HACIENDO PASSING

RITMOS, FIGURAS, ROBOS, REPARTIENDO Y SITESWAP

FIGURAS

Passingdb.com
the Passing Data Base

http://www.passingdb.com

Patterns

These are passing patterns for more than 2 jugglers. Some of them are dynamic, meaning that some of the jugglers will have to move while passing.

Some indications on the level of the jugglers has been given. This was not so easy since many parameters have to be taken into account: ability to play with different rhythms and feed them, to move while juggling, to do dropbacks, to throw long passes, ...
I've given below the 4 levels I've used. You may disagree with these categories.

Beginner
- Able to pass a 4-count

Intermediate
Able to:
- pass reliably a 4-count or 2-count
- feed
- move slowly while juggling
- catch dropbacks

Good
Able to:
- pass in rhythms like PPS
- move and watch what's happening while juggling a 2, 3 or 4-count
- make long passes

Advanced
Able to:
- feed any rhythm (PPS, 1-count, ...)
- move quickly
- pass reliable dropbacks

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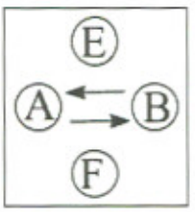
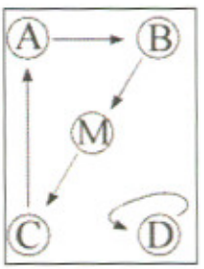
Understanding the diagrams

For most passing patterns I present in this web site, the diagrams are normally sufficient to understand what happens. Here are the rules for reading them (with examples). And if there are still some unclear patterns, please let me know (if I made a mistake I'll correct it, otherwise I'll try to be clearer).

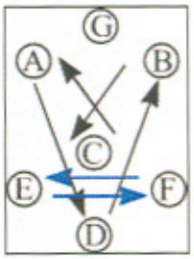
Generalities





- A diagram represents at a given moment the positions (seen from above) of the jugglers (represented by letters), as well as the passes and the movements to do at this moment. On the diagram opposite (top), there are 4 jugglers (A, B, E, and F).
- The passes are represented by black arrows. Usually (top diagram), we can even see from which hand they are thrown and to which hand (here the passes are from "right hand" to "left hand"). If it is not the case (bottom diagram), further explanations will be given (but it's often a 2 or 4−count).
- Very often, to be clearer, selfs throws are not represented (top diagram).Otherwise, they are represented by an arrow which comes back to the juggler (see D on the bottom diagram).
- Only the beats on which there is at least a pass are represented. For example, for a 4−count passing, the diagrams show the beats 0, 4, 8, ...So sometimes it is better to see the other explanations precising the rhythm to understand everything.
- The passes done above the shoulder may be drawn in the same way than the others (M to C on the bottom diagram). But they are mentioned in the explanations given with the diagrams.
- It is generally conventional (apart from an explicite back−to−back passing) that a juggler is in front of the one who throws passes to him. In a few cases, orientation is represented by a black line. (see the line).

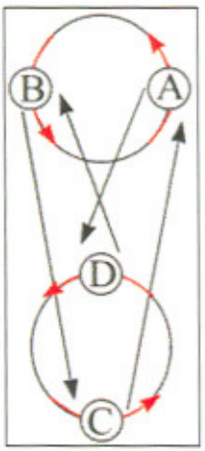
Optional passes



It is possible to add passes for a passing, for example when 2 jugglers (almost face to face) are doing selfs in the same beat. These passes are represented in blue. The advantage is to see and understand easily simple variations (when it is not worth doing another diagram).On the opposite diagram, E and F can either do a pass or do their self with the right hand.

Moving (dynamic passing)

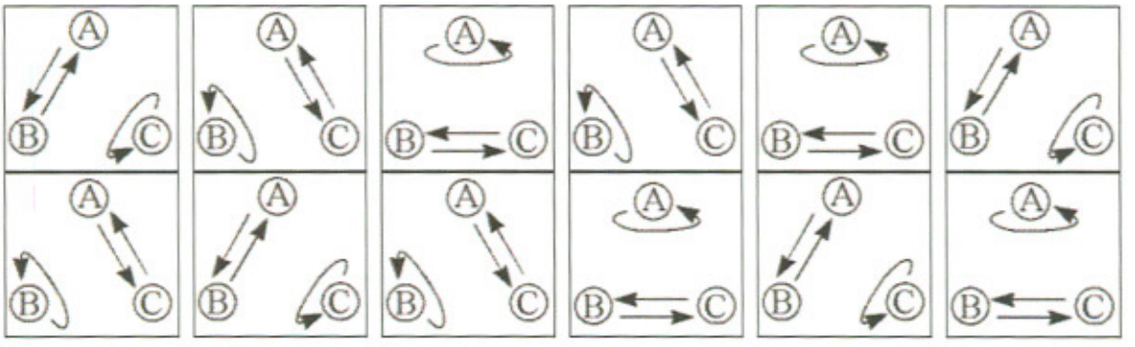
- The movements are represented by red arrows which show where the juggler has to move after the passes. They also show sometimes from where the juggler is coming.
- The juggler has then to make a pass, then to move and keep juggling, in order to be where they have to be on the next diagram.
- When movements are made above a well−known geometrical shape (see the circle opposite), these shapes appear on the diagrams.


B
A
D
C

Pulsar

Credits: Created by Steve Otteson &Madison Area Jugglers, 1993
Jugglers needed (base version): 3 good

In this pattern, the jugglers take turns being feeder.



Let's adopt the following notation (relative to the feeder):
– Right: the juggler to the right of the feeder
– Left: the juggler to the feeder's left

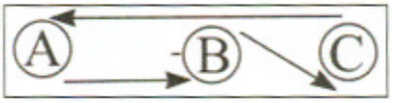
So, in order:

- A passes Right–Left (figures 1 & 2)
- C passes Left–Right (figures 3 & 4)
- B passes Right–Left (figures 5 & 6)
- A passes Left–Right (figures 7 & 8)
- C passes Right–Left (figures 9 & 10)
- B passes Left–Right (figures 11 & 12)

After a feeder does Right–left, the next does Left–Right and vice–versa. When feeding, each juggler might call out which he's doing (Right, Left) to make the pattern easier.

The line

Jugglers needed (base version): 1 intermediate, 2 good



This one is a classic. B faces A and sends his passes back over his shoulder to C. All the passes are singles (C has a long pass).

B's passes should come in as close to the center as possible (like a tomahawk) after making two turns (in theory, it's a single, but in practice, do what you will). There are also variants in which the club is thrown under the left arm, behind the back, or between the legs (trebla or albert, I don't remember which) instead of over the shoulder.

See also 4–person lines.

Rhythms:
Usually done in 4–count or 2–count, but 3–count is also interesting. There is also a special version (compensating for the differences in distance) in which:

- A starts with 4 clubs, C with 3 and B with 2.
- A throws singles in 4–count
- B still throws doubles over his shoulder, but in 2–count (with a false rhythm that makes his job easier).
- C throws doubles in 4–count and starts slightly after B's first pass.

Once solid with 9 clubs, try 10 in 2–count:

- C throws doubles instead of singles
- B and A keep the same spin as with 9
- C begins with 4 clubs and throws the first double to A
- A and B start a beat later, as if passing 7 clubs
- Poor B has a bit of a problem starting since he can't see C's pass. So he must time himself by watching for A to start.

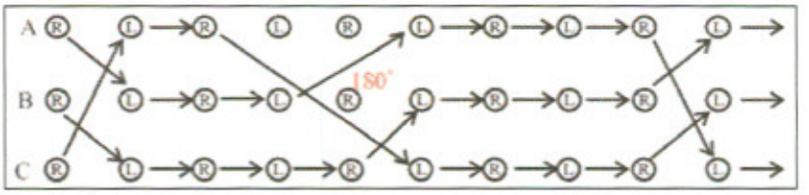
And if 10 works, try 11––the line may be the easiest way to do 11:

- A and C throw doubles
- A and C start together with 4 clubs each
- B starts a beat later with 3 clubs

A Trick

Here is a clean and flashy way for the middle person to make a half–pirouette, thus changing the direction of the line. This works for a 9–club line in 4–count.

Looking at the diagram at the top, A, at any moment, can throw a triple to C (in a 2–count). B immediately sends a crossing left–handed double to A and turns around just in time to receive C's pass. The roles are switched. The diagram below sums it up more clearly.



If this diagram makes no sense to you, read the explanation for causal diagrams.

As you can see, B has little time to react, so preferably, A should give a warning when he decides to throw the triple.

In a 4–count line, B can also turn while juggling (during the 3 selfs) without warning. A and C then react accordingly

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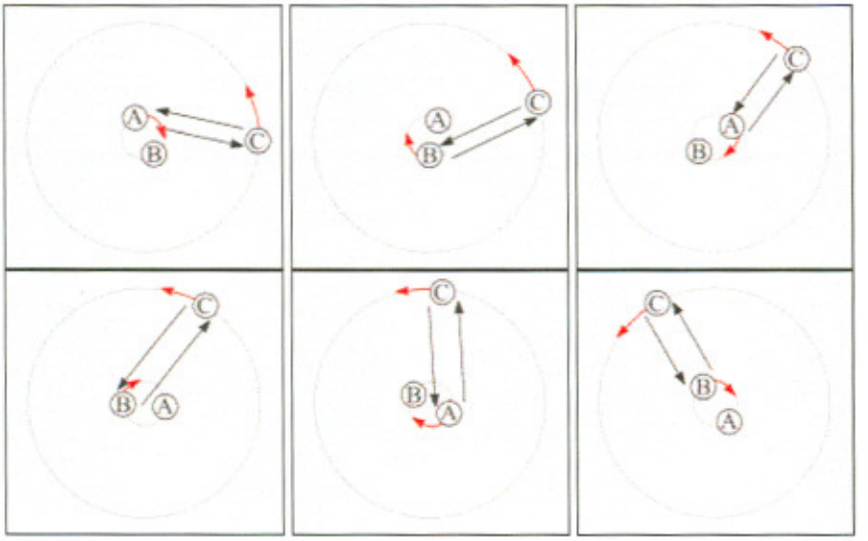
Hans Tornado

Credits: Created by Hans Gault
Jugglers needed (base version): 3 good

This is in fact a tornado in which the feeder also spins, but in the reverse direction compared to the feedees. On the drawings below, the direction is different from the tornado. I had also done the drawings for a version where everydody spins in the other direction (which I think is easier, but opinions vary).

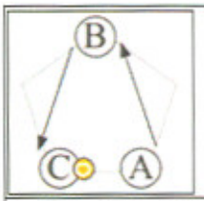
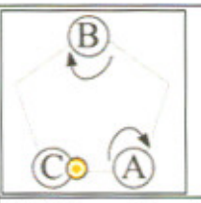
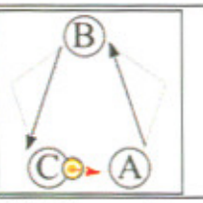


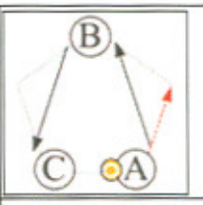
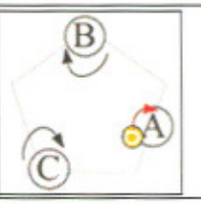
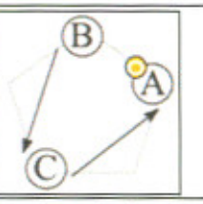
Beer passing

Jugglers needed (base version): 3 good

This beer passing is nothing more than a special runaround. What happens here is, we put down one club (or more) and replace it with a glass of beer (or anything else if you're not into beer or alcohol). The purpose is then to drink one (or more) gulp when you have the glass.

You need 4, 5 or 6 clubs (depending on how difficult you want it to be, and how drunk you already are) and a glass of beer (the yellow disc in the diagrams below). I give some detailed explanation for 6 clubs, but the process really is the same with fewer clubs.

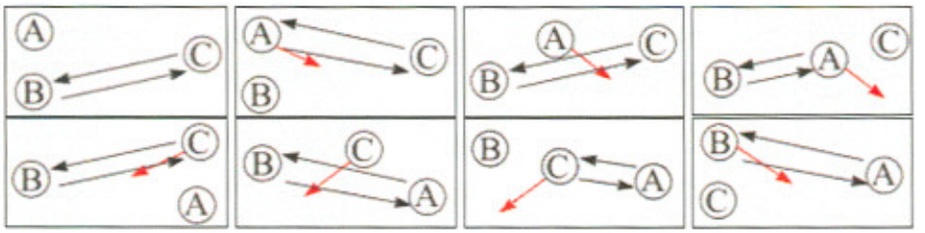
		
A & B start with 3 clubs each on a 2-count. C has the glass in his right hand (and can start drinking). With 5 clubs, B only has 2 clubs and thus doesn't make this first pass.	A & B are doing their LH self. C catches B's first pass, and keeps the glass in his RH. B catches A's pass. A doesn't catch anything, he now only has 2 clubs.	A & B pass. C can now give the glass to A (I did not say throw).

			
B & C are doing a LH self. To free his RH, C must now have given the glass to A.	A & B pass. This is A's last pass. He can start to drink, but he also has to move to B's side.	B & C are doing a LH self. C now has 3 clubs (unless you started with less than 6). A is now moving and drinking at the same time if he can manage that. This is also the moment where a fourth can come and replace the empty glass with a full one.	Back to the beginning, but the roles are different.

Turbo

Jugglers needed (base version): 3 advanced

Turbo is somewhat like Bruno's nightmare: constantly rotating the feeder's position. But turbo uses fewer steps to change posts, making it significantly harder. The juggler who moves (A in drawing 2) must begin turning right away to prepare for the next pass (drawing 4).



Rhythms :2−count for the feeder and 4−count for the feedees (the problem is knowing when to start feeding and when to stop).

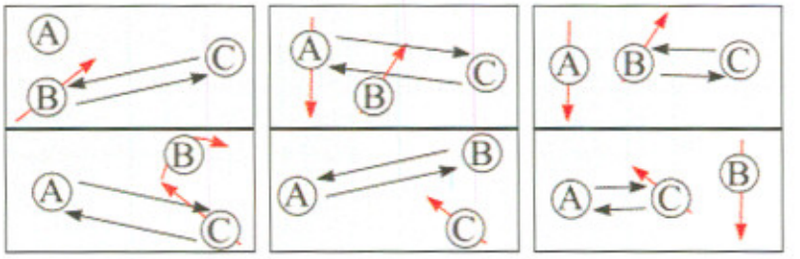
3-count Bruno's nightmare

Jugglers needed (base version): 3 advanced

The idea is similar to regular Bruno's nightmare, except now the feeder is in 3-count. It's slower, and there is one less pass to make when changing places.

In the regular version, the change in positions takes three passes (from the mover's point of view; for the feeder it's 12):
- the first from the starting point (facing the current feeder)
- the second while crossing through the middle of the other two jugglers
- the third beside the feeder (which is also his last pass as feeder)

In the 3-count version, the last pass is omitted. More specifically, after the pass is made from the middle (B in fig. 3), the moving juggler should continue moving to the other side while turning around (fig. 4), preparing to make his pass to the next feeder 6 counts later (fig. 5).



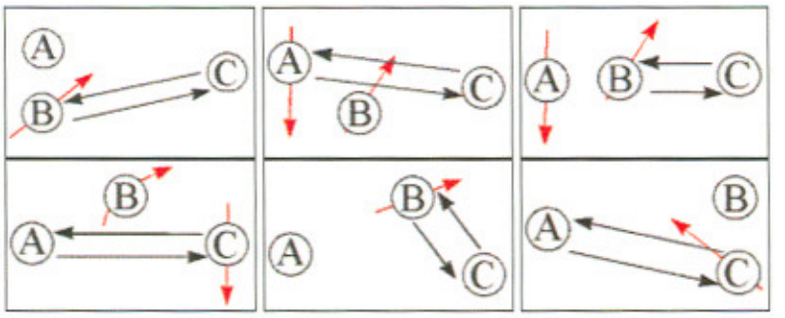
Rhythms:
Three-count (waltz) and 6-count (one person passing with the right hand, the other with the left). To recap, the table below illustrates a full cycle (corresponding with the diagrams above).

	1st rotation	2nd rotation	3rd rotation	4th rotation
A	6-count L	3-count	6-count R	6-count R
B	6-count R	6-count R	3-count	6-count L
C	3-count	6-count L	6-count L	3-count

Bruno's nightmare

Credits: Bruno Saxern &Martin Frost
Jugglers needed (base version): 3 good

Bruno's Nightmare is in fact a rotating feed in which one juggler moves through the middle of the passing pattern. In this pattern, one must imagine that each juggler represents one ball in a giant 3−ball cascade.



The above diagrams show B's movement, passing through the pattern to the other side. The feeder's position then changes from C to A. It's the feeder (C in this case) who counts (if there is a need to count) the 6 passes it takes to change positions. As soon as C makes the sixth pass, it's his turn to begin moving to the other side, passing in 4−count (every other). A is left as feeder, (switching to 2−count) and counts his first pass at the same time as C's sixth.

During B's movement, A should also move slightly (see figures 2, 3, and 4), otherwise B might get knocked in the head.

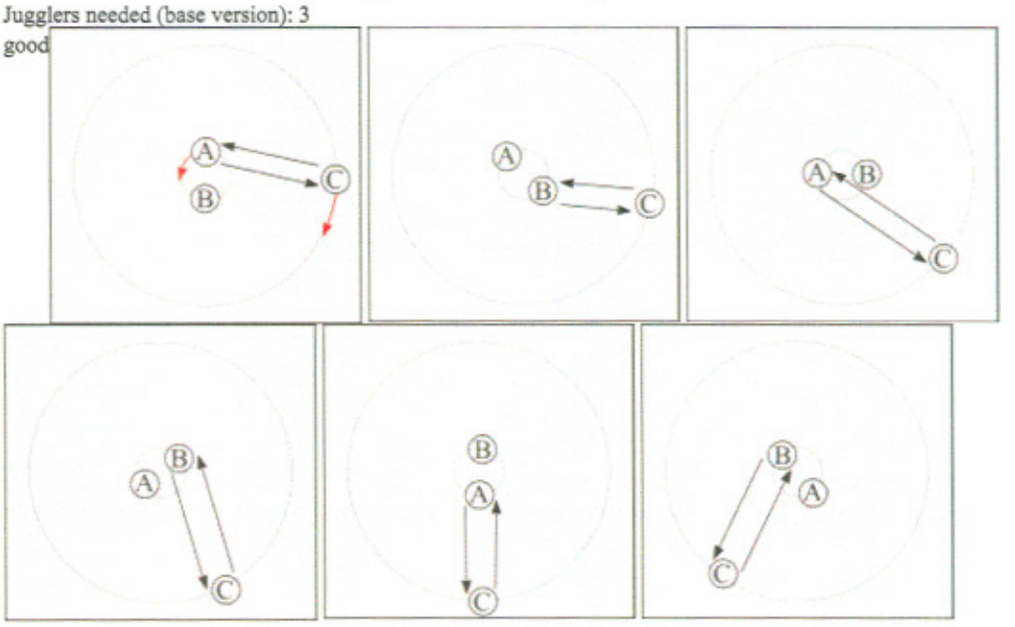
Once you learn this, try Bruno's nightmare in 3−count or turbo with 3.

Rhythms:
4−count (every other) and 2−count (solids) as in a normal feed.

Hans Tornado (Inversed)

Jugglers needed (base version): 3

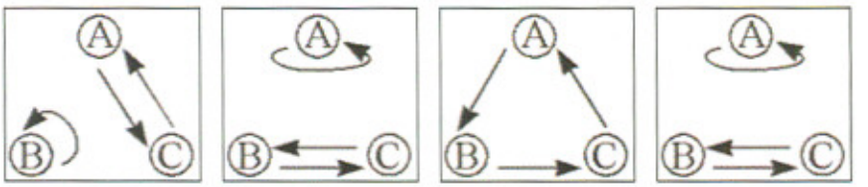
good



version with normal spinning

Triangle 2 (3 jugglers)

Credits: Created by Ed Carsten and/or Co, first publication by Ed Carsten
Jugglers needed (base version): 3 intermediate



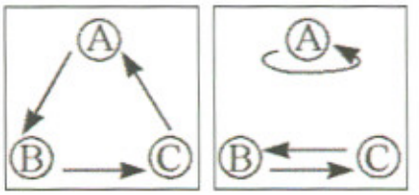
Rhythms:
A: 4–count
B: SPPP
C: 2–count

try also the 4–juggler version.

Triangle 1 (3 jugglers)

Credits: Created by Ed Carsten and/or Co, first publication by Ed Carsten
Jugglers needed (base version): 3 intermediate

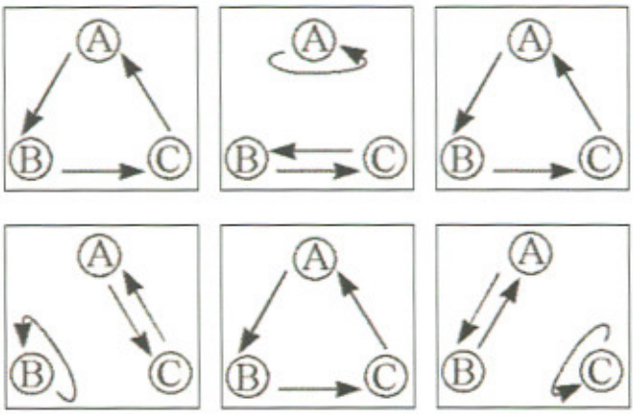
One version in which there are 2 jugglers feeding (B & C):



Rhythms:
A: 4–count
B & C: 2–count

You can also put a fourth juggler in the middle: 4–juggler version.

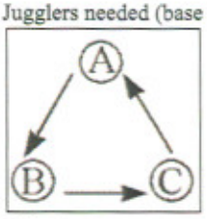
Here it's similar, but you swap roles every 2 counts (change of feedee).



see also: 4–juggler version.

Triangle

Jugglers needed (base version): 3 intermediate



This is the classical triangle pattern, the diagram showing a rhythm with passes made from the right hand. Using such a rhythm, you can do outside passes (as in the diagram) or inside passes (a pass from A's right hand to C's left), or you can alternate. But you also can (and should) use a lot of different rhythms or try the variations described on the pages triangle 1 and triangle 2.

Rhythms:

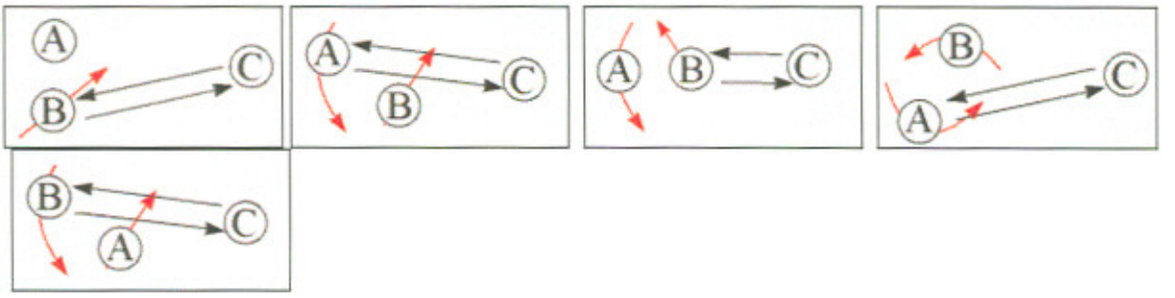
4–count or 2–count as described above.

The 3–count may be the best rhythm for this pattern and the most comfortable (for A : right hand passes to B, left hand passes to C).

But you can choose any rhythm (1–count, PPS, PPSPS...). Playing with PPS and alternating inside and outside passes is great fun.

Tornado

Jugglers needed (base version): 3 good



What we want here is to have A and B turning around each other. The feeling for starting the pattern (diagram 1 for B and 5 for A) is similar to the one in Bruno's nightmare.
The feeder should try his best to anticipate the movements of the feedees.

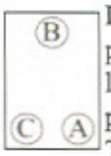
Try also Hans' tornado, so that everybody gets to move.

Rhythms:
4–count for A2–count for C
Should be doable with C on a 3–count.

Runarounds

Jugglers needed (base version): 3 good

Runarounds are passing patterns where a juggler gets rid of all their clubs and takes up another position where they will start juggling again by receiving clubs from their partners.



Imagine yourself in the diagram to the left: A and B have 3 clubs each and C has none. A &B are passing together in 2–count until B decides to throw all his passes to C. Now, after 3 passes A no longer has clubs, so B &C are left passing. A can now move next to B and wait until C decides to pass with him (As in the beginning between C and B).
This is the basic maneuver for the following patterns.

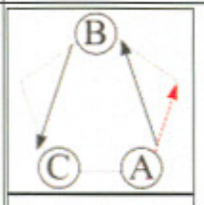
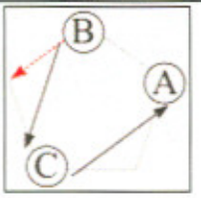
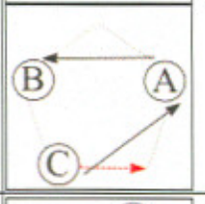
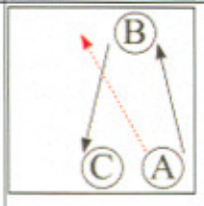
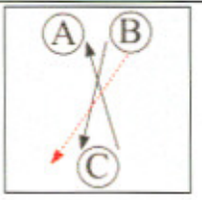
It is possible to perform the maneuver described here without anyone stopping. To achieve this, we must not pass to the person from whom we received our clubs. B starts passing directly with C. After 3 passes C will be ready to throw to A, who no longer has any clubs, and who will have quickly moved next to B.

