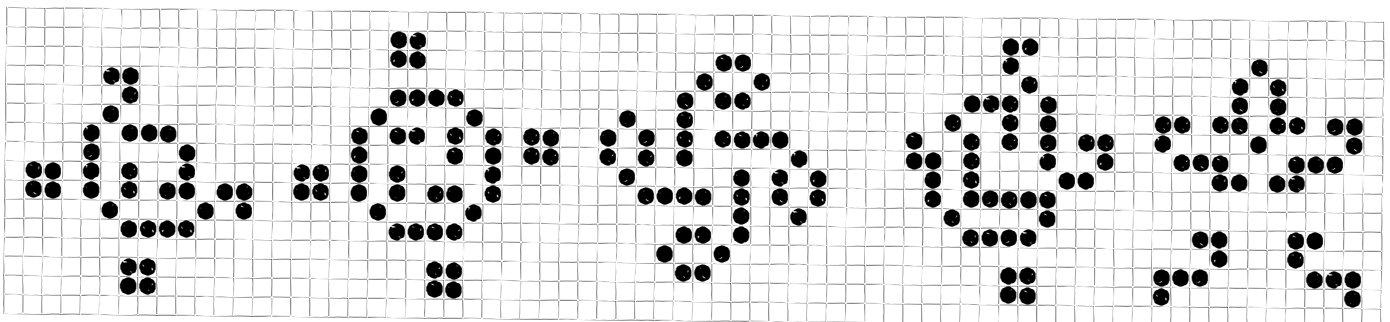


Dave points out that the two eaters complement each other quite nicely, as there are likewise prey species that can be successfully attacked by the fishhook, but not by the new eater. These attacks tend to take longer for the fishhook to complete than the standard 3 generations. A fishhook can eat a blinker in 5 gens. and a loaf in 13 gens., while the new eater cannot consume either of these objects. Dave discovered that the new eater can eat a block in 8 gens. where a transient domino would kill a fishhook.

Eaters attacking their unique prey.



Below are some additional oscillators (all found by Dave) with the first three having period 4 and the last two having period 6. The period 6 oscillators are variations of the previously reported "\$rats" and "Sombreros" (see LIFELINE #5 p.1 and #8 p.1).



Reader Article . . .

P.O. Box 31
Yreka, California 96097
December 3, 1973

Dear Sir:

In 3-4 Life I have made a remarkable discovery that I think will be of great interest to your readers. In my previous letter I had reported a period-12 oscillator (see Figure 8 in Lifeline Number 11, page 21). By adding a 2-bit spark near this oscillator, it instead moves diagonally with a speed of C/3! The three phases of this "jellyfish" are shown in Figure 1.

While experimenting with collisions between a glider and an R-pentomino in standard Life, I discovered a collision that produces a 16-bit "scorpion" still life. A full construction from gliders is difficult to properly align in a single grid, so I have instead provided the sequential construction shown in Figure 2.

In the first step, two gliders collide to form a single cell that converts a third glider into an R-pentomino. This is the same reaction demonstrated by V. Everett Boyer using a lightweight spaceship on page 24 of Lifeline Number 11. After 22 generations, a glider strikes the R-pentomino to initiate the scorpion-forming reaction. Another glider is needed to remove a forming loaf that would otherwise interfere with the reaction. When the pattern settles, there is an extraneous beehive and block which can each be eaten by an additional glider.

I had initially believed that only one glider was needed to collide with the R-pentomino, as shown in Figure 3. However, when attempting to reverse time to find the initial pure-glider configuration, I discovered that this glider would be eaten by a two-bit spark before it could reach the body of the evolving R-pentomino. This necessitated the use of two gliders in the second step of Figure 1 and demonstrates that one cannot be too naive when considering glider collisions.

An amazing fact shown in Figure 4 is that this juvenile (16-bit) scorpion can grow into an adult (17-bit) if we feed it an extra cell while it forms. The extra cell can be provided by the same glider-on-glider collision that was used to create the R-pentomino.

Sincerely,

Dean Hickerson

Dean Hickerson
P.O. Box 31
Yreka, California 96097

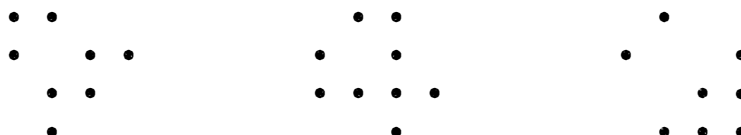


Figure 1

A C/3 "jellyfish" in 3-4 Life

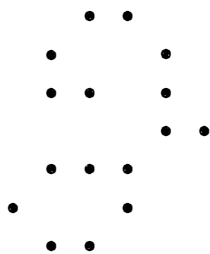
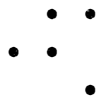
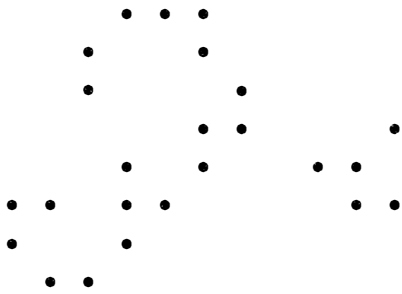
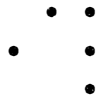
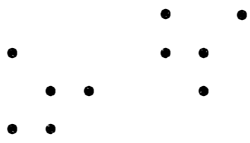