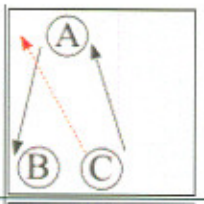
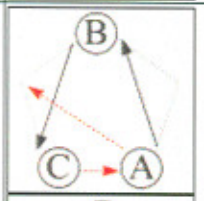
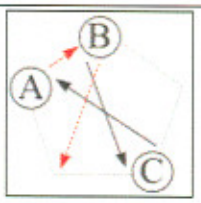
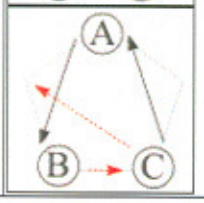
There are many ways to proceed with this maneuver, which may entail different positions to be taken by the jugglers when they move, or adding more clubs (or adding different rhythms but the descriptions here are given for a 2–count).

In the same spirit, the shooting star (4 jugglers) is a beautiful passing pattern, but much more dangerous...

Jugglers' Movement:

Three possibilities (that I am aware of) exist where the jugglers place themselves to the left or right of the juggler facing them when they move.

position	diagram	commentary
left (pentagon)	  	The juggler moves to place themselves to the left of the juggler facing them without crossing through the other two jugglers' pattern.
right (line)	 	The jugglers must go to the right of the juggler facing them. Therefore they must be ready to cross the pattern just after they throw their last pass. They must cross the pattern perpendicularly to the pattern. There is a risk of collision which can be avoided if the person who has just moved

		throws his last pass a little higher than necessary (C here).
right (pentagon)	  	The same thing as previously, but if jugglers don't move as far as previously, they can stay in a circle. All that needs to change is that the person next to the one who has moved, takes that person's place. As above, the same thing for applies for collisions.

Rhythms and numbers of clubs :

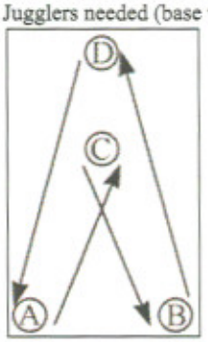
All the passing patterns that I describe are done in a 2−count. It is important to stay in time when one has less than 3 clubs, which means doing selfs (and not hand over a club) as if one has 3 clubs instead of 1 or 2.

Below is a table, which quickly summarizes some possible rhythms.

clubs	description
6	The moving juggler has 2 beats (his hands are empty after his last pass) to take up his new position. Therefore there is a lot of time, and it is not necessary to run or anticipate the move.
7 singles 	The pattern is basically the same as "6", except that the third juggler (C) starts with one club (instead of none). He are thus ready to throw his first club at the same time as the person who is about to move throws his last (A). There are two possibilities: • A (and the others will do the same when their turn comes) only throws 2 passes to B. He then arrives at his new position with the last club. He still has 2 beats to move, which gives him the opportunity for a flashy flourish, thumb−twirl etc... while he moves. • A throws his 3 clubs to B. Keeping in mind that he throws B his first club at the same time that he gets rid of his last, it is essential to anticipate the move. After his second throw, A should approach B and throw him his last pass while moving to catch the one thrown by C.
7 with doubles	The feeling is exactly the same as with 6 clubs except that the base rhythm is a 7−club 2−count. We can therefore add an eighth club as we did when going from "6" to "7 singles".

The Y (aka oogle)

Jugglers needed (base version): 1 beginner, 3 intermediate



It is the geometric position of the jugglers (upside down here) that gives this pattern its name. All passers pass at the same time on the same rhythm. Beware of the (minor) risk of collisions between the passes from A–C and C–B.

Then try the moving version: rotating Y or variations on Y (Oogles &Klingon) with more jugglers (5, 6 or 7).

Rhythms:

With 12 clubs

4–count (every other) or 2–count (solids). For kicks, try other rhythms like waltz.

With 14 clubs

It's possible to try this with 14 clubs and a staggered start. It works exactly like a 7–club 2–count pattern with 2 jugglers (here D and C) starting first, followed a beat later by A and B. Everyone may do doubles, or just D and C (with A and B continuing in singles).

With 16 clubs

4 clubs per person. Everyone starts at the same time and throws doubles.

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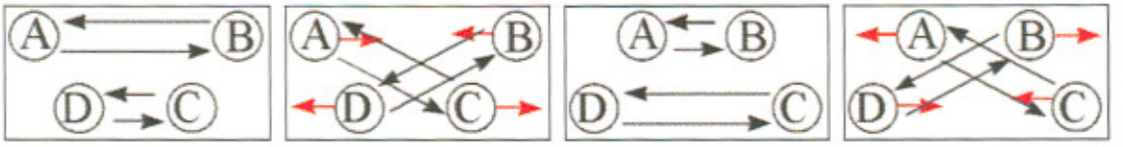
dynamic trapeze

Jugglers needed (base version): 4 good

This pattern is a moving version of trapeze (have a look first if you don't have a clue as to what trapeze is).



It involves moving from the front to the back (or vice versa) every 4 beats (or every other pass if not passing in 2–count). In this manner, jugglers always find themselfs back in the trapeze formation to make crossing passes, thus avoiding collisions. Each movement is made immediately after each crossing pass in such a way as to be in position for the next crossing pass.

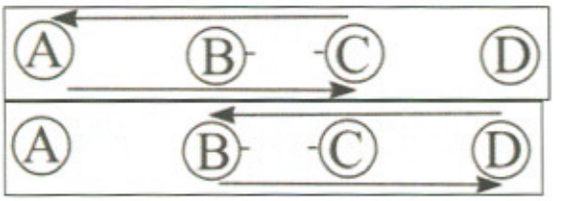
Rhythms:
Solids or other

---

4 jugglers line

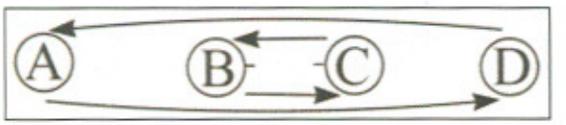
Jugglers needed (base version): 4 good

These are just some possible positions for 4 jugglers standing in a line. Some of them may not be interesting on their own. However, they can be used as a transition between 2 others. You can try (using a few half-pirouettes for the jugglers in the middle) to go from each position to the others.

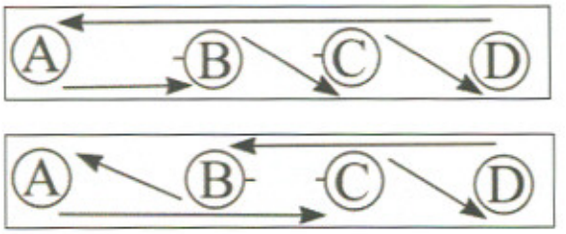


These 2 go together. The principle is the same as in the cross (go there to check out possible rhythms).

What's there to say?



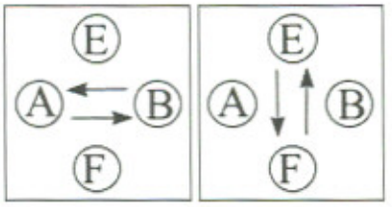
A and D can do their passes in doubles, and can even use 7 clubs.



These are the "improved" versions of the classical line with 3 jugglers.

The cross (aka the box)

Jugglers needed (base version): 4 beginners



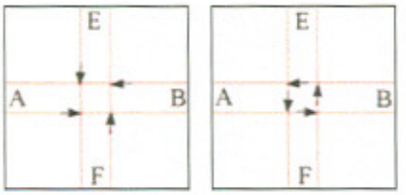
Rhythms:
Everything depends upon the rhythm in this one. The four jugglers all pass with the same rhythm, but this can be done in several different ways, the only goal being to avoid collisions in the middle.

In the **classic version**, everyone does 4–count; while A&B pass, E&F (why not C&D? Who knows?) throw right–handed selfs (fig. 1) and vice–versa.

Second option: everyone doing 2–count; while A&B pass, E&F throw left–handed selfs.

Third option: Choose any rhythm (often two–count but this is a chance to put the left hand to work, so try waltz too). Everyone passes at the same time and as if by some miracle, it can work. The diagrams at right explain why and show the importance of being well synchronized.

Here, it suffices to observe two moments in the clubs' trajectory. The positions of the clubs at each given moment are marked by black arrows, their trajectories by red lines.

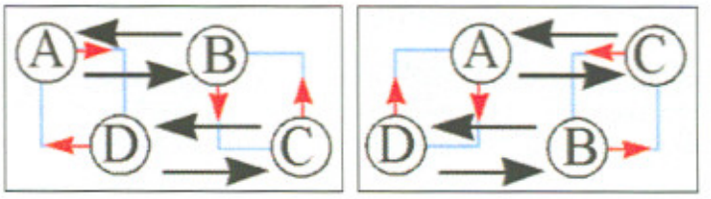


Fourth option: When this works it's a huge deal, and one may well wonder why. A&B and E&F do 7 clubs in doubles. To avoid collisions, each must be sure that he makes each of his throws just after the juggler to his right. If A starts first, F follows half a beat later, then B, and then E.

Try also the cross in PPS.

Pistons

Jugglers needed (base version): 4 intermediate



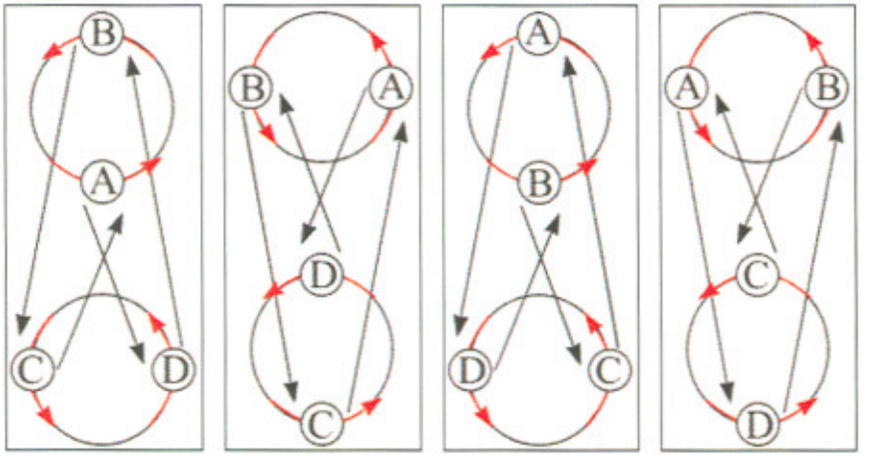
Two more diagrams would be needed to show a complete cycle, but it's fairly easy to understand what's happening. A&D always move in the same direction in a square, movin from corner to corner after each pass. B&C do the same in their own square. Passes are made alternately to each of the two passers in the opposite square. In a version that may be easier, passes may always be made to the same person if A&D rotate in the opposite direction.
The rhythm is usually a 4–count.

For a 6 jugglers version, try prism.

Rotating Y (aka oogle boogie)

Jugglers needed (base version): 4 good

This pattern is taken directly from the static Y. Essentially, at each step, the jugglers find themselfs once again in the shape of a "Y." Furthermore, as in the static version, each juggler always throws to the same person and receives from the same person (but those are two different people).



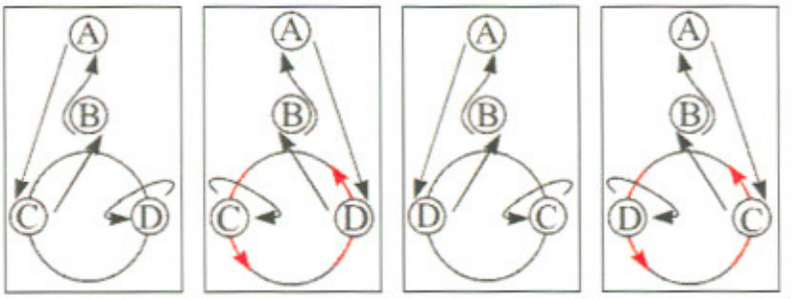
For this to work correctly, each juggler must be exactly in the right position each time while moving in an (imaginary) circle. It's important to visualize where one should be passing (it's even advisable to anticipate the movements of the others) and where incoming passes will come in (2 different places). In particular, in step 2 (valid problem in any step in fact), D may have a tendency to catch the pass intended for C.

Rhythms:

4–count (every other) or 6–count at first if it's too fast. You can also move only on every 2 passes (or 3, or 4...).

Unicycle

Credits: Created by Madison Area Jugglers, 1996
Jugglers needed (base version): 2 good, 2 advanced



A is the seat, B the fork, and C and D make the wheel with the circular path they follow. Passes from B to A are made over the shoulder (backdrops).
Along the same lines, see also the two-seated unicycle (6 jugglers).

Rhythms:
3-count (waltz)

Tarim's runaway

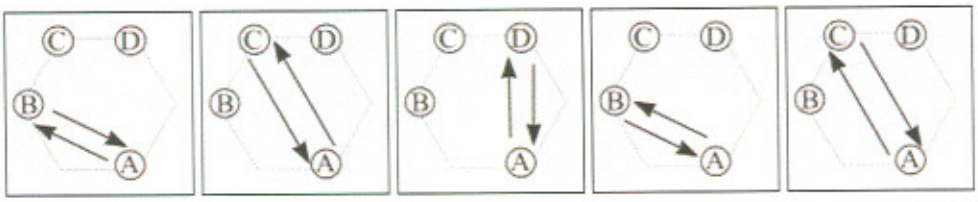
Credits: Created by Tarim
Jugglers needed (base version): 4 advanced

This one is quite tricky (Tarim called it Runaway because when asked to try it out, people usually choose to run away). I would strongly advise you to first try the two static patterns on which this pattern is based:

- PPS cross
- ultimate line feed (distribution 1 with carriage return)

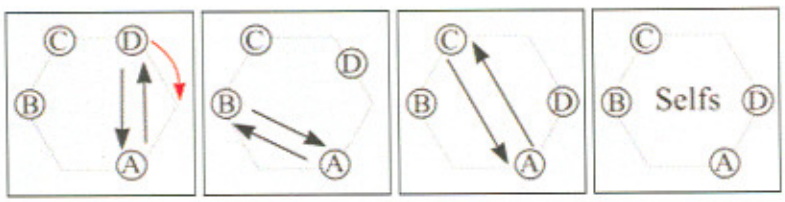
Then you can have a go at the transitions.

Ultimate line feed:

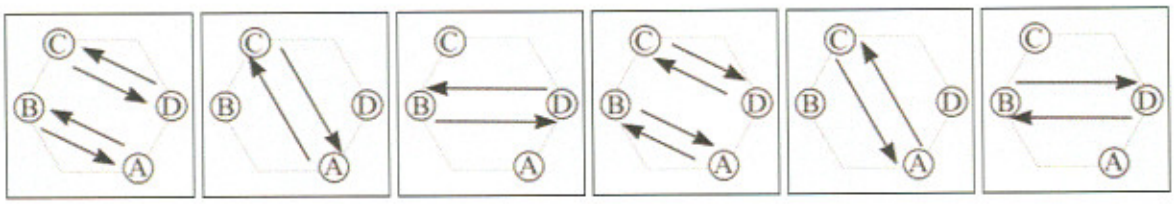


Transition 1:

After a right hand pass, D catches the incoming pass and moves to the next position, ready for PPS with a RH start and starting outside, self, inside, inside...

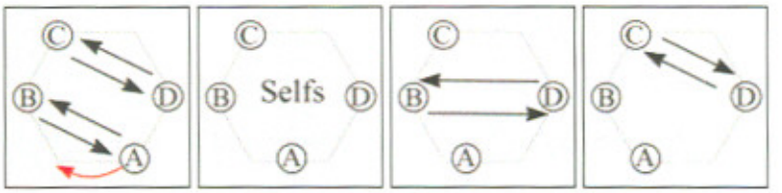


PPS cross



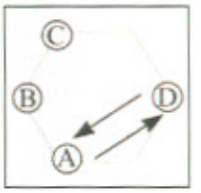
Transition 2:

A moves after a RH pass to B. Before that, he has taken care to say "now" to C on their previous RH pass (so that C goes back to 3-count).
A goes to his new position with a RH pass to D 4 beats later. D, who has seen A moving, starts passing to him instead of doing selfs; he now is doing 1-count.



Ultimate line feed:

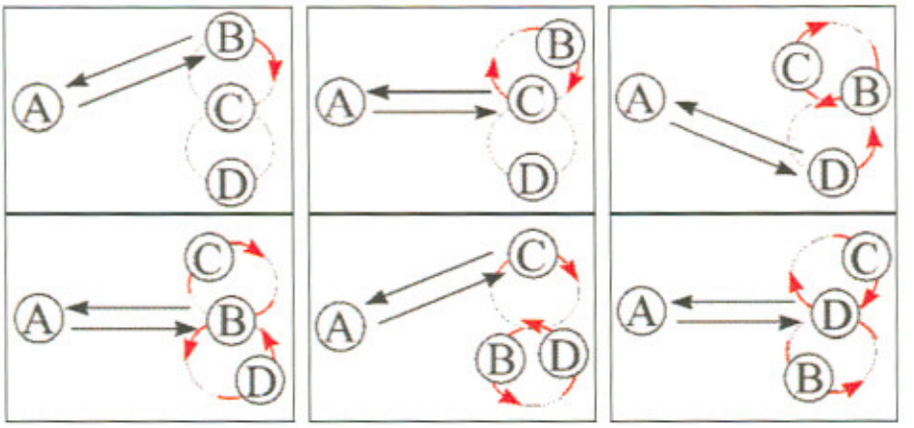
Back to the beginning, with different roles.



Speed-weave

Jugglers needed (base version): 1 intermediate, 3 good

In this pattern, there is one static feeder, and 3 moving feedees who are moving as if they were balls in a 3 ball cascade (a figure 8).



Some details:
The feedees are always moving. They can make a very short pause each time they're throwing (and receiving) a club, i.e. each time they're in the center or on the outside (where B & D are in diagram 1).
One always moves backward when on the outside after passing. When in the center, you move forward and to the side (and you'd better hurry because somebody is waiting to pass behind you).
The feeder passes Right–Center–Left–Center–Right–Center–Left... He should try to anticipate his fellow jugglers' movements (i.e. short on the center, and long on the outside).
With the ***classical version***, the feedees are juggling a 6–count, which give them plenty of time to move (and to pick up should they need it).

Easy version with less passes:
In this slim version, the feeder only passes to the center. The feedees keep moving as in the classical version, but they only pass when in the center position. Erase the passes in diagrams 1, 3 and 5 and replace them with selfs.

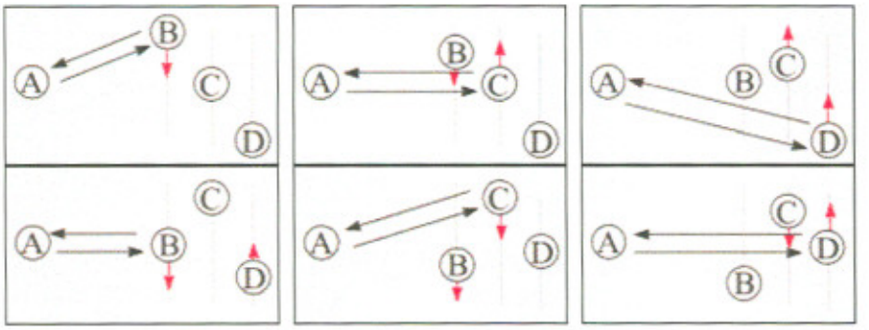
Try also the dresser drawer weave (which might be easier).

Rhythms:
In the usual version, the feeder is doing a 2–count and the feedees are doing a 6–count.
In the easy version with passes only to and from the middle (see speed–weave), feeder in 4–count and feedees in 12–count.
In a hectic version, feeder in 1–count and feedees in 3–count.

Dresser drawer weave

Jugglers needed (base version): 3 intermediate, 1 good

The principle is similar to the classical speed–wave. We still have 3 feedees and a feeder, and they're doing pretty much the same thing. Pretty much, but not exactly, since in this pattern, the 3 feedees all have their own lines on which they're going to move. Not having to move on a small figure 8 shape makes it easier for them (but not for the feeder who has to vary the length of the passes).



Rhythms:

In the usual version, the feeder is doing a 2–count and the feedees are doing a 6–count.

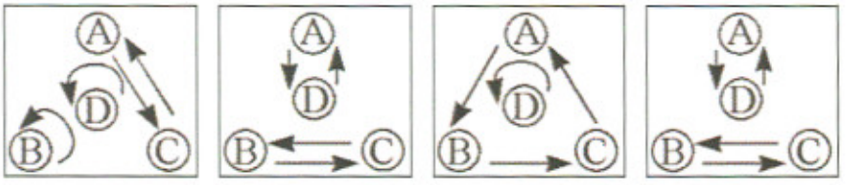
In an easy version with passes only to and from the middle (see speed–weave), feeder in 4–count and feedees in 12–count.

In a hectic version, feeder in 1–count and feedees in 3–count.

Triangle 2 (4 jugglers)

Credits: Created by Ed Carsten and/or Co, first publication by Ed Carsten
Jugglers needed (base version): 1 beginner, 3 intermediate

There is a 3-juggler version.

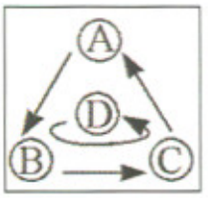


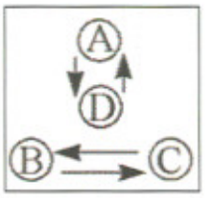
Rhythms:
A : 2-count
B : SPPP
C : 2-count
D : 4-count

Triangle 1 (4 jugglers)

Credits: Created by Ed Carsten and/or Co, first publication by Ed Carsten
Jugglers needed (base version): 1 beginner, 3 intermediate

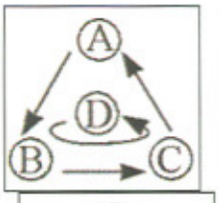
There is a 3-juggler version.

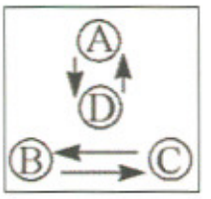


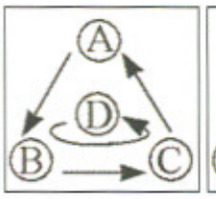


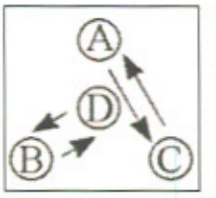
Rhythms:
A B and C: 2-count
D: 4-count

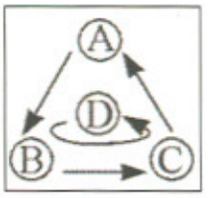
Another version with D turning around in order to face the others in turn.

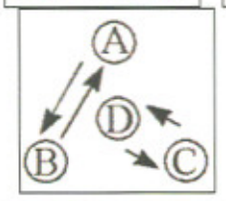






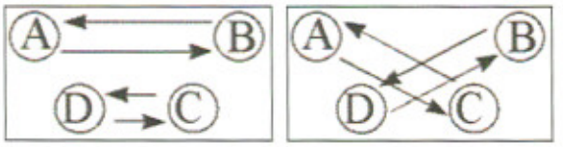






Trapeze

Jugglers needed (base version): 4 intermediate



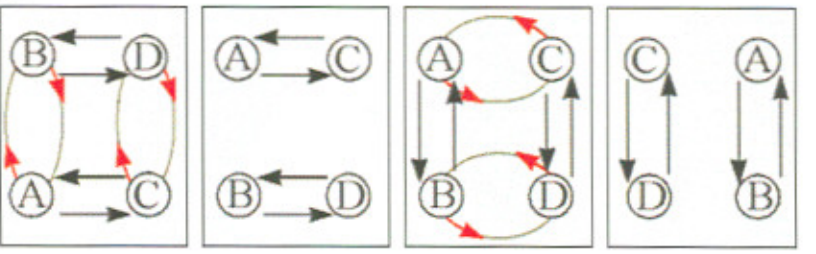
The arrangement of trapeze solves the interesting question of how to have 4 people all feeding (normally in 2–count) while avoiding collisions when the clubs are supposed to cross. Normally, if everyone's passes are dead on time, step 2 works without a hitch. Otherwise, it may be necessary to play with the distances (such as increasing the distance between A and B).
If everything works well, try the moving version: moving trapeze

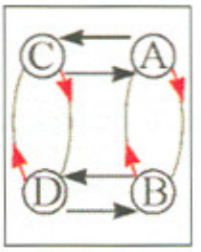
Other interesting solutions include forming a square and putting two people (A&C or B&D) on chairs or to play with precision in timing in a true cross.