Figure 2
Juvenile scorpion

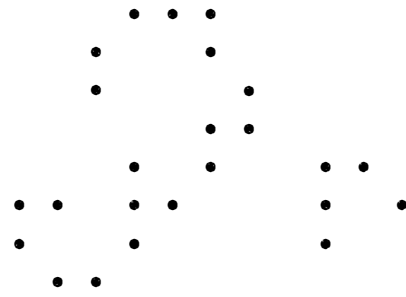


Figure 3
An invalid collision

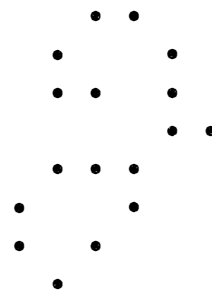
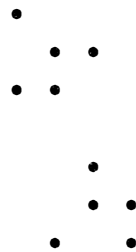
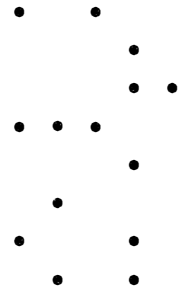


Figure 4
Adult scorpion

Reader Article . . .

98-25 Horace Harding Expway, Apt 16B
Lefrak City, New York, 11368

Despite the restriction to simple patterns in my "Life Codex", I have been overwhelmed by submissions of and questions about glider collisions. Given the increasing attention being paid to this type of pattern (as evinced by the previous two issues of LIFELINE) and to facilitate the answering of the many questions I received, I have begun keeping a fifth companion volume to the Codex that logs collisions of a glider with a common object (block, beehive, etc.)

There are 6 unique collisions between a glider and a block. The final results of these collisions are nothing (3 cols.), a Pi-heptomino (1 col.), a honey farm (1 col.), and another block displaced by a knight's move (1 col.) For a glider striking a blinker there are 12 different collisions, three of which result in nothing, two which become long-lived Methuselahs, and the remaining seven collisions each producing exactly one of the following patterns:

block, ship, loaf, pond, traffic light, Pi-heptomino, shifted blinker

The collisions resulting in a Methuselah are shown below. The first lasts for 556 gens. and has a final population of 104 cells. The second lasts for 2602 gens. and has a final population of 279 cells.

There are 71 unique collisions between two gliders, the outcomes of which, along with their number of occurrences, are given in the table below.

nothing	28	
blinker	3	
block	6	
boat	1	
glider	2	
beehive	1	
loaf	1	
fishhook	1	
P1-heptomino	3	
B-heptomino	3	
pond	2	
twin blocks	1	
half blockade	1	
blinker + loaf	2	
traffic light	3	
2 beehives	1	
blockade	1	
4-block diamond	1	
glider + T.L.	1	
interchange	1	
honey farm	5	
miscellaneous	3	

Of the miscellaneous results, one quickly produces a blinker, block, tub, and loaf, while the other two collisions (shown above) result in Methuselahs. The first of these lasts for 389 gens. and produces 4 beehives and 4 traffic lights. The other collision lasts for 530 gens. with a final population of 72 cells.

Sincerely,
Hugh W. Thompson

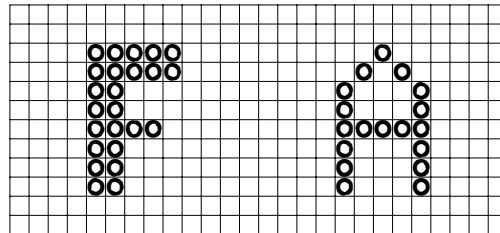
Reader Article . . .

The Predictive Power of Occult Symbology
Using Life Histories
By Curt Gibson, New York City

I must thank V. Everett Boyer for his correction to my prior pugilistic predictions. Indeed, this shows the strength of applying modern computational power to aid in the study of the occult. Thanks to the contacts made through Mr. Wainwright's wonderful newsletter, I am now able to verify future results by computer simulation.

Armed with the power to calculate Life histories more reliably than even the most skilled numerist, I believe a reassessment of their predictive ability is in order, especially in light of the upcoming bout in Zaire between the great heavyweight heavy-hitter, George Foreman, and the smartest boxer inside the ring, with the smartest mouth outside of it, Muhammad Ali.

No doubt the swiftness with which Foreman recently dispatched both Frazier and Norton should make him the clear favorite, if by nothing other than transitivity (Frazier and Norton being the only boxers to yet hand Ali a loss). There is no doubt that Foreman has earned his epithet, 'Big', so I have chosen to represent him by a big 'F'. Ali is similarly represented by an 'A' fitting within the same area. Can Ali choose his fate in the ring, just as he chose his new name?