Rhythms:
2–count or 4–count

Double rotation

Jugglers needed (base version): 4 good



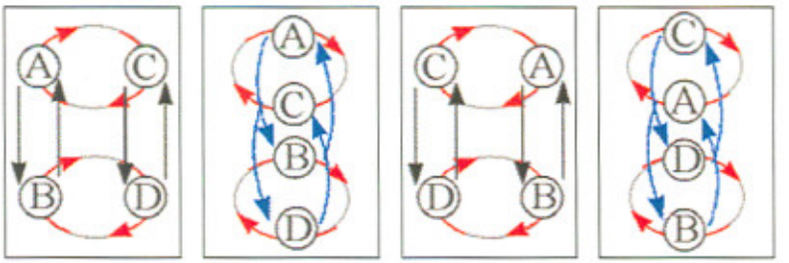


The diagrams do not show a complete cycle, but will suffice to show the concept behind the pattern.
Concentrating only on juggler A, we can say the following:
A passes to the juggler across from him (C), changes places with the juggler next to him (B), makes another pass to C, then turns 90 degrees to change partners and begin the cycle again.
When studying with the movements, it becomes clear that if A goes behind once (red arrow, figure 1), he will pass through in front the next time (red arrow, figure 3).

Rhythms:
4–count (every other). It's also possible to do a 6–count while changing positions.

Rotation

Jugglers needed (base version): 4 intermediate

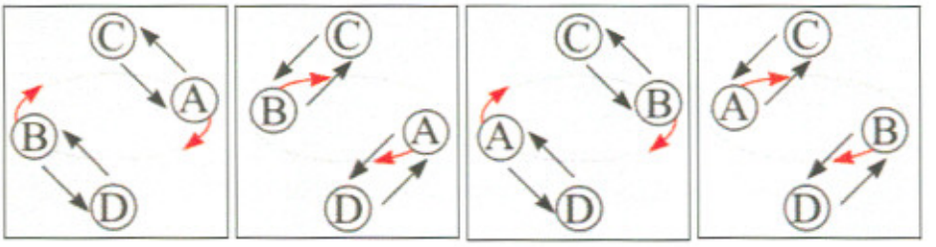


The passes in blue are optional. If you decide to do them, you may choose either to make a normal pass (trying to avoid hitting the person between you and your partner, as well as a nearly inevitable collision) or to make all passes in doubles (not crossing), which adds a nice visual effect (and simplifies the pattern) even if certain purists don't like the resulting dead time.

Rhythms:
4-count in both cases (it can be done in 6-count to simplify things in the version without the blue passes). Jugglers gone mad may try other, faster rhythms.

Benzene Ring for 4 jugglers

Credits: Created in July 1997 by Madison Area Juggers
Jugglers needed (base version): 2 intermediate, 2 good

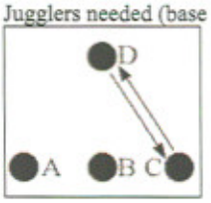


The diagrams should be enough. It's just a little bit fast for A & B when done in a 3–count.
The benzene ring is in fact a double unicycle without the seats.

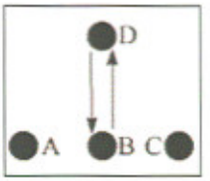
Rhythms:
3–count (waltz): A & B have only 2 selfs for moving or turning (but the diagrams show a 4–count).
Try a slower rhythm (4–count or 5–count) if the 3–count proves too hard.

Karamazovs' feed

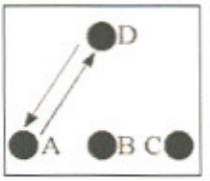
Jugglers needed (base version): 4 good



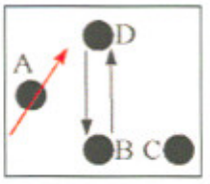
This is actually a rotating feed with 4 jugglers. The post (D here, at the beginning) juggles in solids (2–count). The jugglers on the ends (A and C at the start) are in 8 count (yes, it's slow) and the one in the middle (B) does every–others (4–count). Thus they begin with a feed where D feeds in the order: A, B, C, B, A, B...
A is the one who will move first.



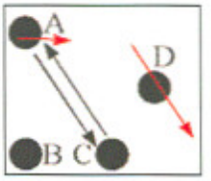
When D passes with B (just after D's pass with C—see the top diagram), A prepares to make his last pass.



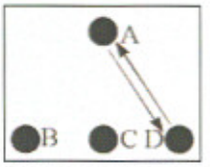
A makes the aforementioned last pass.



As soon as he has received D's pass, A moves quickly across, next to D, while the latter, upon seeing A move, makes his last pass with B (who then goes into 8–count).



At this time, A replaces D as post and passes with C (who should have already adjusted to the change and will then go into 4–count) and D moves quickly across next to C for the next pass.



A now passes with D, and the configuration is once again like the first step. While all this is happening, B, not having much to do, has time to do a few tricks.

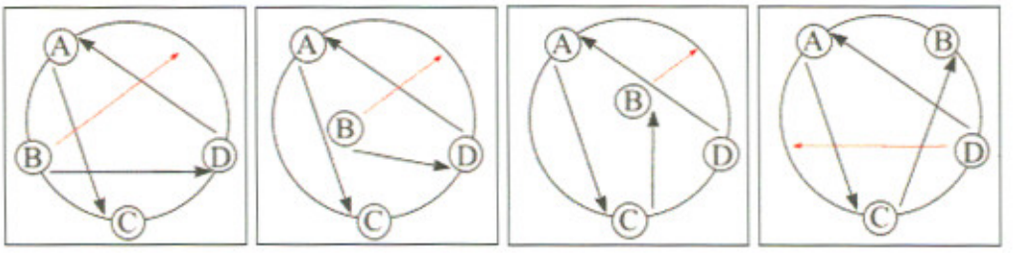
If you want more Karamazov patterns, try the Karamazov rotating feed (5 jugglers)

Shooting Star

Jugglers needed (base version): 4 good

This passing pattern is based on the star (the passes and positions are the same) from which a juggler has been removed. Then you have an empty space and C should not throw to that 'hole'. Thus C will start with no clubs (see variations at the bottom); all the others get 3 clubs.
Meanwhile, B does not receive any passes from the others, so when 3 passes have been made, he won't have any clubs left. At that moment, C will have 3 clubs, and will be about to throw a club in the hole. B now has to go through the pattern and be ready to catch C's pass.
Once B's there, you start again from the beginning, but B now has C's role and D has B's. That's the principle. Now there are a few different ways to cross the pattern (running and hoping you won't get hit by a club is one of them). Here is another one that works on a 2-count.

In fact, B only does 2 passes in diagram 1. Before making his third pass, B steps in the middle of the pattern so that A's pass will travel just behind his neck (diagram 2). He now has to turn to be ready to catch C's first pass (diagram 3) while D's pass to A flies behind his back. By moving backward, he reaches his new position and can breathe again (diagram 4). D can now start to worry about himself.



See also the other runarounds.

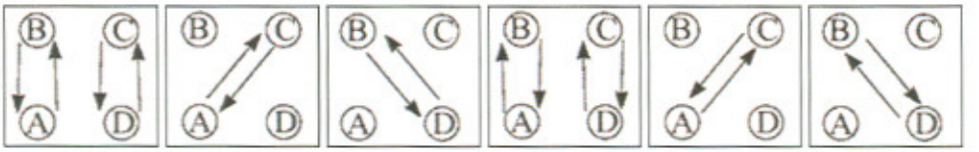
Rhythms and number of clubs:
The above version uses a 2-count and 9 clubs.
But you can also play with the rhythm (between 2 and 4-count) and on the number of clubs (you can add 1 or 2 clubs—though I don't know exactly how—with the 4-count). The more clubs, the faster it gets.

PPS Cross-feed (Two on Two double 3-count)

Credits: July 1997, Madison Area Jugglers
Jugglers needed (base version): 4 advanced

This isn't a true cross like the one I described on another page, but it's very similar, and after all, all you have to do is add a few passes.

Each juggler is in fact doing a PPS feed with the two people facing him. While A&C do PPS, B&D do PSP.



Row Row Row Your Boat

Credits: Julian Orbach, July 1997.

Jugglers needed (base version): 4 intermediate Technically, this is a fairly straight forward pattern. However, it has an interesting twist.

Four jugglers stand in a square facing in, and *sing*. The pattern is in the form of a canon or round – there are four verses, and each person starts with a different verse, so everyone gets to sing every part, at a different time to each other.

The song is the traditional *Row, Row, Row Your Boat.*

If you don't know the tune, try this site or you can download this small mp3 (32 Kb).

To start, one juggler starts at Verse 1 and every other juggler should be singing the verse immediately AFTER the juggler on their RIGHT.

The passing pattern is:

Beat:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Hand:	**R**	**L**	**R**	**L**	**R**	**L**	**R**	**L**
Verse 1								
Sing:	Row,		row,		row	your	boat	
Pass:	across		self		self		across	
Verse 2								
Sing:	Gent–	ly	down	the	stream		**.	
Pass:	self		left		left		self	
Verse 3								
Sing:	Merri–	ly,	merri–	ly,	merri–	ly,	merri–	ly,
Pass:	across		right		right		across	
Verse 4								
Sing:	Life	is	but	a	dream		**	
Pass:	self		self		self		self	

** It is easy to forget the extra beats in Verse 2 and Verse 4 as there is nothing to sing here.

The pattern *could* be done without singing, but it is actually *easier* to keep count by singing along and associating the passes with certain words. Failing to sing is not in keeping with the pattern, and is frowned upon in polite juggling circles.

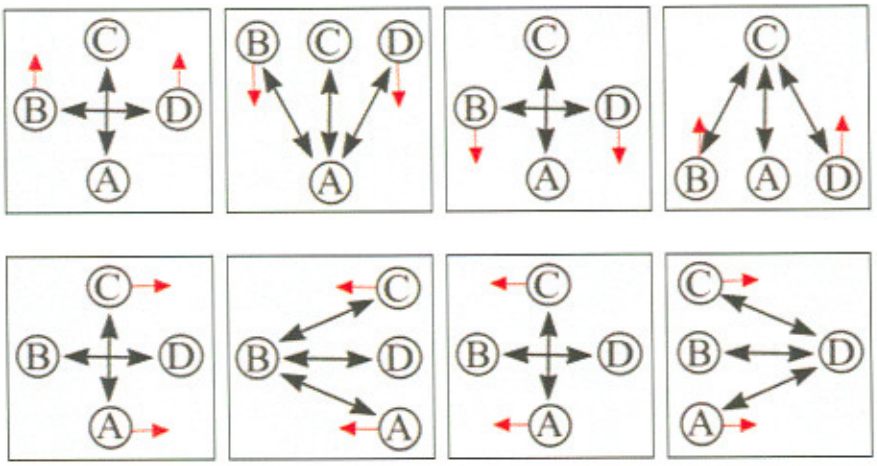
Variation: 1–count (i.e. Verse 3 is ultimates instead of 2–count)

Shifty Ferret

Credits: Created by Who?What?Why?Where? in Perth
Jugglers needed (base version): 4 intermediate

Shifty Ferret builds on the sweep feed and the box in order to create a dynamic pattern. It's not a difficult pattern if you can remember what to do and when.

The diagrams under do not show all beats, but only the different jugglers positions in a chronological order. Let's take the first 2 diagrams to see what happens in details, and I'll leave the rest for you to work out.
– in the first one, A&C pass first, then B&D pass and start moving to position 2.
– A&C pass again (between position 1 and 2).
– A, after his passes to C, becomes feeder in a 2–count and feed D, C & B once.
– A comes back to a 4–count after a last pass to C (between position 2 and 3).



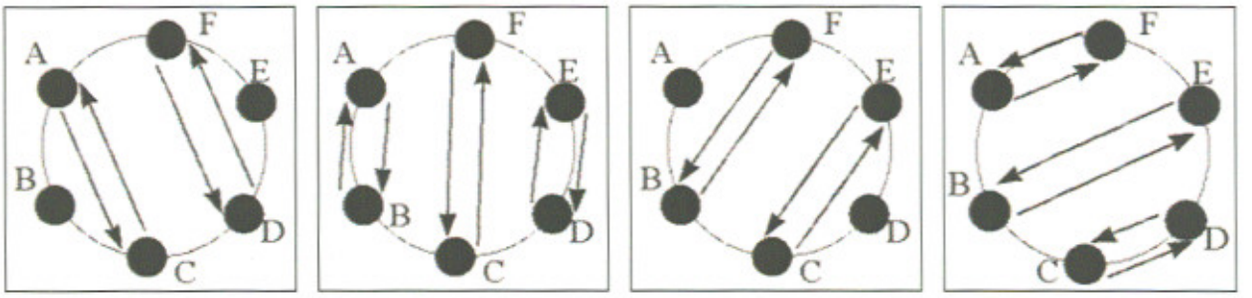
Jugglers alternate in fact between 2–count, 4–count and 8–count. But it's easier to try watch what's happening and pass accordingly than to remember the whole counting cycle.

The Clock (Boston Circle)

Jugglers needed (base version): 5 intermediate

This pattern has also be called "Turning Circle" or "Feast".

For the clock, the successive passes of a same juggler are made to different persons.
As many jugglers as you want can participate (with a minimum of 3), they are arranged in a circle. Each juggler passes in turn to all the other jugglers, including themselfs.
The juggler A will begin with a pass for C (diagram 1), the next pass will be for B (diagram 2), but after that, the pass is for himself, he will do a self (diagram 3) then will continue with a pass for F (diagram 4), and so on.



If there is an odd number of jugglers, one of them will begin with a self (the pass for himself).

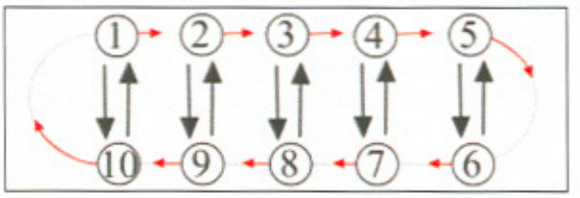
Aidan had suggested in the comment to try the moveable feast as a nice variation. This pattern now has its own page: the moveable feast.

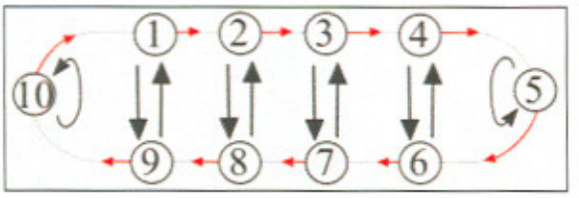
Rhythms:
Any passing rhythm.

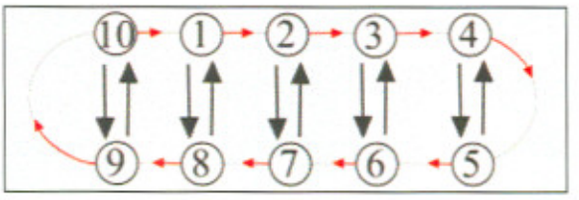
Moveable Feast

Jugglers needed (base version): 6 good

The moveable feast is a variation on the clock, where every juggler passes to all the others in turn, including themselves. The jugglers start in 2 lines facing each other and pass to the person opposite them. So, no matter how many people join in, there are no awkward long passes.



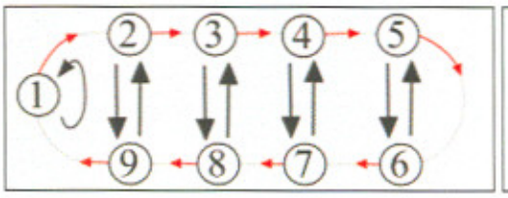


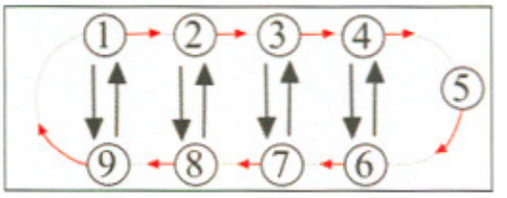


These diagrams for 10 jugglers should give you a good idea of the pattern, even if they don't show a full cycle. Here are a few more tips:

- The usual rhythm is a 4–count for everybody
- After each pass, everyone moves 1 step to the left, so their next pass will be with a new partner (the person next to their last partner). In the diagrams, J7 passes with J4, then J3, then J2, ...
- After passing at the left end of each line (J5 and J10 in diagram 1), a juggler has 7 beats to change side, 3 selfs, a pass to himself(!) and 3 more selfs. Some people might prefer to gather their clubs and start again on the other side.
- Adding 2 jugglers to the pattern is fairly simple. One joins each line.

If you have an odd number of jugglers, then there will always be somebody changing line. See the diagrams under for 9 jugglers.





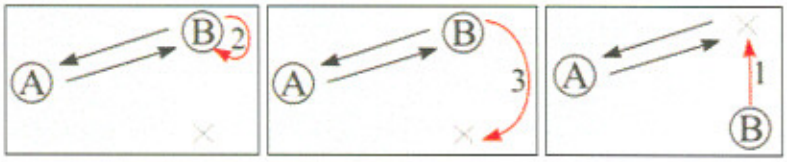
Gandini's siteswaps weaves

Jugglers needed (base version): 4 good

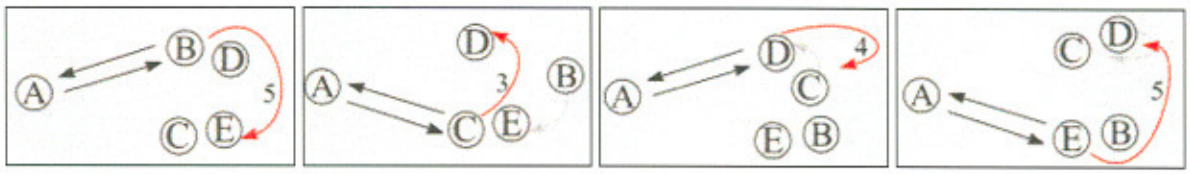
The principle is to use a feeder that will represent the brain of a giant juggler. The balls are represented by other jugglers (the feedees) who go back and forth between 2 positions (the cross on the diagrams) where they pass with the feeder; these positions are the giant juggler's hands. We're also going to use a bit of siteswap theory.

The feeder passes alternately to both positions (and usually in a 2−count). A feedee will be either in one of the hands, or queuing behind if there is already someone there. When a feedee is in the hand, the feeder (at the same time as the pass is made) will give him a number (corresponding to a siteswap throw). The feedee will then move according to this number (let's call it n) and we have:
− (number of right hand selfs before the next pass) = n−1
− if n is even, the feedee will queue again for the same position (hand)
− if n is odd, the feedee will change hands.

Here are a few diagrams to show you what a feedee should do when the feeder says 1, 2 or 3.



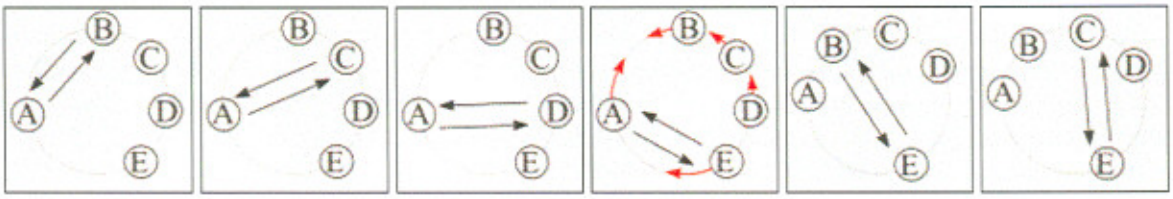
On a general level, the feeder will choose a working siteswap sequence, and the feedees in front of him will arrange themselves to start correctly (compare with how many balls in each hand you need for the true pattern), and there you go!
The feeder can choose to change the siteswap sequence at any moment since he's saying the numbers out loud. Below is an example for 534 (4 feedees since it's a 4 object pattern):



Karamazovs' rotating feed

Jugglers needed (base version): 5 good

This rotating feed is an invention of the "Flying Karamazov Brothers" who presented it on stage during their show. Each juggler in turn will become post in a line feed, and in fact only makes one sweep through the line, after which the last feedee becomes the feeder. To allow the formation to turn, the jugglers should form a circle rather than a true line. You may, of course, try this with a smaller or greater number of jugglers.



In the diagrams, A is the post at the beginning. He feeds the other 4 in order, and the feeder changes with A's pass with E (at the end of the line). Everyone then repositions themselfs (cf. diagrams 4 and 5) and E continues as post. The next feeder will be D, etc....

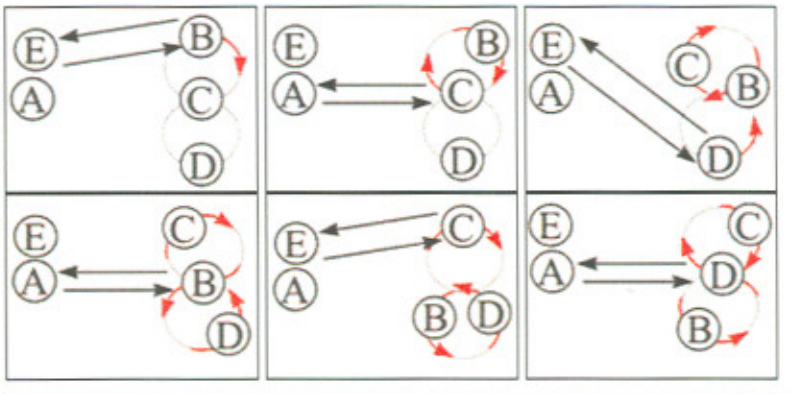
Along the same lines, there is also the Karamazov rotating feed.

Rhythms:
the classical version is 2–count for the post and 4–count for the others, now it's up to you to use your imagination.

Speed-weave with 2 feeders (Mr. Inside Mr. Outside Weave)

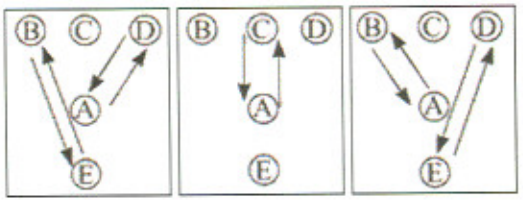
Jugglers needed (base version): 2 intermediate, 3 good

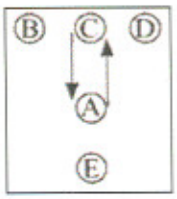
You just take the speed-weave, but you give the feeder position to 2 people—A & E who are then doing a 4-count. E makes the outside passes, while A passes to the juggler in the middle position. You can also try it with E standing on A's shoulders.



Double feed (aka Apollo)

Jugglers needed (base version): 1 beginner, 1 intermediate, 3 good





The easiest rhythm (shown in the diagrams) is:
–A in 2–count
–B, C, D & E in 4–count.

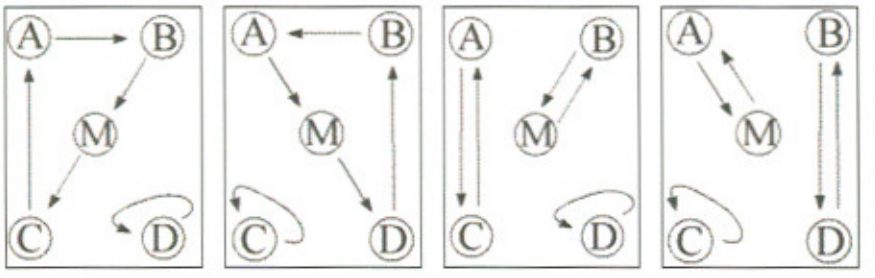
To make some jugglers' left hands participate, this can also be done with:
–A in 1–count (ultimates)
–C in left–handed 2–count
–B, D, & E in right–handed 2–count

Finally, you might try adding a club (on a rhythm with A in 2–count). Thus A starts with 4 clubs. E, B, & D start one count later, and C starts one beat after A's second pass (which is coming to him). For E, it feels the same as before.

Torture Chamber

Credits: Created by Carsten &Co, first publication by Ed Carsten
Jugglers needed (base version): 2 intermediate, 2 good, 1 advanced

Well, the figures below combined with some comments should do it. When it's all said and done, it's much easier to explain than to do.



Given that C and D are in every others (4–count), these should normally be the easiest positions, but they must be able to catch M's potentially hazardous passes. That's all for C and D. The others are all passing in solids (2–count). M faces A and B.

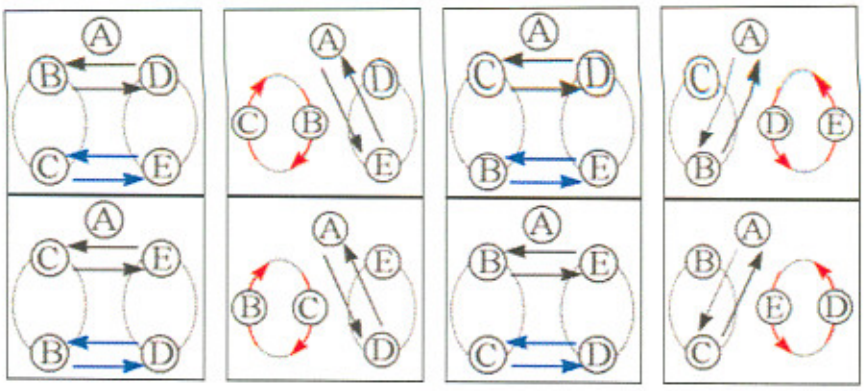
Positions A and B are a little harder. A should wait for a pass from C when throwing to B (steps 1 and 2). This makes a 90° angle. Also, they are doing solids (2–count), making a feed without a carriage return (cf. line feeds).

Finally we have M (as in Masochist). That's where it's best to have a good passer. Since M faces A and B, the passes to C and D are made blindly. Either the two passes are made over the shoulder (backdrops), or M can turn slightly and throw under his arm to C and over the shoulder to D.

If you want to add more people, see how with torture chamber for 7.

Egg beater

Credits: Created by Mike Newton &Madison Area Jugglers, blue variation invented by Martin Frost
Jugglers needed (base version): 5 good



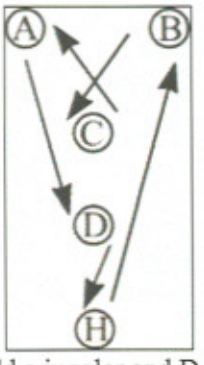
Rhythms:
2–count for A, SSPSPSSP for the others without the blue passes.
2–count for A, PSPPPSPS for the others with the blue passes.

Oogles &Klingons

Credits: First publication on the web by Chan Wilson
Jugglers needed (base version): 1 beginner, 2 intermediate, 2 good

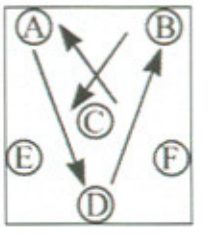
Here are a few variations on the Y (aka Oogle) in which 1, 2 or 3 jugglers can be added to the pattern.

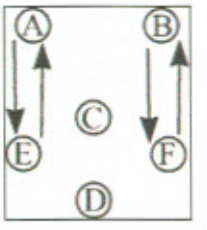
Double Oogle



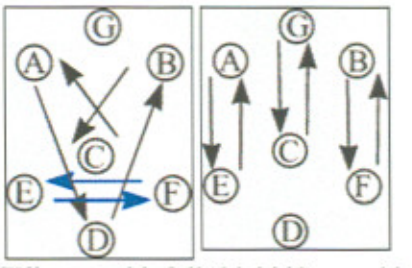
You add a juggler and D passes dropback to him.

Klingon (Oogle with wings)





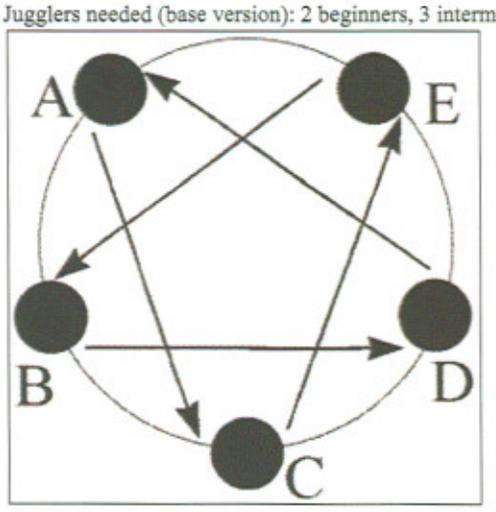
Klingon with shield



(Klingon with full shield if you add the blue passes)

Star

Jugglers needed (base version): 2 beginners, 3 intermediate



The diagram (here passing with the right hand with the same rhythm) simply lays out what a star looks like. The concept becomes interesting starting with 5 jugglers, but it's possible to add more (the distance of the passes increases with the number), as long as there is an odd number of jugglers.

Always keep in mind that the timing of the passes is important, otherwise there's a risk of collisions between B's passes and A's (or C's) for example.

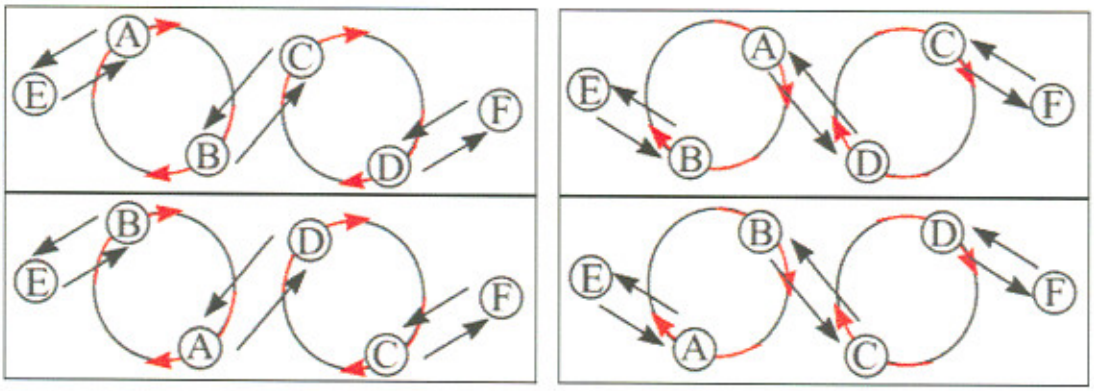
There's a dangerous version with 4 people: shooting star.

Rhythms:

Um, all of them (I think; in the end it depends on whether you can avoid collisions)

Razor

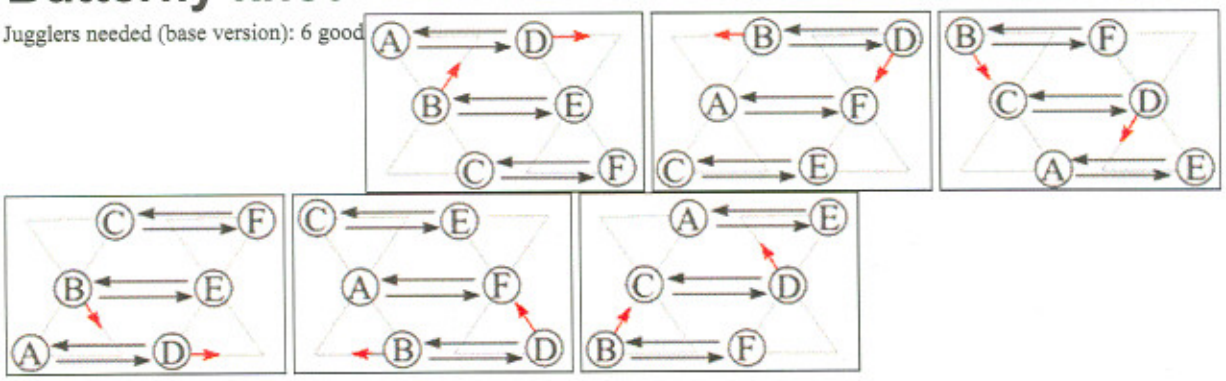
Credits: Created by Peter Kaseman &Madison Area Jugglers
Jugglers needed (base version): 2 good, 4 advanced



Rhythms:
3–count (very hard), 4–count or 6–count

Butterfly knot

Jugglers needed (base version): 6 good



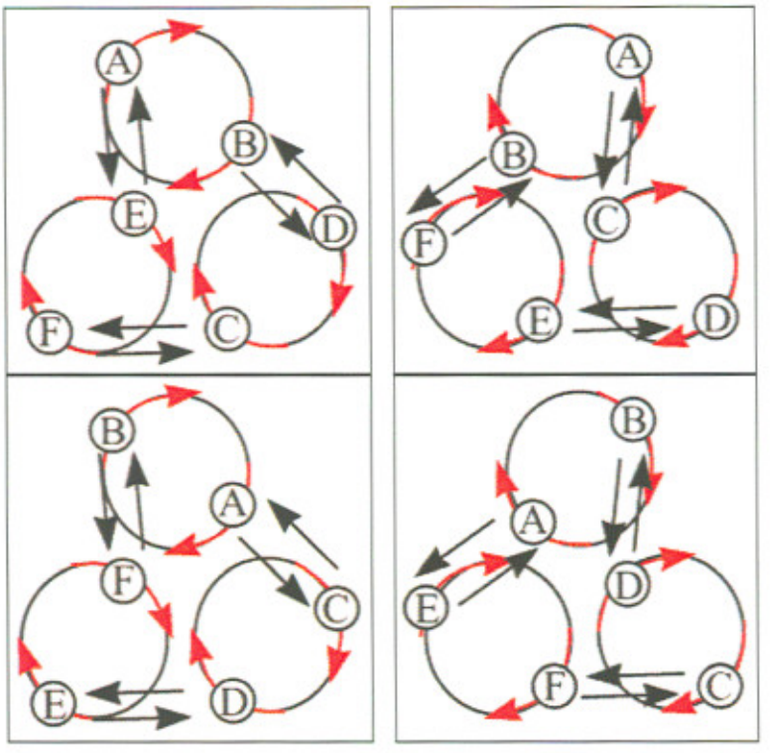
Rhythms :

4–count

Electrical Razor

Credits: Created by Peter Kaseman, summer 98

Jugglers needed (base version): 6 good



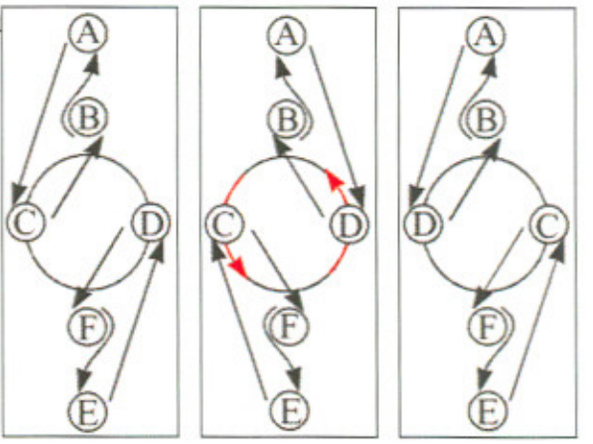
Rhythms:

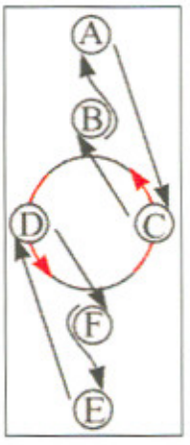
3–count (very hard), otherwise 4 or 6–count

Double unicycle

Credits: Created by Madison Area Jugglers

Jugglers needed (base version): 4 good, 2 advanced





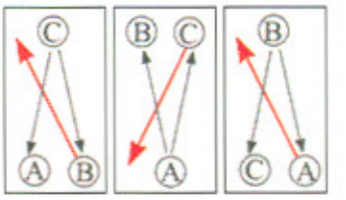
First have a go to the basic version: the unicycle (4 jugglers). The benzene ring for 4 can also help you build up to the pattern, since it's a double unicycle without the seats.

Rhythms:
3–count (waltz)

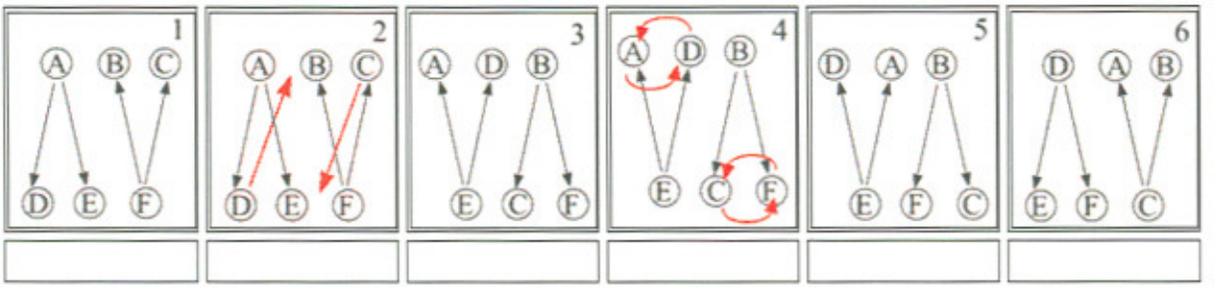
Magermix

Jugglers needed (base version): 6 good

I've never tried this pattern, since I'm even not sure how it goes. Please contact me if you know. On the right is a representation of Bruno's nightmare (diagrams being slightly different than usual). And below is what I think would be magermix.



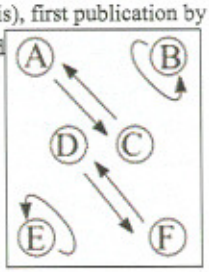
Bruno's nightmare

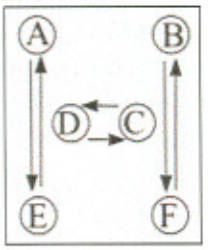


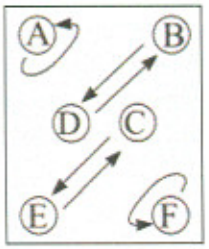
Hourglass

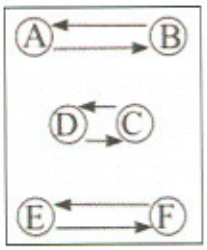
Credits: Created by Carsten &Co at IJA 1991 (St Louis), first publication by Ed Carsten

Jugglers needed (base version): 4 intermediate, 2 good



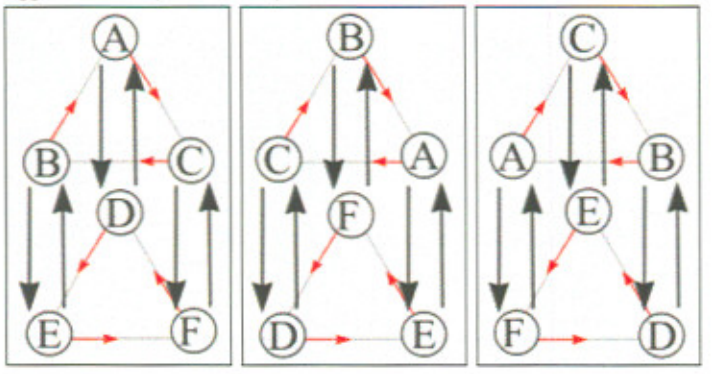






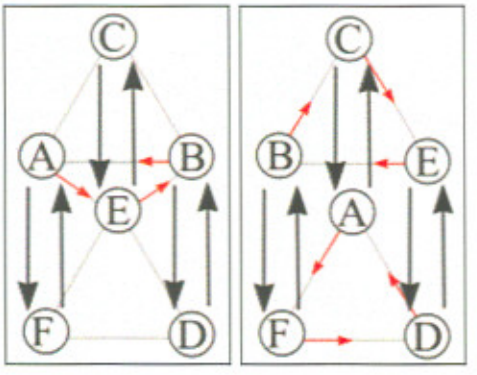
Prism

Credits: Created by Aidan, March 2003
Jugglers needed (base version): 6 intermediate



This is a variation of pistons for 6 jugglers.

A variation:



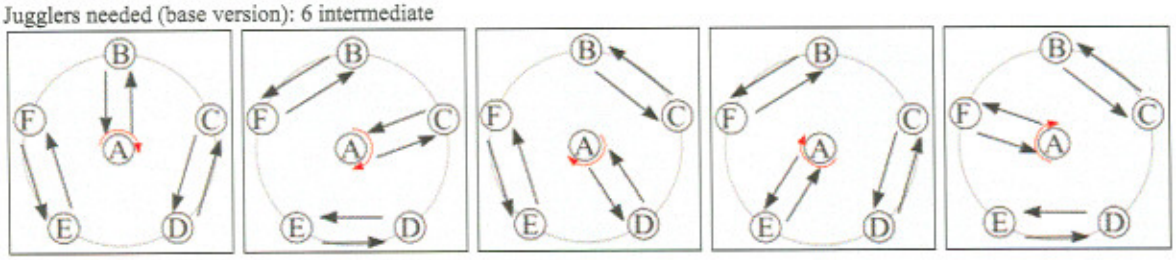
Aidan also came up with a variation where 2 jugglers swap sides in the pattern every 3 passes.

Imagine the jugglers have done the first 2 passes (see the first 2 diagrams above). Now replace the third diagram above by the first one on the left. The passes are the same, but the movement that follows is going to be different :
– C, F and D are not going to move
– A, B, and E are going to swap position in the middle triangle, and A&E also have to turn 180° while moving.
When this is done, A & E have swapped sides, and the normal pattern resumes for 3 more passes.

In this pattern, B never swaps side.

Spinning Top

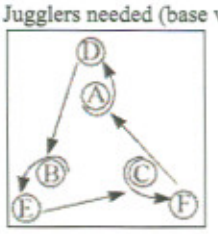
Jugglers needed (base version): 6 intermediate



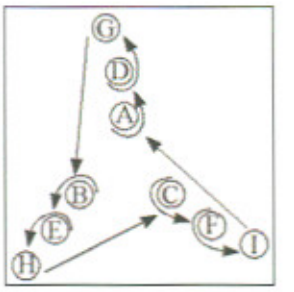
A turns in order to feed all the others alternatively.
The 5 others alternate their passes between their 2 neighboors, except of course when they're passing to A (the next pass is then made to the right neighboor).
You can try in with a 4-count or 3-count.

Inside-outside triangles

Credits: first published by Ed Carsten
Jugglers needed (base version): 6 good

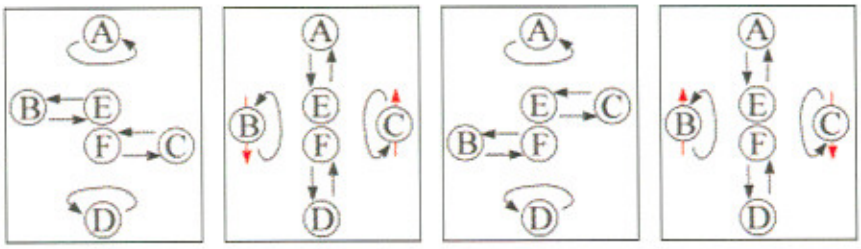


If the basic pattern is a 4 counts, it is possible to pass separately in the 2 triangles (inside and outside) on the beat of the self.
To enlarge this concept, it is also possible theoretically to add as many triangles as we want, as shown on the diagram on the right.



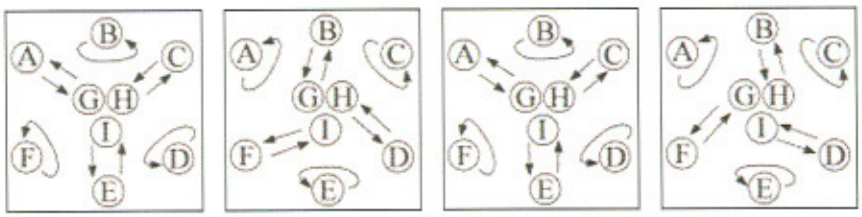
It's possible

Credits: A Rolla Rob Creation, first publication by Ed Carsten
Jugglers needed (base version): 2 beginners, 2 intermediate, 2 good



B and C can move slightly between each pass as shown in the diagrams, in order to ease E & F's task.

You can also add 3 jugglers to the pattern, which will make it easier for the first 6 (3 more since if you add somebody in the middle, then you need 2 more on the outside circle).

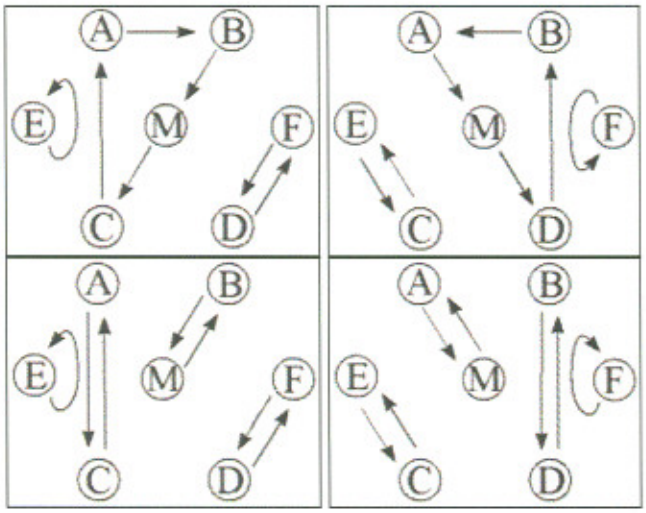


On the outside circle, you then have 2 triangles (ACE and BDF) that are doing a 4-count with a gap between them. If you take each triangle individually, it's not possible (due to the amount of stuff and jugglers in the middle) for the jugglers in one triangle to add passes among themselves instead of their selfs (A-C, C-E, E-A for example). But some early or late doubles could work.

Torture chamber for 7 jugglers

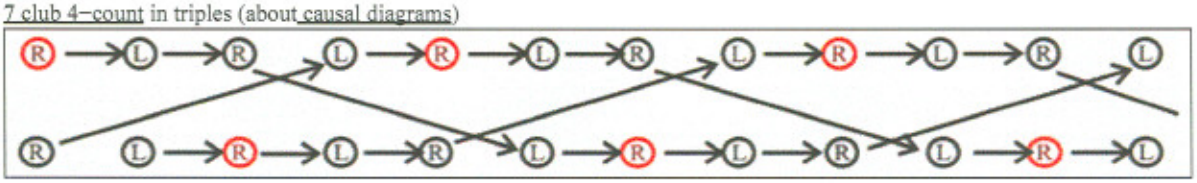
Credits: Created by Carsten &Co, first publication by Ed Carsten
Jugglers needed (base version): 2 beginners, 2 intermediate, 2 good, 1 advanced

Take the torture chamber for 5 and add 2 jugglers to make it 7. These extra 2 jugglers are going to do a simple 4−count: E will pass with C and F will pass with D. These passes, E−C and F−D will happen instead of C and D RH selfs in the 5−juggler version.



If E and F get bored (since they're only doing a 4−count), they can add another club to the pattern, and replace their RH selfs with some triple passes to each other. Then it's as if they're juggling a 7−club 4−count in triples, but making passes to C and D instead of their RH selfs (in red in the above diagram).

7 club 4−count in triples (about causal diagrams)



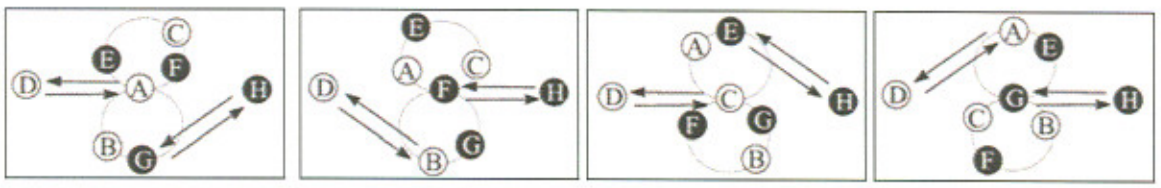
You can put more people in torture chambers.

Interlaced speed-weave

Jugglers needed (base version): 8 advanced

That's what it is, 2 speed-weaves, one inside the other. A, B & C are facing D and are doing a classical speed-weave. E, F, & G are facing H and are doing a speed-weave but rotating in the opposite direction (going backward when at the center position). I've not tried it yet, and to my knowledge, no one has.

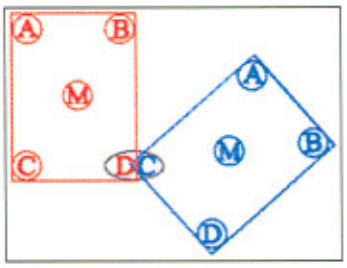
If this is possible, I think you'll have to juggle slowly in order to make room for everybody on the figure 8.



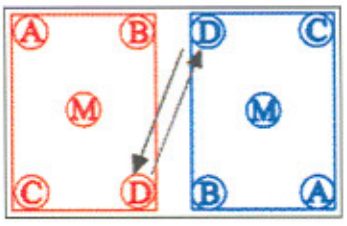
More people in Torture Chambers

Jugglers needed (base version): 8 good, 2 advanced

The principle is to connect several torture chambers. Two ways of doing that are explained here. If you don't know what is exactly a torture chamber, check the relevant page.



The first technique is to use one of the jugglers in a 4 counts (C or D but here the pivot is [D_red=C_blue] who is actually only one person) as a link between two chambers in which he is participating simultaneously.
This principle can then be continued until one circle is closed (3 chambers may be enough with 12 very good jugglers).

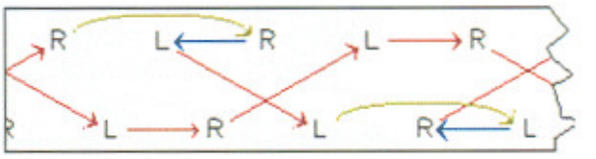


The other technic is to align two chambers alongside each other. The passes are the same at every moment in the two chambers.
The two jugglers D_red and D_blue are not then in 4 counts anymore, but in 2 counts, making passes between them instead of selfs.
With this technique, you can align as many chambers as the number of jugglers allows since C can also be used as a link.

RITMOS

Rhythms

These pages deal with possible passing rhythms for 2 jugglers.
The thing on the right is a causal diagram, understanding the patterns will quite often require you to understand this kind of diagram. For that matter, the article section in passingdb has a page that explains causal diagrams (http://www.passingdb.com/articles.php?id=3)



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6 clubs Whynot?

Credits: pattern invented by Christophe Prechac

This amazing rhythm was first revealed (at least I think so) in an article from Christophe Prechac: Symmetric Passing Patterns.

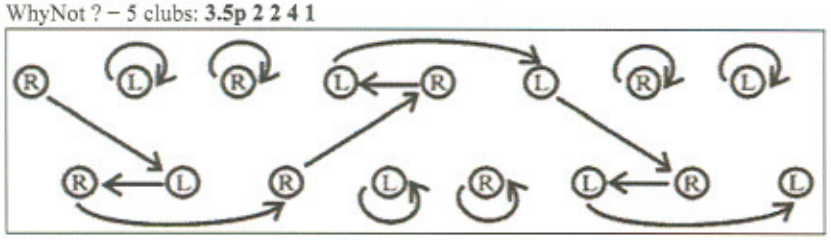
One juggler does crossing passes, while the other one does straight passes. All passes are singles (floaty singles, the siteswap value being 3.5).