With the temporal proximity of the 'Rumble in the Jungle', I only needed to advance their symbolic representatives by one re to see who will walk away from Kinshasa with the crown. While this was easy for me, I was comforted to know it was verified by a computer, especially given my surprise when I saw the results.

On re 2, Foreman's F drops from its initial size of 24 down to 16, while Ali's A expands from 20 to 29! I see a winded Foreman misapplying his superior strength, while a careful Ali sizes up his opponent to deal efficient, calculated strikes. As Boyer pointed out, the beehive represents the boxing crown, and Ali's A becomes just that on re 32. Here Life tells us to reject the conventional wisdom and place our bet on the Louisville Lip who will take the title at the age of 32!

For a longer range forecast, I have been able to observe the computer simulations of both F and A. With A completely stabilizing at re 32, it's clear that Ali will remain champion for some time, but he is ultimately nearing the twilight of his career. One might be tempted to think any boxer of his age would be, but the evolution of F has me thinking otherwise. Indeed, F has a short-term up-and-down trajectory, signaling a rough patch for Foreman, but it makes up for this with an unprecedented longevity. I would not be surprised to see Big George shock the world by retaking his title at an age well beyond which the typical boxer would have retired.

EN: Some entertaining predictions. Will any of them come true?

Lifeline Errata . . .

V. Everett Boyer submits the following corrections:

The lightweight spaceship collision on page 2 of Lifeline #10 only works for even spacings that are not a multiple of 4.

The glider collision producing a hat at the bottom of Lifeline #11, page 13 does not work. It can be fixed by moving the top two gliders down by one cell.

Reader Briefs . . .

o o o Hugh W. Thomposon notes that there is exactly one
 o o nonomino with the same fate as Charles Corderman's
 o o o o switch engine. This nonomino fully matches the switch
 engine as presented in Lifeline #4 p.1 after both
 patterns have been advanced by two generations.

V. Everett Boyer provides the following collisions between a glider and a boat or long boat that each result in a single new glider traveling northeast.

```

      o
     oo
    ooo

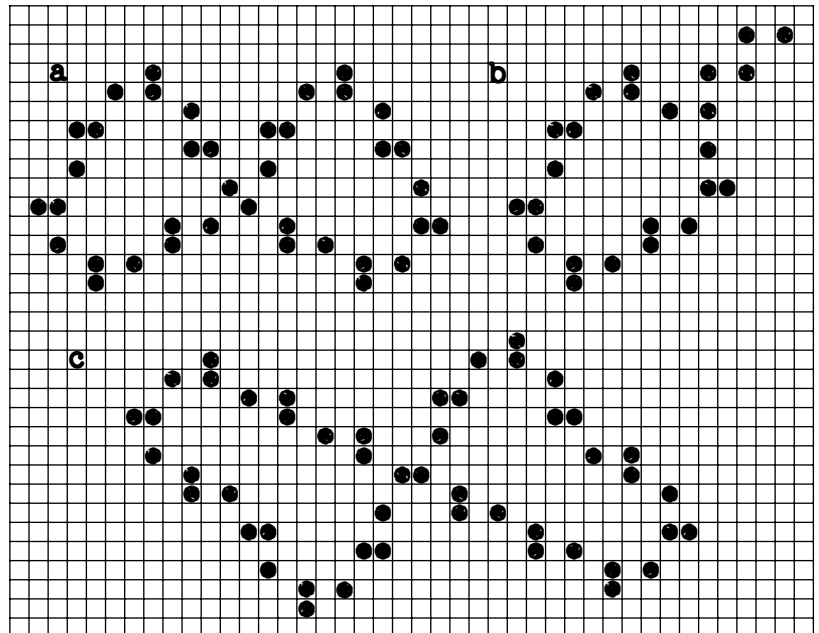
      oo
     oo
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      oo
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April Pratt of Ann Arbor, Michigan has submitted an analysis of oscillators in which every living cell dies in each generation. She calls these patterns 'mayflies', after the insect that famously lives for only a day, just long enough to reproduce. Some of her most interesting mayflies are shown below.

- A mayfly containing two diagonally connected bits.
- A mayfly terminus for the barber pole wick.
- A mayfly containing a different number of dominoes in each phase.

So far, all known mayflies have a period of 2. Pratt has provided a 14-page handwritten document containing an extremely clever proof that no mayfly can have an odd period. Regrettably, I have not yet had time to rewrite this proof in a format suitable for Lifeline, but you can rest assured that it will be the feature article of Lifeline #13. Higher even-period mayflies might exist similar to those found in 3-4 Life. (#11 p.15)



Lifequote:

'In three words I can sum up everything I've learned about life: it goes on.'

-Robert Frost