The 5–club version may be considered a rhythm on its own (and surely is), but is a compulsory first step to the 6–club version. It will make it a lot easier for you to learn the **double–zip** thing that will allow you to catch a pass.

Explanation of the double–zip: when a pass is coming to your right hand (and similarly to your left hand), instead of freeing it with a usual self (3), you have to do a left hand double (4), followed by a right to left hand–across (1).

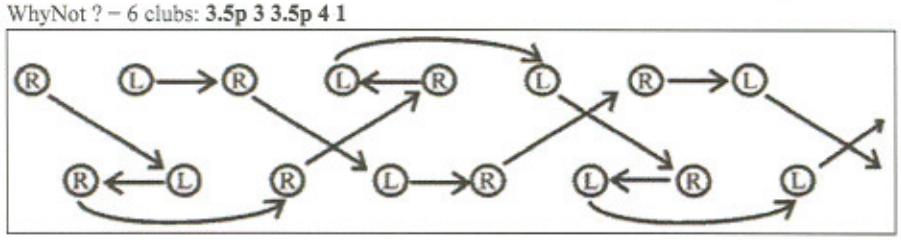
The 5–club rhythm is then:
double, zip, pass, hold, hold, and start again from the other hand. The hard part at the beginning is to know from which side you must throw the double.

WhyNot ? – 5 clubs: **3.5p 2 2 4 1**



We're using the holds on the 5–club version to add the 6th club (check out the diagrams: we've added another line instead of the 2s). The cycle becomes:
double, zip, pass, self, pass. If you can remember the pass–self–pass thing, which is a short 2–count, the 6–club rhythm feels natural once the 5–club one is mastered.

WhyNot ? – 6 clubs: **3.5p 3 3.5p 4 1**



To start, the best is to have J1 starting with 4 clubs, and doing pass, self, pass, double, zip. J2 starts half a beat later with the self double.
If you have 3 clubs each, J2 starts half a beat before J1 with a pass, then you do as if J1 had 4 clubs (as explained above).

The whynot can be seen as a four–hand siteswap: 86277

6 clubs NotWhy?

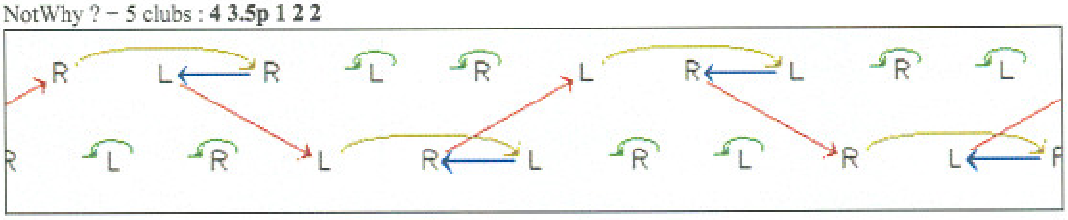
So why the name NotWhy?
There are two reasons, and I'll take responsibility for that. NotWhy and WhyNot? can also be described by a 4–handed siteswap, and the two look very much alike: 86277 for WhyNot?, and 86772 for NotWhy?. Moreover, I stumbled upon the fact that, if you read the causal diagram for WhyNot from right to left (instead of left to right), you find that it's NotWhy?. To this day, I haven't found another rhythm which, thus reversed, produces anything other than itself.
There you have it, and now we'll move on to the serious stuff.

Here also, one of the jugglers will make only crossing passes while the other makes straight passes. The passes are lofty singles.

If you have previously learned WhyNot, or if you are used to juggling a pattern as soon as you're given the complete cycle, you may skip straight to the 6–club version. Otherwise, the 5–club version will help you learn. Here, in order to catch a pass, you throw just one double, followed by a pass and a hand–across (zip). It's a little easier to get used to than the double zip in WhyNot?.

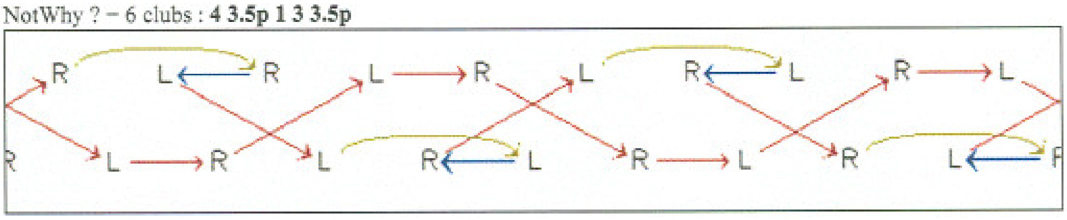
Thus the rhythm with 5 clubs is: double, pass, zip, pause, pause (then you start over on the other side). Instead of two pauses (siteswap 22), you could do a self, zip (siteswap 31).

NotWhy ? – 5 clubs : **4 3.5p 1 2 2**



We're using the holds on the 5–club version to add the 6th club (check out the diagrams: we've added another line instead of the 2s). The cycle becomes:
double, pass, zip, self, pass.

NotWhy ? – 6 clubs : **4 3.5p 1 3 3.5p**



Start: 3 clubs each (2 in the RH), J1 starts with a RH double and does crossing passes. J2 starts half a beat after J1's first pass (1.5 beat after J1's start) with a RH pass, followed by a double to start the cycle. J2 does straight passes.

ultimate–zip

The principle of these rhythms is exactly the same with 5, 6, 7 (or more) clubs. The base pattern is the 1–count (or ultimate) with 5, 6 or 7 clubs.
Reminder: the rhythm is RH pass, LH pass, RH pass, LH pass, ...

What's currently happening for the right hand is:
1 – a club is coming to my right hand
2 – in order to catch it, I throw back a club from my right hand

What you're going to do instead is:
1 – a club is coming to my right hand
2 – in order to catch it, I do a right to left hand–across (or zip)
3 – In order to catch the zipped club in my left hand, I throw back a club from my left hand

In fact, 2 and 3 are happening simultaneously. And since both your hands are working, you get a lot of hurries.
Note also that if the right hand throw is crossed in the normal ultimate, then the pass made from the left hand (step 3) are straight in ultimate–zip (and conversely).

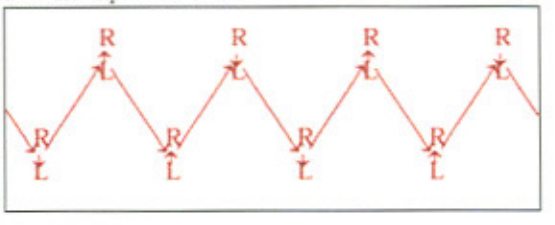
You can have only one of the jugglers doing the ultimate–zip; the other one does the normal version.

To start the rhythm, it's better to start from a normal 1–count, and, passing twice from the same hand, begin to do the zips. For example with a 5–count:

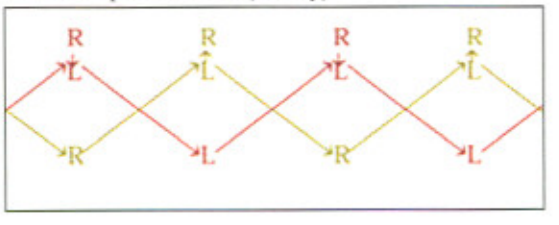
RH pass – LH pass – RH pass – LH pass – **RH pass** – [**RH pass** | zip LH to RH] – [LH pass | zip RH to LH] – .....
In the blue part, all passes are cross, in the red one, they are straight.

The more clubs the faster. Try making floaty passes, and begin with 5 clubs.

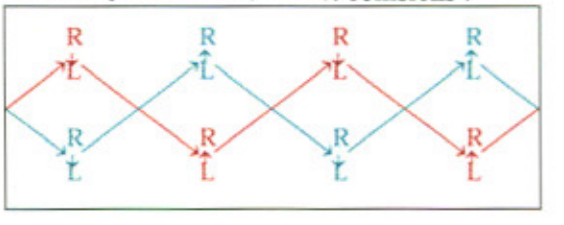
ultimate–zip with 5 clubs



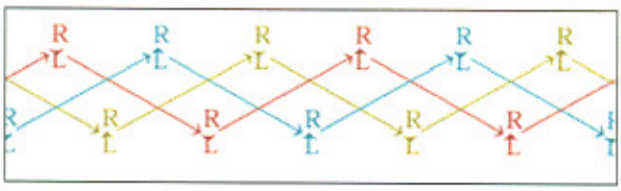
ultimate–zip with 6 clubs (J1 only)



ultimate–zip with 6 clubs (J1 & J2): collisions !



ultimate–zip with 7 clubs


R
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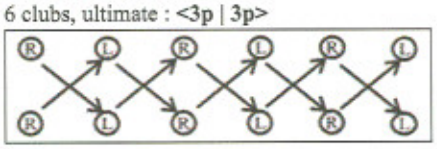
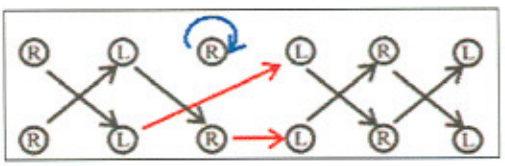
6 clubs 1-count (ultimate)

Here there is no more selfs, only some passes. It's as if you were juggling 3 clubs on each side of the passing (if you cut it along the line that pass through both jugglers). You both start at the same time doing RH pass, LH pass, RH pass, LH pass...
To get used to left hand passing, you can try 3-count or PPS if you haven't already done so.

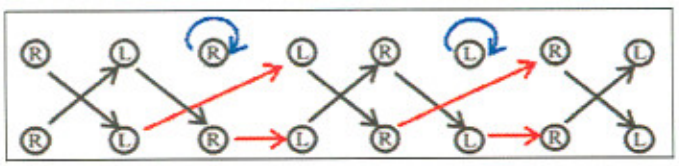
6 clubs, ultimate : **<3p | 3p>**



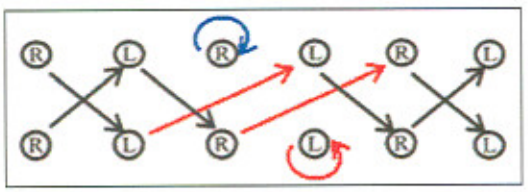
Syncops from BN theory



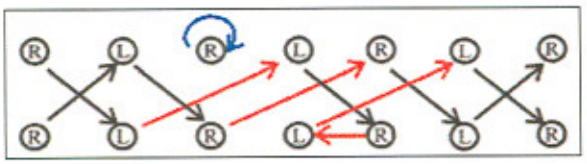
BN : 53
SiteSwap : <3p 3p 2 3p 3p ...| 3p 4p 3 3p 3p ...>
With plain words : double-self



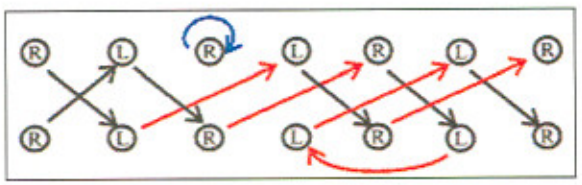
BN : 534 (continuously)
SiteSwap : <3p 2 3p| 4p 3 3p>
With plain words : double, self, pass, double, self, pass,...
remark : it's almost a PPS



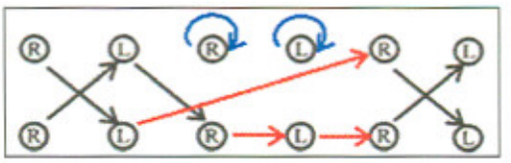
BN : 552
SiteSwap : <3p 3p 2 3p 3p ...| 3p 4p 4p 2 3p...>
With plain words : double, double, hold



BN : 5551
SiteSwap : <3p 3p 2 3p 3p 3p...| 3p 4p 4p 4p 1 3p...>
With plain words : double, double, double, zip



BN : 55550
SiteSwap : <3p 3p 2 3p 3p 3p...| 3p 4p 4p 4p 4p 0 ...>
With plain words : double, double, double, double, empty hand



BN : 633
SiteSwap : <3p 3p 2 2 3p ...| 3p 5p 3 3 3p...>
With plain words : triple, self, self

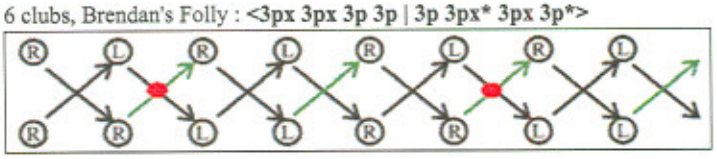
Brendan's Folly (6 clubs)

Credits: Created by Brendan Brolly

Brendan's Folly is a 1-count (or ultimate) rhythm for 6 clubs. The two jugglers have a different role :

- J1 (top line) does "Right-Left-Right-Left" as "crossing-crossing-straight-straight"
- J2 does "Right-Right-Left-Left" as "straight-crossing-crossing-straight" and gets the hurried throws (in green)

6 clubs, Brendan's Folly : **<3px 3px 3p 3p | 3p 3px* 3px 3p*>**



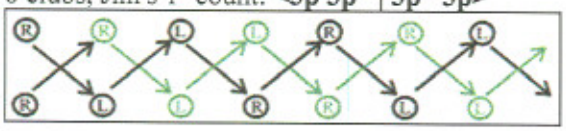
There is also a heavy risk of collision no later than beat 2 (red circle). To avoid that, you can agree that J2 (right hand crossing pass) will throw from the outside and J2 (left hand crossing pass) will throw from the inside. See page collisions for some diagrams.

6 clubs : Jim's 1−count

This is the ultimate (or 1−count) version of Jim's 3 count (which should be mastered first). Hurried passes are colored in green in the diagram.

J1 (upper line) does straight passes, J2 does crossing passes. The rhythm for both jugglers goes : right right left left... On a similar style, you can try Brendan's Folly.

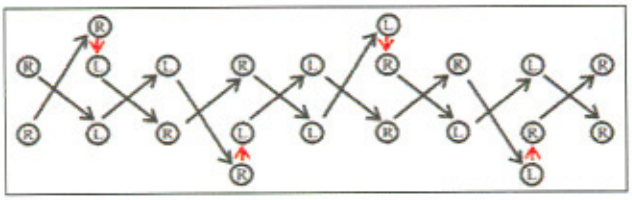
6 clubs, Jim's 1−count: **<3p 3p* | 3p* 3p>**



6 clubs : Martin's 1−count (PPPPZ)

This can be seen as the 1−count (ultimate) version of Mild Madness. The principle is the same: making zips when a pass arrives in your "wrong" hand. Just keep thinking you must only do passes, as one might want to add a few selfs when used to doing Mild Madness.

The rhythm can also be seen from a different point en view and be used to go on to Martin's Mildness, as it is a good way to learn to make zips without getting confused by the rhythm. You need for that to see it as being :
– PPPPZ: pass, pass, pass, pass, zip (handacross)
The juggler doing straight passes (upper line) will need to start at the middle of the sequence by PPZ (and then PPPPZ...).



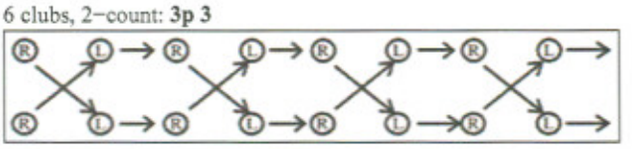
You can try to find the corresponding variants of Mild Madness variants.

6 clubs : 2-count

This is the second most popular passing rhythm (after the 4-count, and despite all efforts made by ambidextrous freaks to have the 3-count recognised as the "base pattern"). Here, all throws made from the right hand are passes, all throws made from the left are selfs. You keep doing:

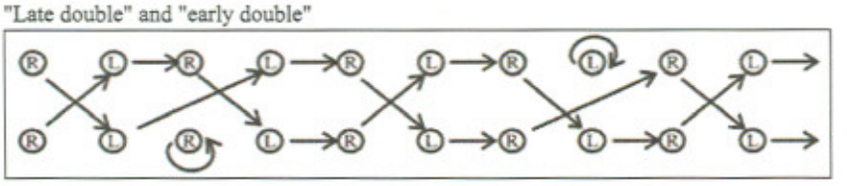
- RH: pass
- LH: self

6 clubs, 2-count: **3p 3**

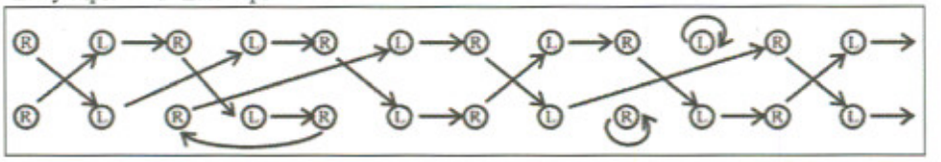


Tricks

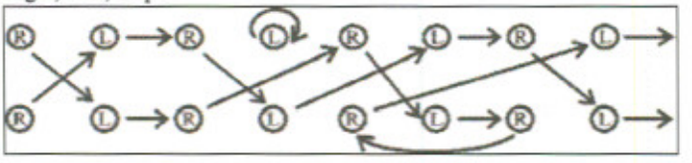
"Late double" and "early double"



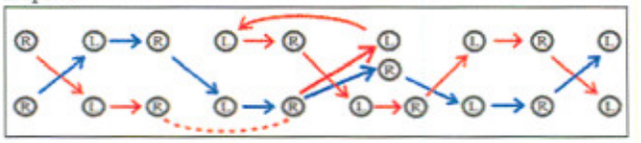
"Early triple" and "Late triple"



Right, Left, Triple



Duplex



6 clubs 3-count

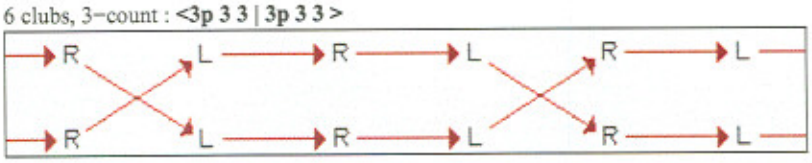
The 3-count (also called waltz or tic-tac) is not as widely known as it should. It requires some left hand passes, which jugglers are afraid of at the beginning. Don't be scared, this is not as difficult as it seems, and it paves the way for more passing fun (see below the 3-count advantages).

Explications:
In 3 count, passes are made alternately by both hands: if a pass is made from the right hand, the following pass will be done from the left hand. A simple way to ease up the pattern is to use 2 clubs from a different color and to use them for doing the passes, because in 3-count, it's always the same 2 clubs that are being passed back and forth between the 2 jugglers.

From a more practical point of view, here is how you go (Ti being throw number i):
- T_1 : RH pass
- T_2 : LH self (to catch the incoming pass: say you have used red clubs for passes)
- T_3 : RH self
- T_4 : LH pass (with the red club)
- T_5 : RH self
- T_6 : LH self

You can check: a pass is being made every 3 counts (T_1, T_4, T_7, ... T_{3n+1}).

6 clubs, 3-count : **<3p 3 3 | 3p 3 3 >**



What is good in 3-count ?
- You still have a few selfs to play with (as in a 4-count)
- Each RH trick (in 2 and 4-count) can now be done with both hands. To name only but a few:

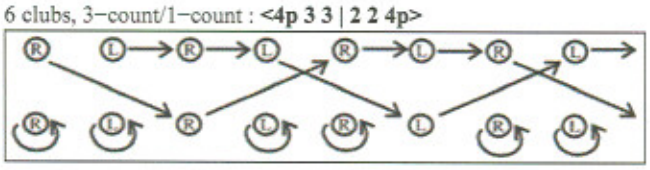
  - early and left doubles
  - triples, quadruples
  - special passes: tomahawks, flats, over the shoulder
  - ...

- It's more convenient for solo tricks that follows a 3-count throws rule (such as Mill's Mess).
- It's less tiring for your right arm, and allows you to use your left arm equally, making you a more balanced juggler.
- It opens the doors of the realm of ambidextrous rhythms, which it is the base pattern. You now can choose between 10 times more patterns to play with !

6 clubs 3-count/1-count

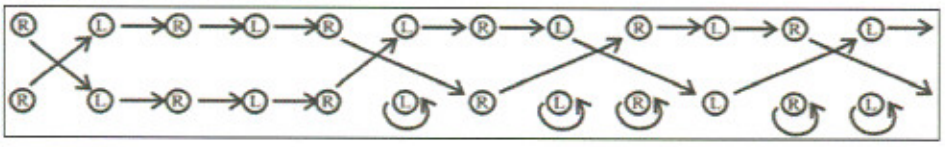
This pattern allows one juggler to work on the 7 clubs 3-count while the other one juggles a very slow 1-count on doubles (and can use some holds). It's not exactly a slow-fast though because the jugglers keep juggling at the same speed (if we count a hold as being a throw).
All passes are crossing doubles.

6 clubs, 3-count/1-count : **<4p 3 3 | 2 2 4p>**



An easy way to start this pattern is to start from a 4-count, and then to throw a late double. The one who throws the double starts juggling on a 3-count, the other one starts his 1-count side of the pattern by throwing back a crossing double under the incoming double (see diagram below).

3-count/1-count with a 4-count start

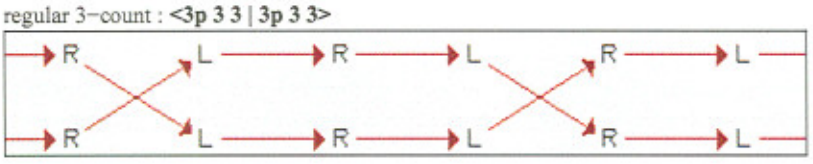


6 clubs : Jim's 3−count

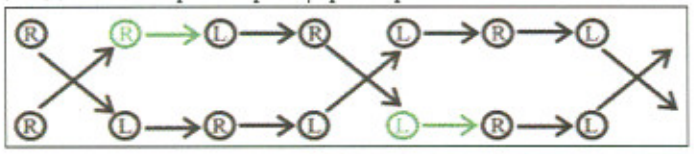
This rhythm is very similar to regular 3−count, and is not really harder. His main utility is when you do a feed with mild madness (these feeds are called Martin's mildness and Martin's madness), both feedees juggle Jim's 3−count.

The difference to regular 3−count is that a juggler crosses his passes (for every throw). Hence it creates a hurry, but as long as you remember that you have to **throw the club you just received**, it should present no particular problem. A consequence of the hurry is that each juggler regularly throws twice in a row with the same hand (see the following causal diagrams, the hurries are represented in green) .

regular 3−count : **<3p 3 3 | 3p 3 3>**



Jim's 3−count : **<3p 3* 3 3p 3 3 | 3p 3 3 3p 3* 3>**

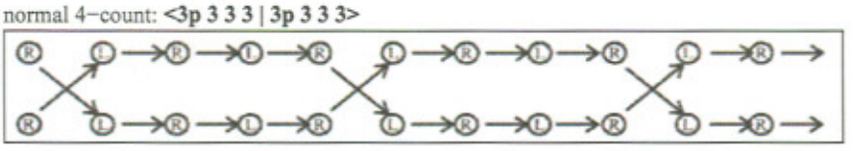


6 clubs : Jim's 4-count

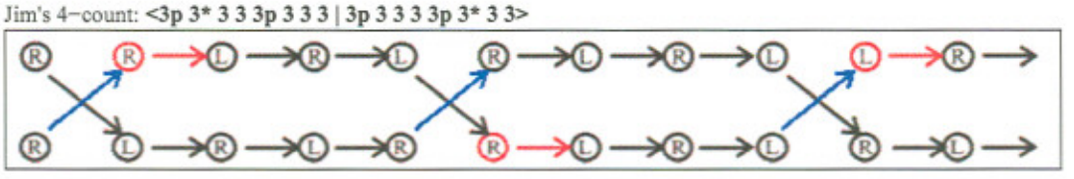
The difference with a normal 4-count is that one of the jugglers (the bottom one in the diagrams) will cross all their passes. This is very similar to Jim's 3-count but with 3 self's instead of 2 between each pass.

See also: introduction to hurries

normal 4-count: **<3p 3 3 3 | 3p 3 3 3>**



Jim's 4-count: **<3p 3* 3 3 3p 3 3 3 | 3p 3 3 3 3p 3* 3 3>**



6 clubs 4-count

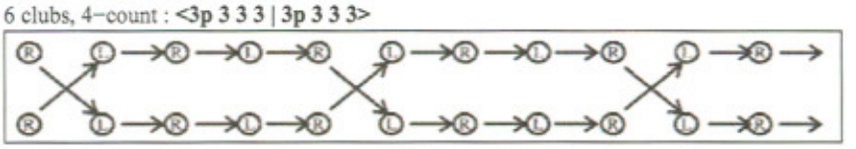
THE classical pattern of passing. When a juggler starts passing with you nine times out of ten you will end up passing a 4-count. You throw every pass with your right hand, and receive in your left hand.

When a clubs arrives on your left hand, you go:

- LH to RH self (to free your left hand before catching the pass)
- RH to LH self
- LH to RH self
- RH pass (you pass 1 time out of 4, hence the name 4-count)
- and then you do it again. Your partner throws exactly at the same time you do.

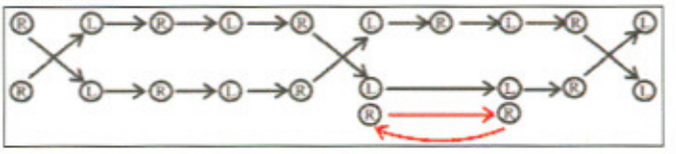
The following diagram shows it, starting with the passes. How to read this diagram : click here.

6 clubs, 4-count : **<3p 3 3 3 | 3p 3 3 3>**



The tricks

The columns

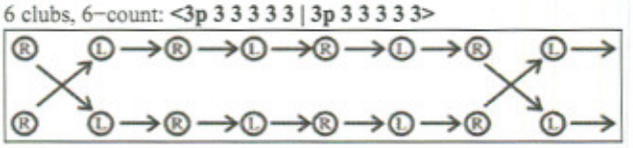


6 clubs 6-count

This rhythm is not that interesting, but it can be used for beginners who are learning to pass (since it's slow), or in some passing patterns with more than 2 jugglers: speed-weave....

You always throw from the right hand, throwing back the club you've just received as soon as it gets to your right hand.

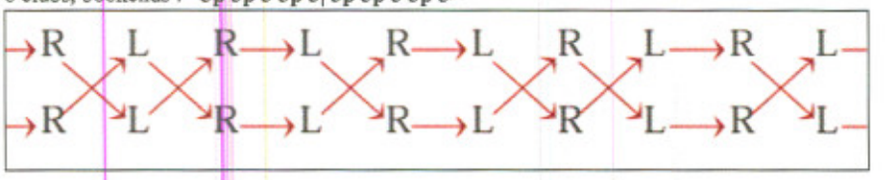
6 clubs, 6-count: **<3p 3 3 3 3 3 | 3p 3 3 3 3 3>**



6 clubs bookends (or PPSPS)

Its other name is PPSPS, a 5−count with 3 passes and 2 selfs. You'd better be quite comfortable with PPS because it's slightly harder for the brain, quite easy though. It is mainly used as a practice for the 7 clubs versions.

6 clubs, bookends : **<3p 3p 3 3p 3| 3p 3p 3 3p 3>**

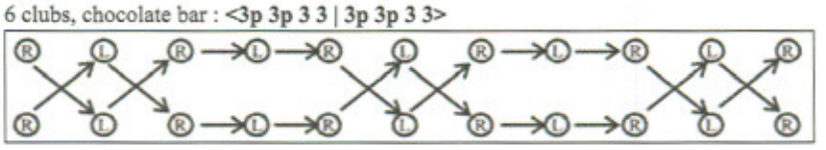


note : There are two ways of considering bookends rhythms. One is just PPSPS, the other is PSPSP (i.e., 3 passes with RH in 2−count followed immediately by 3 LH passes in 2−count, without any self in between). Try to run this single rhythm with both ways, you will have two different feelings, even if your arms are doing exactly the same movements.

6 clubs chocolate bar (PPSS)

Once you say PPSS, there is not much left to say. A good practice to PPS but PPSS is not fully ambidextrous.

6 clubs, chocolate bar : **<3p 3p 3 3 | 3p 3p 3 3>**



This rhythm is also called Desmond Tutu, or more simply Desmond, or even two-two (2-2).

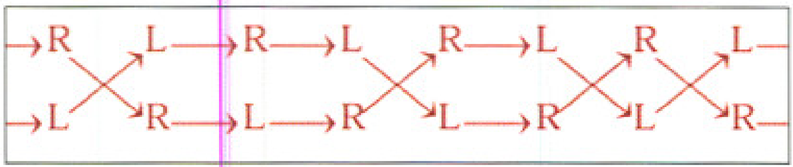
6 clubs countdowns

The countdowns are a family of patterns in which you constantly change the main pattern. For instance, you start with a 4–count cycle, a 3–count cycle, a 2–count cycle, an ultimate cycle (only one pass) and back, and so on.

As you can guess, the word "countdown" is not completely appropriate, since you count up as much as you count down. The countdown from 3 is the shorter, since a countdown from 2 is a simple PPS. .

Countdown from 3

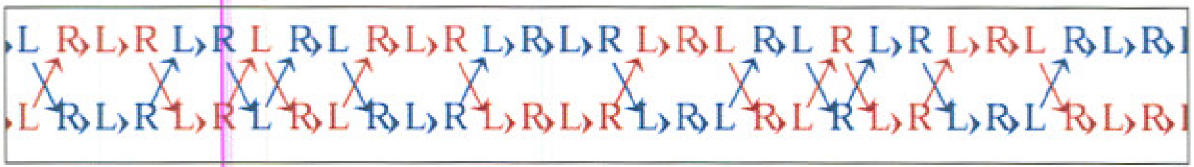
We start then from 3–count, hence we do a 3–count cycle, then a 2–count cycle a 1–count, a 2–count, and then we start again.
This rhythm is a cycle of 8 throws, which means there are two versions of it (one starts with a RH pass, the other with a LH pass). This rhythm is not symetrical, since it has an even number of throws.
The entire sequence is PSSPSPPS, easier to remember when you think of it as PSSP–SPPS.



It's also a practice for the 7 clubs version : Copenhagen countdown

countdown from 4

Run a 4–count cycle, a 3–count cycle, a 2–count, a 1–count, a 2–count and a 3–count, then starts from the other hand. As opposed to the countdown from 3 there is only one version since you alternate a start with the RH and a start in the LH in the same pattern.
The sequence is PSSSPSSPSPPSPSS, but you'd rather count in your head than learn it by heart.



And it's also a practice for the 7 clubs version : Oslo countdown

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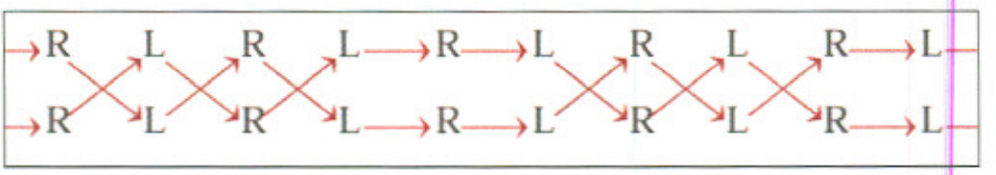
6 clubs PPPSS

Not much more things to say than PPPSS.It's a 5−count and thus completely symetrical. It's mostly a practice to his elder brother : 7 clubs PPPSS.



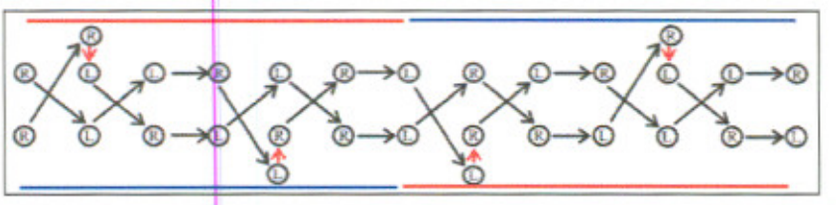
6 clubs Mild Madness – going further

These are variations on mild madness.

Variations are made by having the 2 jugglers swap between crossing and straight passes. I've used colored bars to help you see if a juggler is doing crossing (blue) or straight (red) passes. It's always quite fun to see who's going to drop first.

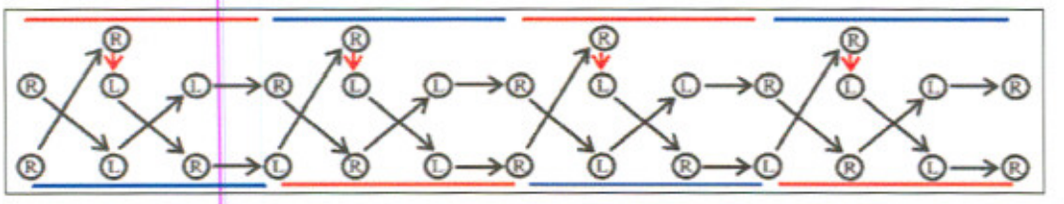
Synchronous change (6 beats)

The two jugglers change at the same time every 6 beats (the time for PPS PPZS). The consequence is that each juggler has the zip twice in a row, the new cycle being PPS PPZS PPZS PPS.



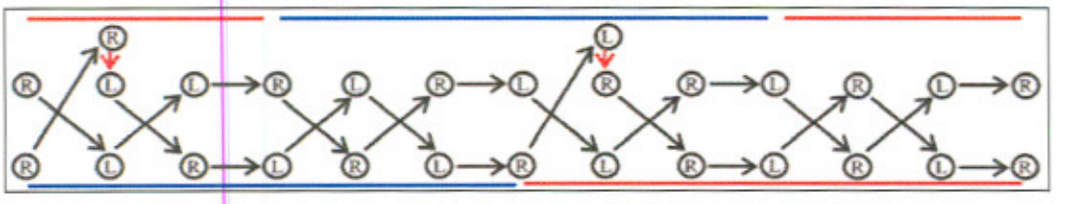
Synchronous change (3 beats)

The two jugglers change at the same time every 3 beats (the time for PPS or for PPZS). As a consequence, one juggler now has all the zips, while the other one is just doing PPS.



Asynchronous change (6 beats)

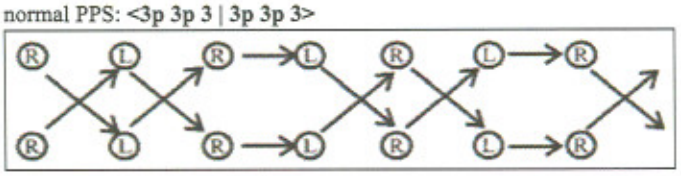
The two jugglers change every 6 beats but not at the same time. As a consequence, one of them has no more zips, while the other one keeps having as many zips as usual. There are some collision problems.



6 clubs Mild Madness

Mild Madness (some people may call it Martin's PPS, but Martin Frost frowns on that) is an evolved version of the normal PPS, whose causal diagrams I've placed below in order to compare a few things. Being comfortable with PPS is required.

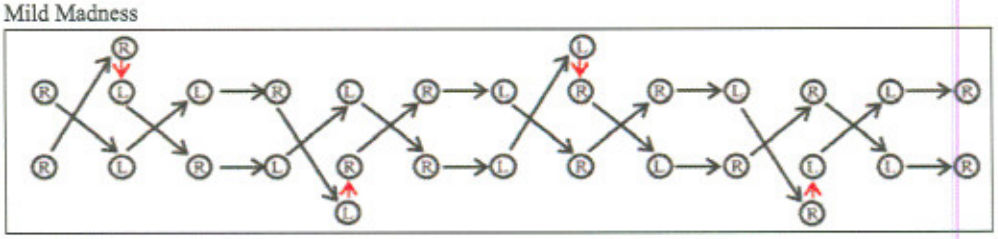
normal PPS: **<3p 3p 3 | 3p 3p 3>**



In Mild Madness, one juggler will cross all his passes (Right Hand to RH, LH to LH). If you try it this way (it's worth it), you'll realize very soon that there is a small problem. The 'small' problem is solved as follows:

- You sometimes need to do some hand−acrosses or zips. 'Sometimes' being in fact at the same moment as the second pass in a PPS cycle, when you need to do the zip. Since both are done at the same time, this is where the hurries occur.
- These zips (noted Z, or sometimes H) are made in turns by both the jugglers.
- The cycle becomes: PPS PPZS. Plainly speaking, it's "normal PPS", then "PPS with a zip".
- The pattern is ambidextrous, which means, to be more precise, that the true cycle is PPS PP'Zrl'S PPS PP'Zlr'S (Zrl meaning zip from right to left).
- At any moment, if A is doing PPS, B is doing PPZS and conversely.
- The causal diagram (for a full cycle) sums it all up (zips being the red arrows). You'll notice that the bottom juggler is doing the crossing passes.

Mild Madness



A few more remarks:

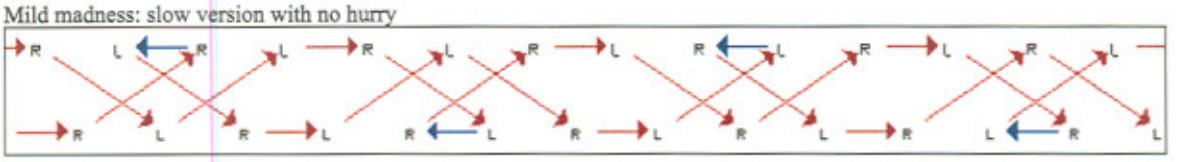
- A classical mistake is to forget the self. So be careful, the zip does not replace the self.
- Another mistake is to replace the zip by a pass (this is a psychosis).

- When you've mastered it, you can change (both of you) between crossing and straight passes on the fly every 6 beats.
  The new cycle is then: PPS PPZS PPZS PPS.
  See variations on mild madness.
- You can feed with mild madness.
- There also is a 1−count version: Martin's ultimate.

Slow version

On a theoretical point of view, there also is a version with no hurries, and passes done with floaty singles. Practically speaking, you'll be juggling something in between.

Mild madness: slow version with no hurry



This slow version can be seen as a four-hand siteswap: 7777266

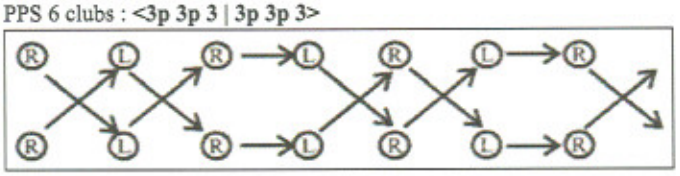
6 clubs PPS (aka double 3-count)

This pattern is quite a mess at the beginning, you always have to count PPS PPS PPS in your mind. If you have no problems with 3 count (for the LH passes), it's not so difficult once you get used to rhythm problems. It can also be an efficient practice to ultimate (1-count) (and back).

Both jugglers do exactly at the same time :

- RH pass
- LH pass
- RH self
- LH pass
- RH pass
- LH self

PPS 6 clubs : **<3p 3p 3 | 3p 3p 3>**

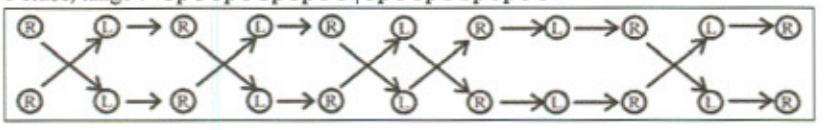


NB : The 4 passed clubs are always the same, just like the two clubs that are used for selfs.

6 clubs tango (PSPS PPSS)

This rhythm is a combination of a 2−count and a chocolate bar. The easiest way to describe it consists in saying : PS PS PPSS. It can also be considered as a 2, 2, 1, 3−count.

6 clubs, tango : **<3p 3 3p 3 3p 3p 3 3 | 3p 3 3p 3 3p 3p 3 3>**



6 clubs: Tic Toc Don't Stop

Tic Toc Don't Stop is a more like a mini–routine than a rhythm. It uses several ambidextrous rhythms, namely 3–count, PPS and 1–count, so make sure you master these before.

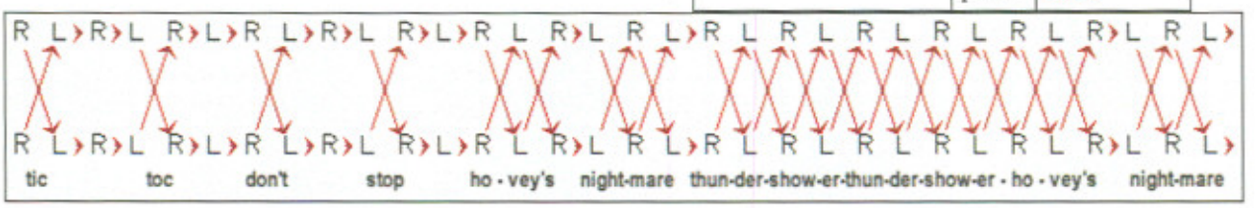
The idea is to juggle while singing (speaking) the following text:
Tic, Toc, Don't, Stop
Hovey's Nightmare
Thundershower, Thundershower
Hovey's Nightmare

Each syllable corresponds to a pass in the pattern. Use the table on the right or the causal diagram below to get a more precise idea.

But the best way to be sure how it works might well be to have a look at Jeremy and David doing it on video (below if everything is fine).

You go 3–count, PPS, 1–count, PPS and back to the 3–count at the beginning. When you want to stop, say **Do Stop** instead of **Don't Stop** during the 3–count.

4 cycles of 3–count	pass 1	**tic**
	pass 2	**toc**
	pass 3	**don't (or do)**
	pass 4	**stop**
2 cycles of PPS	pass 1	**ho–**
	pass 2	**vey's**
	pass 3	**night–**
	pass 4	**mare**
8 cycles of 1–count	pass 1	**thun–**
	pass 2	**der–**
	pass 3	**show–**
	pass 4	**er**
	pass 5	**thun–**
	pass 6	**der–**
	pass 7	**show–**
	pass 8	**er**
2 cycles of PPS	pass 1	**ho–**
	pass 2	**vey's**
	pass 3	**night–**
	pass 4	**mare**



6 clubs hurrys gallore

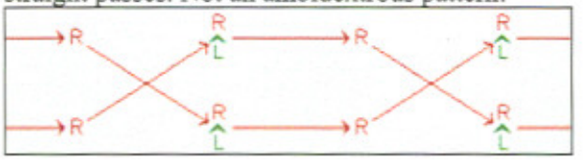
Credits: David Harvey &JiBe, December 2002

All these rhythms are based on a 2–count, on which we add some hurries with the following combinations:

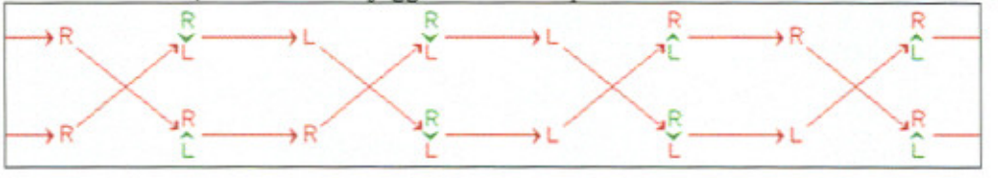
Selfs: make a synchronous self–zip with the self being either straight (3x: half–box), or cross (3: shower).
Passes: Either the 2 jugglers do straight passes, or one of them does cross passes and the other straight passes.

This gives us 4 possibles combinations.
Being able to juggle the box or the shower on singles will help.

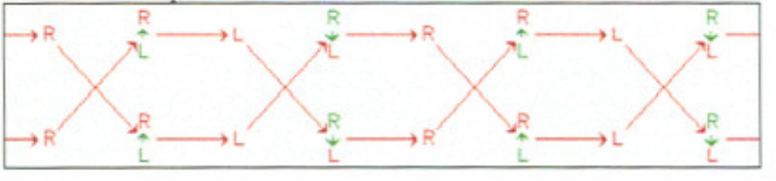
1– half–box, straight passes
This one might be the easiest. Upon receiving a pass to the LH, throw a RH straight self and a handacross LH to RH at a the same time. When the self comes down again, throw the handacrossed club. Both jugglers do straight passes. Not an ambidextrous pattern!



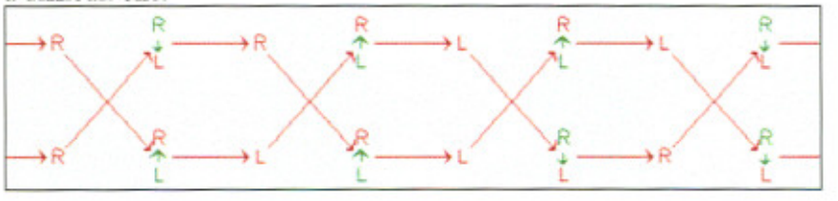
2– half–box, straight and cross passes
Same than above, but one of the jugglers cross his passes. The result is a nice ambidextrous rhythm.



3– shower, straight passes
Upon receiving a pass to the LH, throw a RH self to the LH and a handacross LH to RH at a the same time. When the self comes down again, throw the club you've just caught. Both jugglers do straight passes. Ambidextrous pattern.



4– shower, straight and cross passes
Same than above, but one of the jugglers cross his passes. Passes are made twice in a row on each side. Rather a difficult one.



More:
On the same principle, you have to try out what the 3–count has to offer, especially if you juggle a box instead

of normal selfs. In fact, you can try on any rhythm to replace the selfs by some synchronous selfs–handacrosses. PPS somebody? :–).

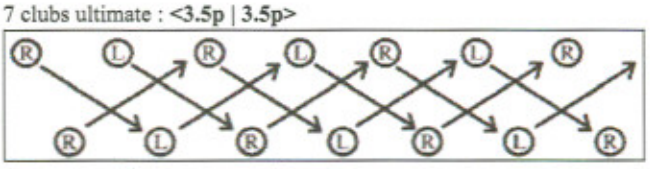
7 clubs 1-count

There's no "big secret" to this amazing pattern. You just need a lot of practice and some precision. You can either juggle in on doubles (harder because of the precision needed) or on floaty singles (faster but easier to get down and nicer). Since the siteswap is <3.5p|3.5p>, it's theorically just between a double (4) and a single (3).

J1 starts with 4 clubs (2 in each hand) and make tramline passes (the RH make the first pass), J2 starts half a beat later (with 3 clubs) and throw diagonal passes (the RH make the first pass).

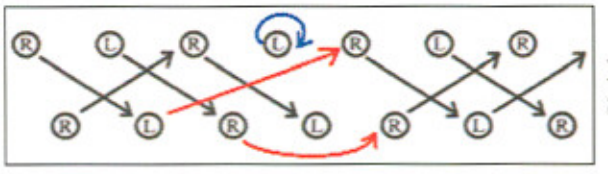
On singles, try to slow down the pattern by throwing higher passes.

7 clubs ultimate : **<3.5p | 3.5p>**

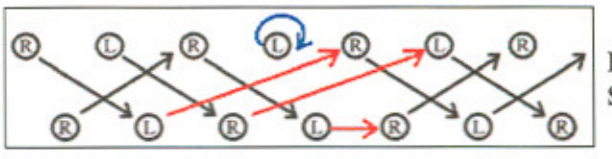


Reminder : Ultimate = no self

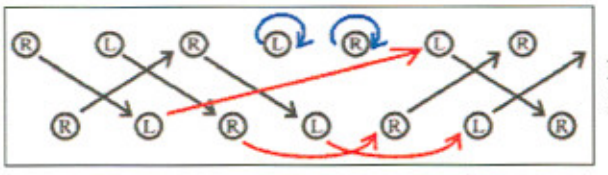
Patterns inspired by the BN theory



BN : 64
Sequence : double pass, double self



BN : 663
Sequence : double pass, double pass, self



BN : 744
Sequence : triple pass, self, self

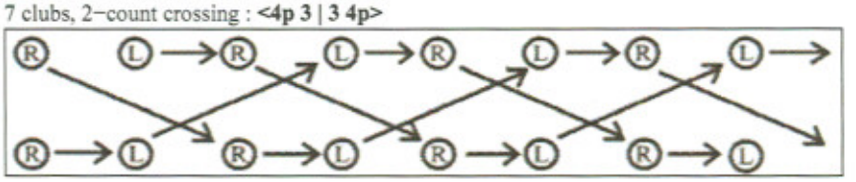
If you've understood the BN theory, you'll discover many more patterns using some 5 ball siteswaps.

7 clubs : crossing 2-count

This pattern is nearly identical to the classic 7 clubs pattern except that :

- J2 make left hand passes
- Both J1 and J2 make diagonal passes.

7 clubs, 2-count crossing : **<4p 3 | 3 4p>**



You can look for more details on the relationship between the two patterns in the examples of the causual diagrams explanations.

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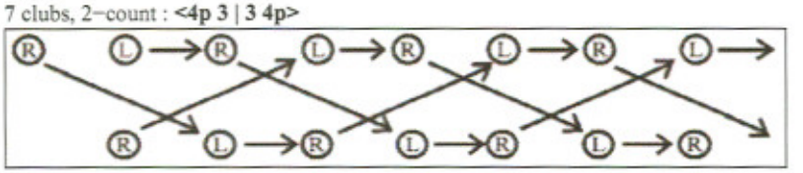
7 clubs 2-count

This is THE basic 7 clubs pattern. Both jugglers are passing a 2-count on doubles (i.e. : RH tramline pass on double, LH self).

J1 (on top) starts with 2 clubs in each hand and begins with a pass, J2 starts a beat later with a pass.

7 clubs, 2-count : **<4p 3 | 3 4p>**



You can also try this pattern with floaty singles instead of doubles. If it goes too fast, keep cool and throw higher passes and selfs.

In both the doubles and singles version, any trick of the 6 clubs 2-count will work (doubles, triples, tomahawk, duplex...) provided that you make the necessary adjusments (the doubles become triples for example).

7 clubs 3-count

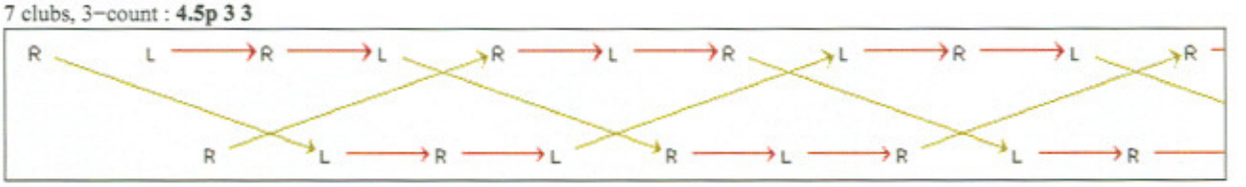
7 clubs 3-count on doubles

A very nice rhythm for 7 clubs. It's balanced, it isn't as hard as it looks (because the mistakes are easy to correct) and you can throw many tricks in it once you get the base pattern solid.More than than, it's also the door to all the ambidextrous 7 clubs patterns.

It works like this :

- It's a 3-count, so the feeling is the same as the 6 clubs 3-count. The incoming clubs are those that are thrown back (it's always the same 3 clubs in the air).
- The passes are made on doubles. The theorical siteswap of the passes is 4.5 so make them high and slow. It's also possible to make the passes on single (see below).
- J1 starts with 2 clubs in each hand and juggles : RH pass, self, self, ...
- J2 waits for as long as possible (one and a half beat) and starts with a pass : RH pass, self, self, ... (please note that the diagram below shows J2 starting 0.5 after J1 with a LH self).

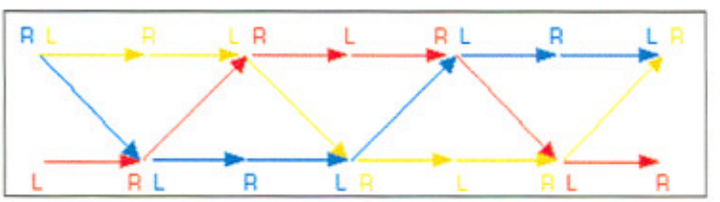
7 clubs, 3-count : **4.5p 3 3**



7 clubs 3-count on singles

It's a lot harder but it can be done.
Everything written above stays the same (just change 'double' by 'single').
As the diagram below shows clearly, you need to make synchronous throws sometimes. The sequence becomes :

- RH pass / LH self
- RH self
- LH pass / RH self
- LH self



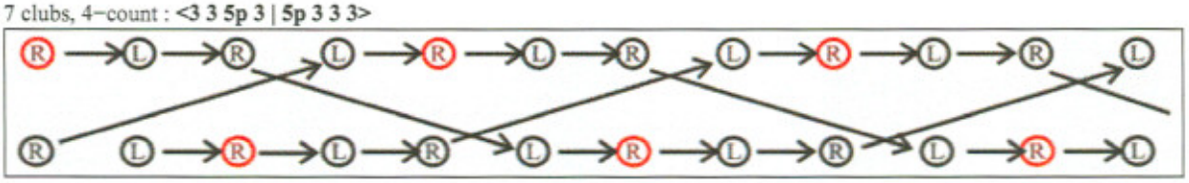
This rhythm is used in some patterns. Check the technofeeds for example.

7 clubs 4-count

Nothing really tough here : both passers are juggling a 4-count and the passes are made on triples (you got to make them nice & clean). The passes are not thrown at the same time : there's two beat between the pass of the first juggler and the pass of his partner. To get started, J1 starts with a pass and J2 starts at the same time with the sequence : RH self, LH self, pass...

Since it's a 4-count, you can use many of the 6 clubs 4-count tricks (441 for example).

7 clubs, 4-count : **<3 3 5p 3 | 5p 3 3 3>**



I've highlighted in red the beats when the jugglers can make a pass (and get one club back a beat later) to other jugglers like in the 7 clubs torture chamber pattern.

For a speedy but easier variation (because the passes are usually better), throw doubles instead of triples: a good pattern that helps to master the 11 clubs 2-count feed.

7 clubs bookends (PPSPS)

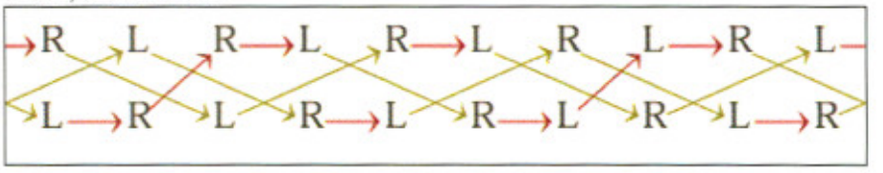
What follows was written by Jon in Kaskade 65:

Now we get into 7-club versions of the 'old' 6-club pattern 'bookends', a 5-count with 3 passes and 2 selfs. The selfs always have min. one pass in between. There are (at least) two different ways to think about bookends patterns. One is to just do ppsps, the other is to pspsp (i.e., three right hand shower passes in a row followed immediately – no self in between! – by three left hand passes). Try to do the same pattern with both "feelings" – it doesn't feel like the same pattern even though your body is doing exactly the same (trippy, huh).

Basic bookends

The basic pattern in this section is another great fusion of technology, creative inspiration and skill (thanx for your patience, Mandy), but it isn't actually that hard, you just add another pass and another self to the basic pps. J2 starts with 4 clubs.
I also discovered that this pattern is exactly the same as one that Wolfgang describes in Kaskade 57 as <4p 3 4p 3 3p|3 4p 3 4p 4p>, but never mind…
Don't forget to try both ends and to reverse the passes like in the pps patterns

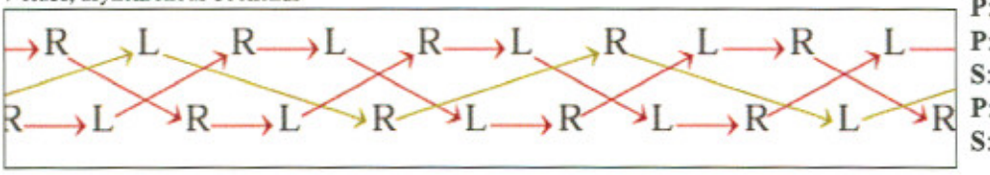
7 clubs, basic bookends



Asynchronous Bookends

Here is a version where both jugglers do (almost) the same. J1 does floaty crossing singles and straight floaty doubles and J2 does the opposite – is that clear?!?.
J2 has 4 clubs and starts RH with PPSPS, and J1 starts immediately (half a beat) after with PS (then PPSPS) on the LH.
As this pattern is asynchronous (none of the four hands throw at the same time) it can be written down as a fourhanded siteswap: 96677 (see footnote 2). Each juggler throws 96767.

7 clubs, asynchronous bookends



P: floaty single
P: floaty double
S: single
P: floaty single
S: single

Funky Bookends

For an even weirder bookends (as if it needs to get any weirder!) try 86777, where each juggler juggles 87767 in turn. J1 has 4 clubs, and J2 starts half a beat later with PS (then PPSPS) on the LH.

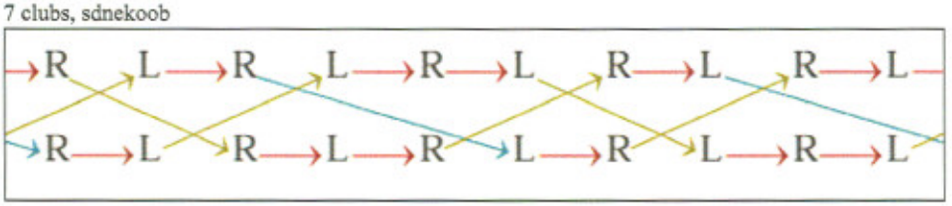
7 clubs, funky bookends

P: floaty single
P: floaty single
S: single
P: floaty single
S: straight double

Sdnekoob

For a 'reverse' bookends (SSPSP or PSPSS) try this one – it even has a triple in it – oooohhh. J1 starts with 4 clubs by PSS (at the same time as J2 who starts with SSP).
This one cannot be written in a fourhanded site swap as it is a synchronous pattern, which also means that the passes don't need to be floaty, and that you can try making the crossing passes straight and vice versa.

7 clubs, sdnekoob



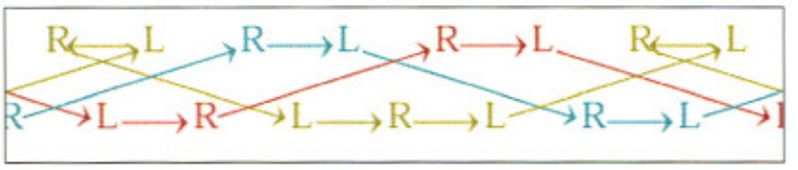
P: straight triple for J1
crossing double for J2
S: single
S: single
P: crossing double
S: single

7 clubs Copenhaguen countdown

What follows was written by Jon in Kaskade 66:

This pattern is a countdown from 3 – (that is, one round of three–count, then a two–count, a one–count, a two–count and then all over again). As you can see, the name 'countdown' is actually not really appropriate as there is as much counting up as there is down, but what the heck. The countdown from 3 is the shortest of the patterns worth denoting with the dubious term (a countdown from 2 would be a pps). It actually only has 8 throws before it repeats itself, which makes it one–sided (as 8 is an even number). The entire throwing sequence is then psspspps. Some people (myself included) find it easier to remember the entire sequence rather than counting down (and up). I normally think of it as one round of a three–count (that is 'pssp') followed immediately by the reverse (that is 'spps').

To do this pattern warm up by doing it with 6 clubs. When that feels comfortable pick up that extra club and proceed to the Copenhagen Countdown.



In this pattern 'Juggler 1' (let this be the best of you if you are not at the same level – the reason for this will become clear in a moment) starts with two clubs in each hand throwing the countdown sequence like in the 6–club version but making his passes crossing floaty doubles. If 'Juggler 1' (J1) starts from the left hand it will be easier for 'Juggler 2' (J2), (so J1 actually does the left–handed version of the countdown, while 'J2 does it right–handed. You could practice the left–handed version with 6 clubs first if you are sure this won't mess up your partner's head even more as he will then have to learn it left–handed. The terms 'left–handed' and 'right–handed' are not totally appropriate in this context as the pattern has two right passes and two left passes, no matter what hand you start from. However, the pattern is still one–sided since it repeats every eight beats, and it actually feels a bit different doing the 'left–handed' version.).
J2 has two clubs in his right and one in his left and does exactly what he was doing in 6–club version (starting right–handed), only his passes are (straight) floaty doubles (this will be fairly easy if you have the 6–club version solid). J2 starts one and a half beats after J1, so the timing of the start is exactly like in a 7–club three–count.

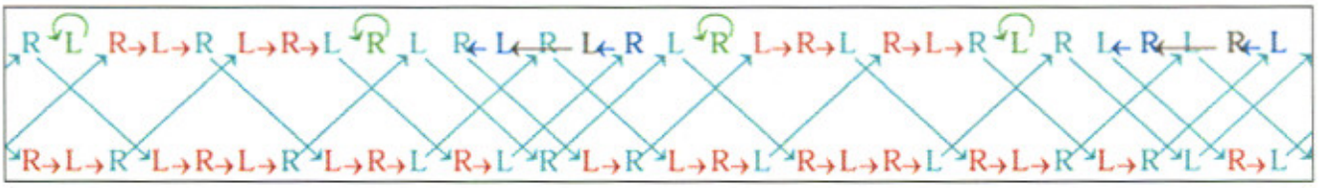
But wait! There is more! Because to get this to work J1, gets two 'zips' (aka 'handacrosses' or '1s' in normal siteswap) instead of two selfs. The zips are in the diagram represented by the back pointing arrows. So her entire throwing sequence is pzspsppz (Note: The first zip in the first round should be thrown as a normal self, meaning that the first actual zip is throw number 8). This might all sound very complicated but it is a lot easier than it sounds, as the zips come natural (if you are used to doing zips, that is). It might also be helpful to know that the two zips are both from right to left so J1's right hand will be doing no normal selfs (except for its very first throw) so the her right hand will be starting with a self and then doing pass, pass, zip, zip, pass, pass, zip, etc.

In case anyone is interested, the fourhanded siteswap for the Copenhagen Countdown is 9629669669969929. J1 does 92696992 and J2 starts one and a half beats later and does 96696996.
OK, enough explanations. Enjoy and remember that this pattern is not so difficult – so if you are an ambidextrous 7–club passer and this seems impossible you are probably doing something wrong.

7 clubs Oslo countdown

Oslo countdown

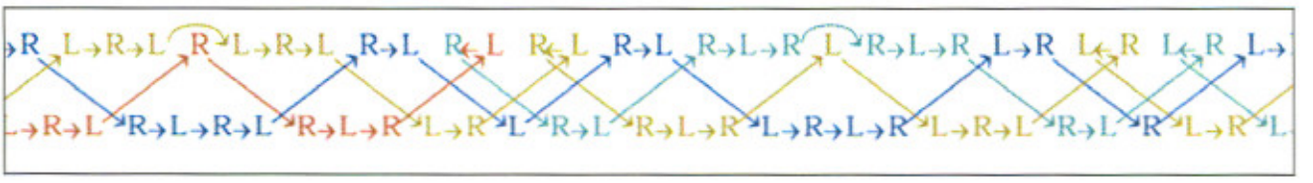
This one is a real bastard as the sequence is 15 beats long (from each side, that is), and furthermore because of collision danger. If you are planning on just a little bit of success with this pattern do yourself the favour to learn the 6-club version (countdown from 4). Just do one round of four-count, one of three-count, one of two-count, a one-count, a two count, a three-count, and then all over starting with the other hand. The throwing sequence is pssspsspsppspss.
The original version of the Oslo Countdown is a synchronous pattern where both jugglers do straight (!) passes – either on triples or doubles (mathematically it is supposed to be triples, but doubles may – or may not – be easier to control). It was courageously invented and attempted last summer with Magnus in the centre of Oslo). Especially around the one-count the pattern gets a bit weird for J1 as the sequence goes (starting from throw number 8) … pass, hold, pass, pass, zip, pass, empty hand, zip, pass, hold … Anyway – here it is. Good luck. J1 starts with 4 clubs.



If you can't get it work, don't worry – I have only managed to do three quarters of it so far, but since that is counting down, up and down again it means that it by no means is impossible. When we tried it in doubles we found that making the four-count very fast (try to do a 7-club four-count in doubles in stead of triples to warm up). The one-count, on the other hand, should be nice and slooooow.

Asynchronous Oslo countdown

Once you have tried your luck with this one you can try a version that is (possibly) a bit easier. (I say 'possibly' because I have actually never done this one as the only decent passing partner here in Copenhagen is JoePass!) there is an asynchronous version that might be a bit easier, as all the passes are floaty doubles (definitely doubles!), and as it contains no holds or empty hands. However there is a self double, but hey – if you have gotten this far that shouldn't be a problem. J1 starts with 4 clubs, and J2 starts one and a half beats later.



The monster 4 hands siteswap for that one would be
9669668696696696699699299629 66
where each juggler juggles:
J1: 9668 966 96 9 92 926
J2: 9666 966 96 9 96 966

7 clubs : compressed mesopotamia

Credits: Created by Martin Frost

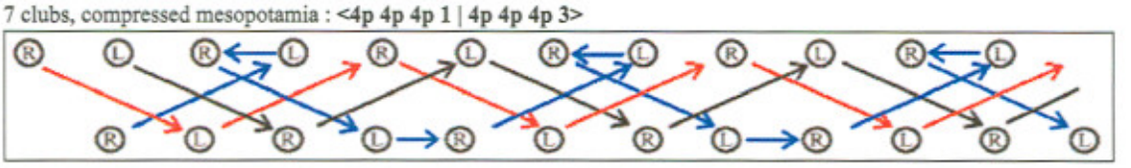
A hardcore rhythm, highly collision prone.

Both jugglers are passing on doubles (die–hard passing fanatics can try it on singles too).

- J1 juggles : Pass, pass, pass, zip. (PPPZ)
- J2 juggles : Pass, pass, pass, self. (PPPS)

To avoid collisions, try to keep the passes in corridors. That's all the help I can give you at the moment.

7 clubs, compressed mesopotamia : **<4p 4p 4p 1 | 4p 4p 4p 3>**



I've found 2 variations that I've written down below (mainly to remember them). The idea is to create a 0.5 delay (make passes as 3.5p or 4.5p with one juggler passing tramline passes and the other diagonal passes to avoid collisions).

1) 3.5p passes (6 clubs)

- J1 juggles : Pass, pass, pass, zip. (3.5p 3.5p 3.5p 1)
- J2 juggles : Pass, pass, pass, hold. (3.5p 3.5p 3.5p 2)

2) 4.5p passes, an 8 clubs pattern.

- J1 juggles : Pass, pass, pass, zip. (4.5p 4.5p 4.5p 1)
- J2 juggles : Pass, pass, pass, double. (4.5p 4.5p 4.5p 4)

Last variation of the basic pattern : J1 makes triple passes while J2 makes single passes. Even better would be floaty doubles and floaty singles.

---

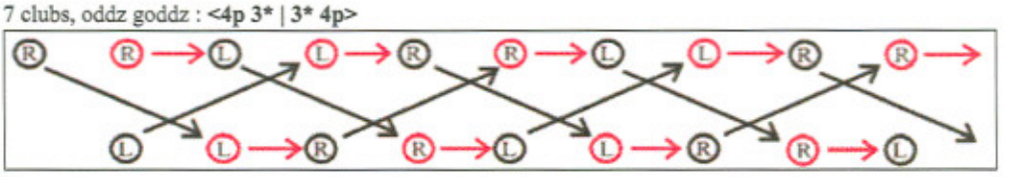
7 clubs Oddz Godz

Oddz Godz is (for me), the hurry of the normal 7 clubs 2–count. It's definitely a hurried pattern and you'll feel the hurries, believe me ! (All red passes in the diagram are hurries).

Here is the pattern in details :

- One of the juggler makes tramline passes on doubles.
- The other one makes diagonal passes on doubles.
- The rhythm for each juggler is : RH pass, RH self, LH pass, LH self. Each hand throw two times in a row.
- At the beginning, J1 (on top) starts with 3 clubs in the RH and one in LH. He goes like this : RH pass, RH self, ...
- J2 starts with 2 clubs in the RH and one in LH. He starts at the same time as J1 and juggles : RH self, LH pass, LH self, ... Please, note that the diagram bellow doesn't show the first self.

7 clubs, oddz goddz : **<4p 3* | 3* 4p>**



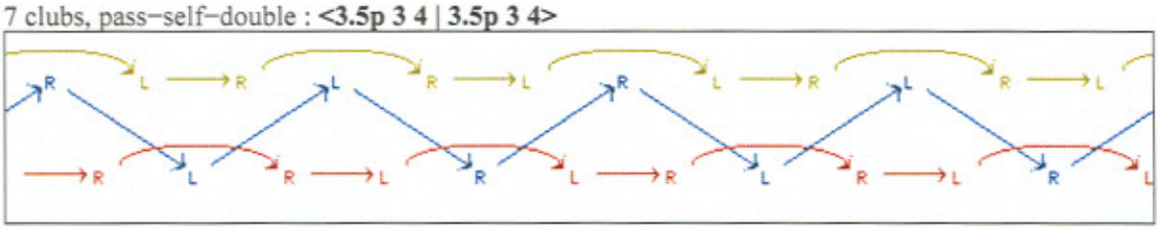
7 clubs : 3-count popcorn (French 3-count)

This one is really cool ! Everybody juggles the magic pattern :

- **pass** (floaty diagonal single for one of you and tramline pass for the other)
- **self** (crossing single)
- **double** (non-crossing self)

Since you will be juggling with a delay of a half beat, the second passer needs to wait a bit before throwing his first pass. He can wait half a beat and start with the double or wait one and a half beat and start with the pass.

7 clubs, pass-self-double : **<3.5p 3 4 | 3.5p 3 4>**

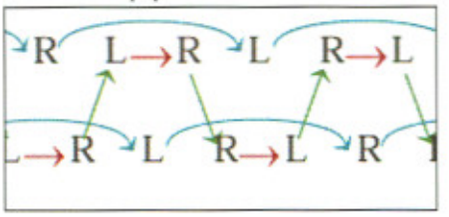


Please note (red line on the diagram) that you only throw a pass when you receive one, and only then.

Fast 3-count Popcorn

There's a 3-count popcorn that follows the logic of the 7-count and 5-count popcorns. The sequence would be : a self triple followed by a normal self and a very fast pass (a low flat).

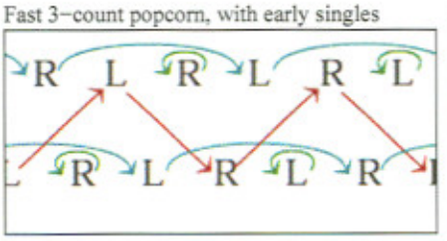
Fast 3-count popcorn



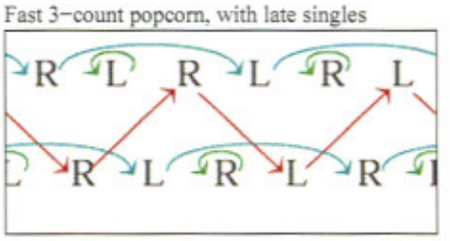
This pattern is nearly impossible to juggle properly (and even improperly, it's tough enough) – it can even prove dangerous with clubs because the pass is a 5 (a 2,5 in solo juggling). But it seems that it can be done with rings.

To juggle it with clubs, you can throw all the passes a beat earlier as floaty singles or throw all the passes on the beat as floaty singles too (swapping the tramline-diagonal in each case). Both patterns will have a hold (or a very low throw, siteswap 2) so the 4 hands siteswaps are 10-7-4 and 10-4-7. A 8 clubs PPS variatation can also be extrapolated if you throw passes instead of holds.

Fast 3-count popcorn, with early singles



Fast 3-count popcorn, with late singles



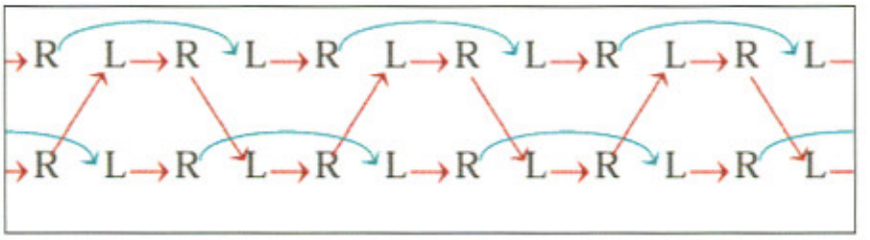
7 clubs : 4-count popcorn

The 4-count popcorn, non-ambidextrous and of a limited interest in itself, is still usefull as a mean to boost the difficulty of some feeds (see popcorn feeds).

The sequence is : RH triple, LH self, RH single pass, LH self. J1 starts with 4 clubs and begins with the pass, J2 starts at the same time with the triple.

Since the sequence is short because of the single passes, it can be difficult to find the correct tempo. Try to concentrate on making your triples high enough and your passes low and fast.

You can also try the "twin towers" version : RH double, LH double (each double comes back in the hand that threw it) instead of the RH triple, LH self. For the siteswap inclined : 44 instead of 53.



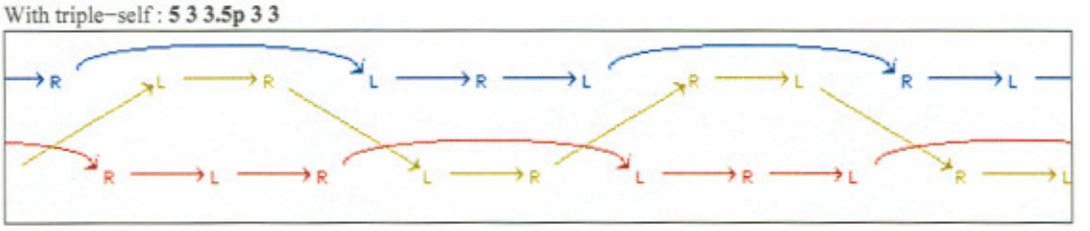
7 clubs : 5–count popcorn

Here's a popcorn that will force you to work on your left hand as much as your right (see also : popcorn 7–counts and 3–counts among others)

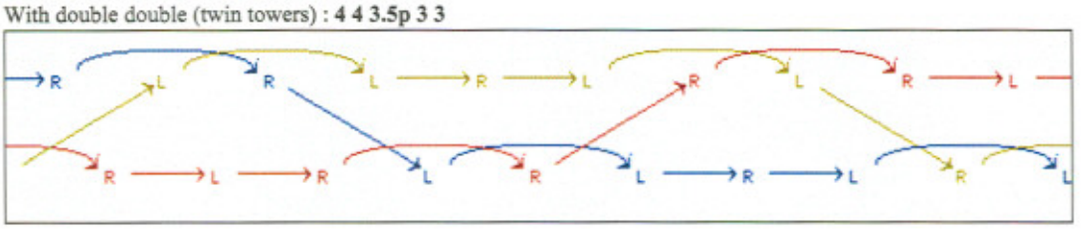
Here is what you have to do : ***thing, thing, (floaty) single pass, self, self*** where :
– ***thing, thing*** = triple, self (original but tricky because of the triple)
– or : ***thing, thing*** = double, double ("twin towers" version, easier)

When a pass comes your way, you throw 2 doubles (or a triple–self) to get the 4 clubs, make a pass, then throw two selfs before starting again on the other side.

With triple–self : **5 3 3.5p 3 3**

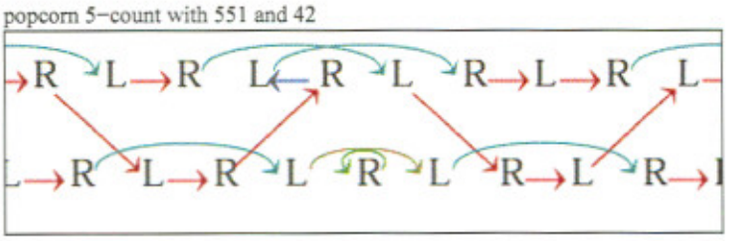


With double double (twin towers) : **4 4 3.5p 3 3**



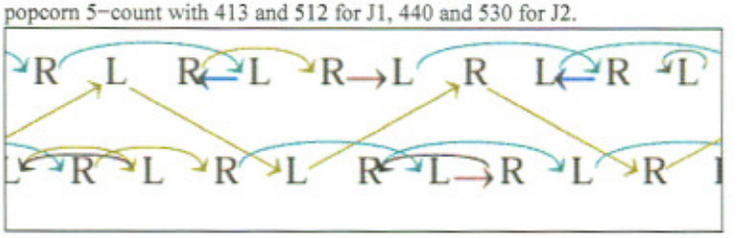
Let's assume that you're juggling the triple–single version.
Note : Since the triple (siteswap 5) is thrown every 5 beats, it's always the same club that is thrown as the triple.
Tricks : There's not too many siteswap variations here because we only have 2 selfs. 42 is a possibility, especially if you throw the 2 as a very fast single. You can also try to throw a self triple on the beat before the normal triple, forcing you to make a transfer instead of a self after the second triple (know why ? Because you're juggling 551 before the pass instead of 353). Here's the diagram with J1 juggling 551 and J2 juggling 42.

popcorn 5–count with 551 and 42



You can also throw an early double followed by a hold – something that opens new possibilities since there's now the hold and the 2 selfs (ie : 233) to have fun with. Try 530 for example, 440 or 413, 512 (throwing the 2 or not, you decide). You can see below those 4 variations, with J1 juggling 413 and 512 while J2 juggles 440 and 530.

popcorn 5−count with 413 and 512 for J1, 440 and 530 for J2.



7 clubs : 6-count popcorn

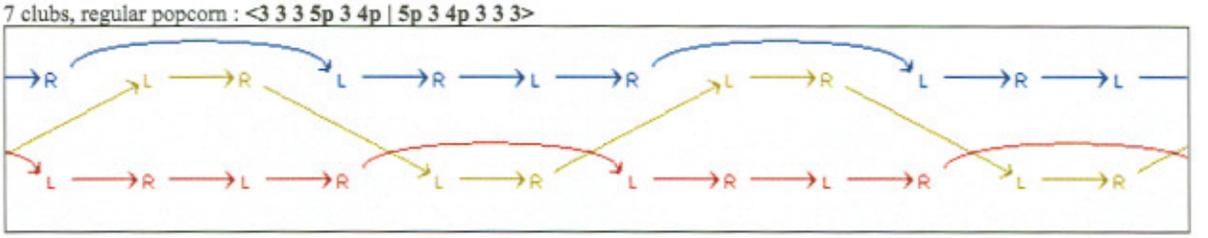
The name "popcorn" for these patterns comes from the fact that the jugglers throw singles, doubles and triples ; something visually similar to what happens to corn in a frying pan.

The right hand sequence (the left hand throws only singles) for each juggler is :

- triple-self (thrown to the left hand)
- tramline pass on double
- self (thrown to the left hand).

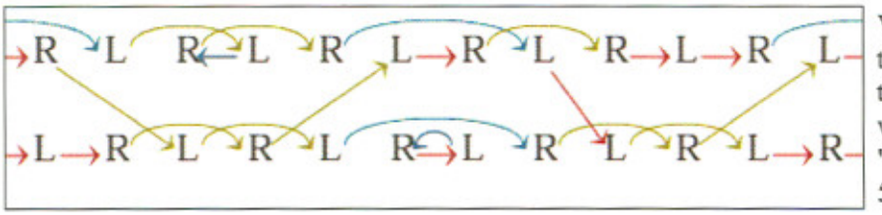
It's just a round of solo triple-single (the triple is a self) when the double (the pass) comes in.

7 clubs, regular popcorn : **<3 3 3 5p 3 4p | 5p 3 4p 3 3 3>**



One of the possible variations consists of replacing the triple-self's by double-self's and the passes on doubles by passes on singles. It's a little faster and it breaks the rhythm but since the pattern is lower, it's easier to master.

Another variation, one that simplifies things a bit, is to replace the triple-singles (siteswap 53) by 2 self doubles (44). As a matter of fact, you can switch between the two at any moment. The double-double variation is knows as the "Twin Towers" by some and can prove helpful for 5-count and 7-count popcorn. Moreover, since each juggler gets 3 normal self's after the pass, you can get into 441 or 531 (leading to their own variations). 531 is more visual since the 5 is thrown at the same time as your partner throws a triple. A final variation can be juggled by throwing a right hand double self instead of the pass followed by a diagonal pass on single (landing in your partner's hand just in time).

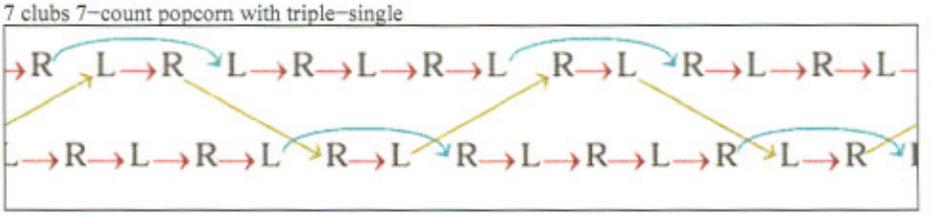


Variations : – J1 juggles triple-singles with a bit of 441 then throws the diagonal pass with single spin. – J2 does the "twin towers" beginning with 531.

7 clubs : 7−count popcorn

Take the 6−count popcorn (regular), and apply theses modifications : − add a self (we now have an ambidextrous pattern) − make the passes more "floaty" (4,5p) − convince your partner that it's not going to work at all until one of you makes diagonal passes.

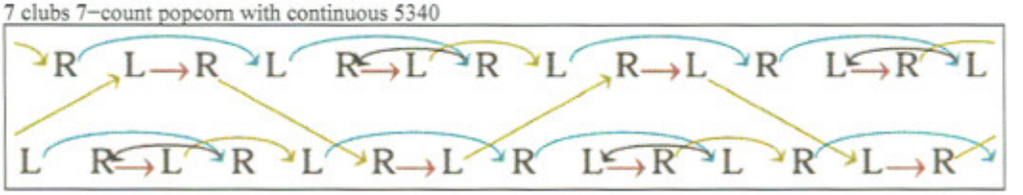
7 clubs 7−count popcorn with triple−single



If we break it down, we have: − triple−self (or double−double; see notes on the 6−count popcorn "twin towers" variation) − pass as a floaty double (tramline for you, diagonal for your partner) − 4 normal selfs − ... (same thing on the other side of the pattern)

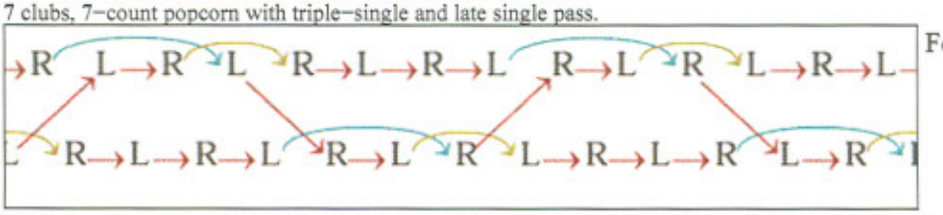
Try the same variations as in the 6−count. You can choose when to throw the 441 or the 531 because of the 4 selfs that you have to play with. Or you can do any 3 club siteswap of length 4, like the superfunky 5340. If you juggle it continously, add another club and make the pass a floaty single, you have the 8 clubs 7−count popcorn of Jon and Dani.

7 clubs 7−count popcorn with continuous 5340

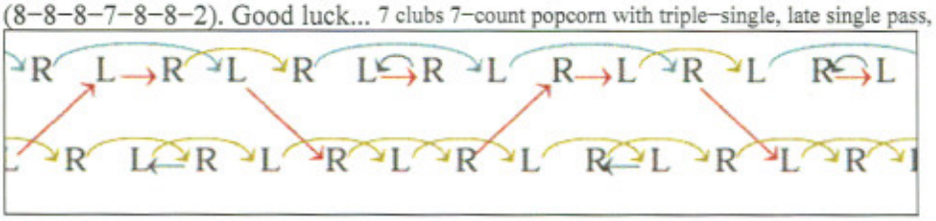


By replacing the pass on the double by a right self double (a normal 4), followed by a floaty single pass (diagonal if you were throwing tramline doubles and vice−versa), we obtain a fantastic rhythm (10−6−6−6−8−6−7 in the 4 hand siteswap notation, each juggler does 10−6−8−7−6−6−6). It's easier if you can both juggle 534 solo, because what you're doing here is a 534 followed by a floaty single pass then 3 normal selfs before starting again on the other side.

7 clubs, 7−count popcorn with triple−single and late single pass.



For a spicier variation even, you can try any of the 6−count variations since you still have 3 selfs left to play with. Here's the diagram of J1 juggling a popcorn and 531 (10−6−8−7−10−6−2) while J2 does the Twin Towers with a 441 (8−8−8−7−8−8−2). Good luck... 7 clubs 7−count popcorn with triple−single, late single pass, 531 and 441.

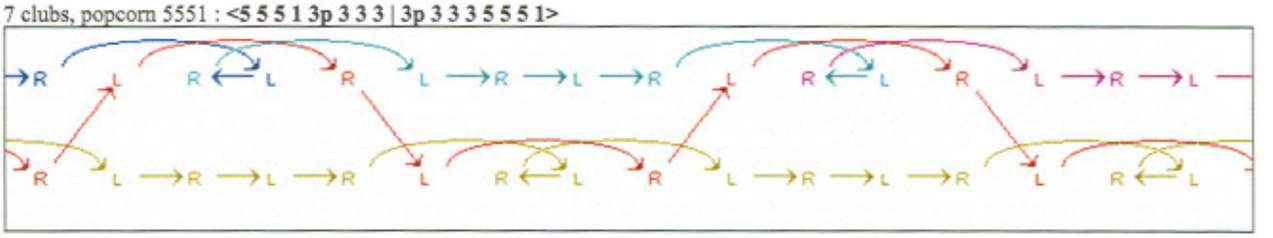


7 clubs : 8-count 5551 popcorn

The idea here is the same as with any popcorn: juggling 4 clubs for a very short period of time while your partner is juggling 3 then, passing them the extra club.

In this pattern, it's always the same club that is passed between the jugglers as a single. When the pass comes in, flash your 3 clubs (as triples in theory, however it's easier with floaty doubles), catch the pass, feed it to the other hand, pass it back to your partner then catch everything that comes down.

7 clubs, popcorn 5551 : **<5 5 5 1 3p 3 3 3 | 3p 3 3 3 5 5 5 1>**

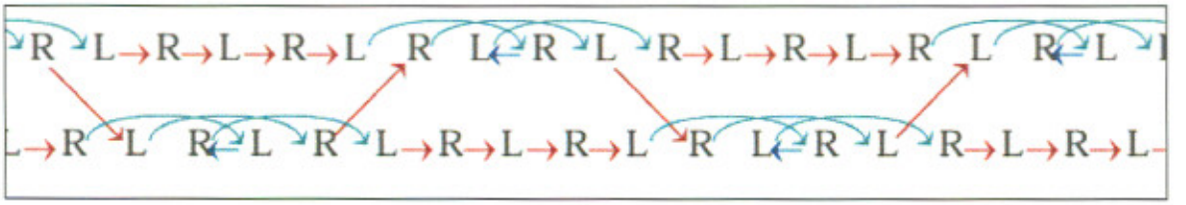


Tip: make your flash on doubles (make sure you don't throw them forward) and try to throw the second double (left hand) really high to calm things down. Also, be careful with your single passes; there's a natural tendency to throw them a bit too high.

7 clubs : 9−count 5551 popcorn

This is the full ambidextrous variation of the 8−count 5551 popcorn (you dreamt about it, we made it a reality!). All you have to do is add an extra self. In order to do that, one of you must throw tramline passes while the other responds with diagonal passes. All passes have are single spins and must be as floaty as possible.

The beginning is the same as in the 8−count. The sequence becomes: triple, triple, triple, feed, pass, self, self, self, self and repeats on the other side. Throwing doubles instead of triples will probably be easier here too.

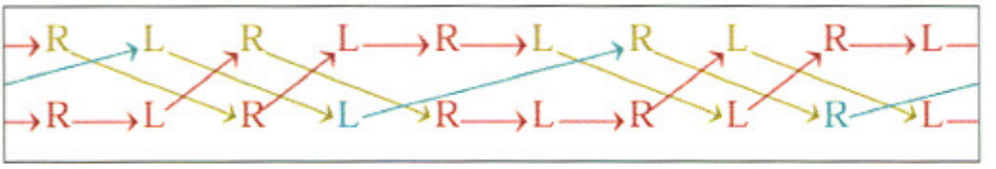


7 clubs : PPPSS

Preliminaries: try the 6–clubs version to familiarise yourself with the tempo.

J1 starts with 4 clubs and throws three diagonal passes on doubles followed by two normal selfs. J2 starts at the same time but throws a self first, before going into their PPPSS sequence: tramline pass on single, tramline pass on single, tramline pass on triple. Since the sequence has an odd length cycle, it takes 10 throws to arrive back at the beginning.

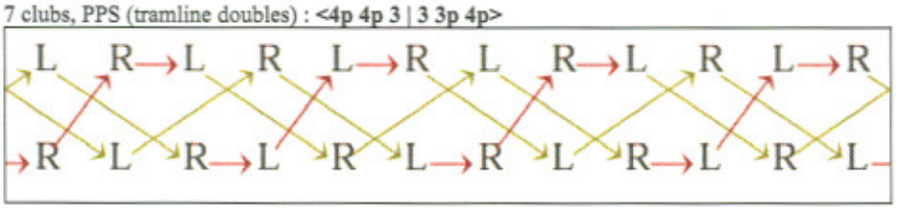
The diagram below shows the same thing, only with all the crossing throws inverted. You can try the 2 versions; it just depends on which hand J1 and J2 will start with.



7 clubs PPS

Before going any further, we suggest you to get familiar with the 6 clubs PPS (for the rhythm) and the 7 clubs 3-count (for the right and left hand double throws). You also need to know that there is no such thing as a symetrical PPS (i.e. : 2 jugglers doing the same thing) with 7 clubs. You may think that you just need to make the passes on doubles with one of you making tramline passes while the other throw diagonally, but it doesn't work. In the version below (there's others, depending on who is the tramline passer and who is the diagonal one) one of the juggler must alternate between passes on singles and passes on doubles.

7 clubs, PPS (tramline doubles) : **<4p 4p 3 | 3 3p 4p>**



In details :

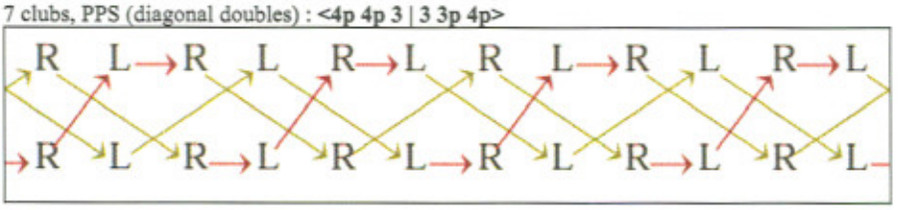
- The juggler at the top is doing a PPS with double tramline passes. It's the easy end of the pattern (well, you still need to catch the incoming passes!).
- The juggler at the bottom is also doing a PPS but:
  - the first pass is a diagonal single
  - the second pass is a tramline double

  You pass twice in a row to the same side of the pattern. You need to make your singles really low compared to the height of the doubles.

Variation:

Here's a variation with a different feel, even if the siteswap sequence stays the same: throw the doubles as diagonal passes and the singles as tramline.

7 clubs, PPS (diagonal doubles) : **<4p 4p 3 | 3 3p 4p>**



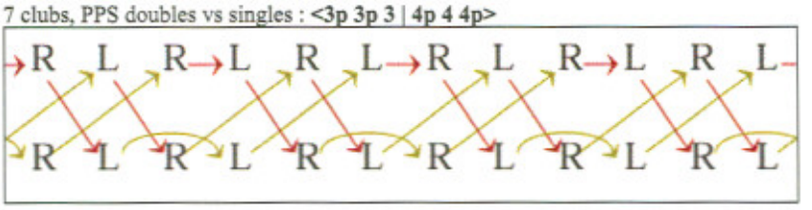
see also: 7 clubs PPS double vs single.

7 clubs : PPS doubles vs singles

Here's an easy PPS pattern: J1 is juggling everything on single spins, J2 on doubles – even the uncrossing selfs. The passes from J1 are tramline singles and those from J2 are diagonal doubles.

We can see that J1 is juggling a regular 6 clubs PPS while J2 is juggling a PPS inspired by the 8 clubs patterns made out of 4 clubs solo. The average of all this is indeed 7.

7 clubs, PPS doubles vs singles : **<3p 3p 3 | 4p 4 4p>**



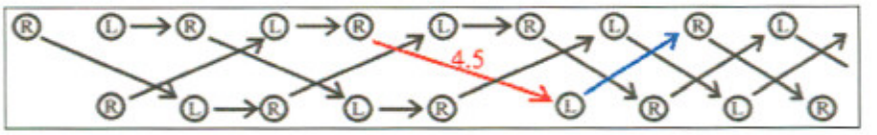
For more PPS with 7 clubs, see the Regular PPS.

7 clubs : transition 2-count/1-count

From 2-count to ultimates

From a 2-count on singles (floaty ones), A throws a double (instead of the single; in red in the diagram) to B. A then makes a last self before going into ultimates with diagonal throws. B waits for the double to come down before getting into ultimates with tramline passes by throwing a left hand passes (in blue) under the incoming doubles.

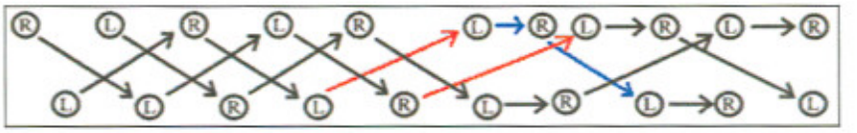
2-count to ultimate



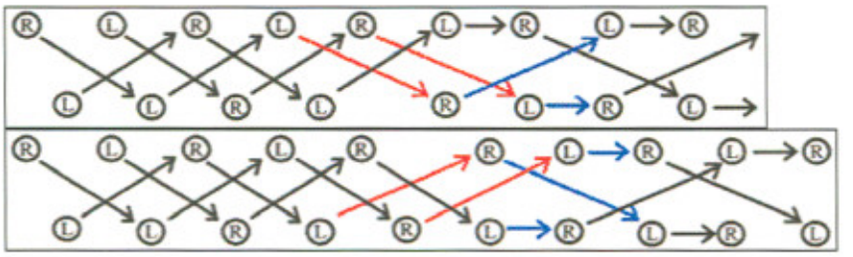
From ultimates to 2-count

From ultimates on singles, the juggler who is throwing diagonal passes makes a diagonal double (LH to LH) instead of a single, followed by a tramline double (RH to LH) before clicking into the 2-count. When the first double arrives, the other juggler goes directly into a 2-count (a self instead of a pass, you'd better react quickly!). The 2-count you both fall into can be juggled on singles or doubles.

ultimate to 2-count



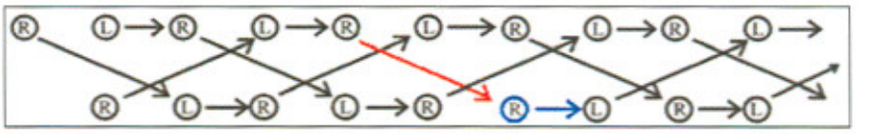
I've also found these two variations (from ultimates to 2-count) while drawing the diagram of the transition above.



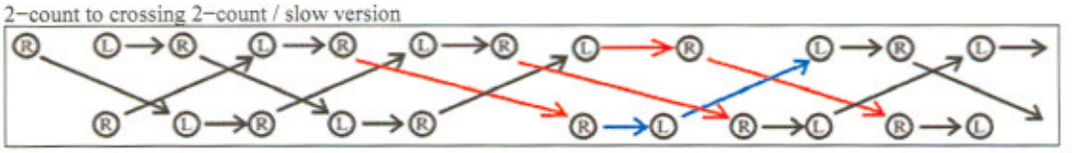
7 clubs : transition 2-count/crossing 2-count

From 2-count to crossing 2-count

2-count to crossing 2-count / with hurry

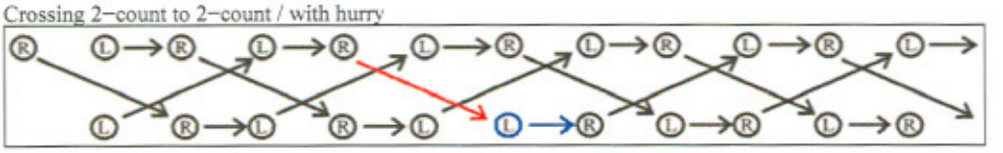


2-count to crossing 2-count / slow version

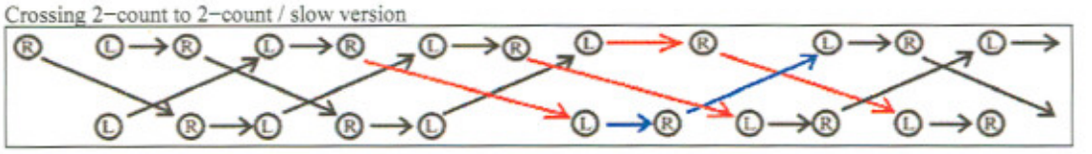


From crossing 2-count to 2-count

Crossing 2-count to 2-count / with hurry

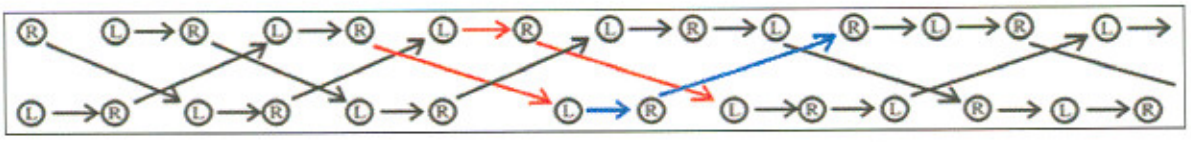


Crossing 2-count to 2-count / slow version

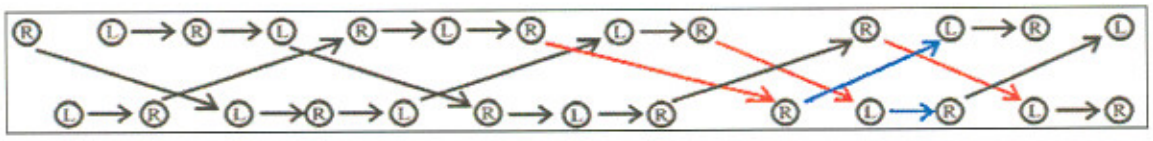


7 clubs : transition 2-count/3-count

From 2-count to 3-count

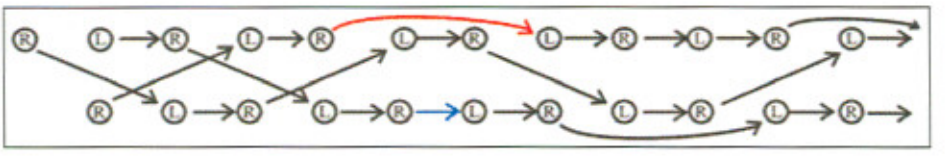


From 3-count to 2-count

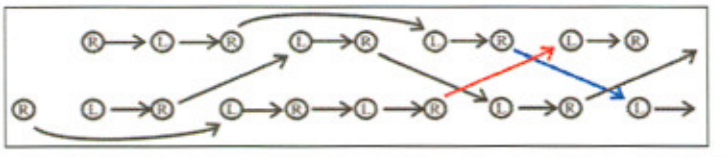


7 clubs : transition 2-count/6-count popcorn

From 2-count to regular popcorn



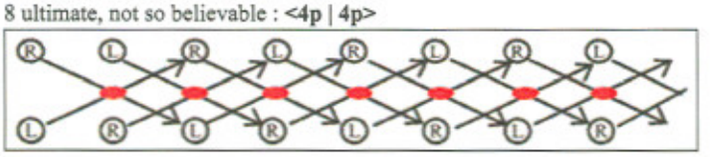
From popcorn to 2-count



8 clubs 1−count (ultimates)

If we apply a basic mathematics theory, we can guess that for an 8 clubs ultimate, both jugglers throw doubles, i.e. **<4p | 4p>**, just like in the following scheme. Nevertheless there is a huge problem with collisions (every red circle). Hence it is quite hard to do it this way (if you really wish to do it, you'll have to define a "row" for each juggler and for each hand, and be really precise −see page collisions).
NB : JoePass! is not concern about these collision problems.

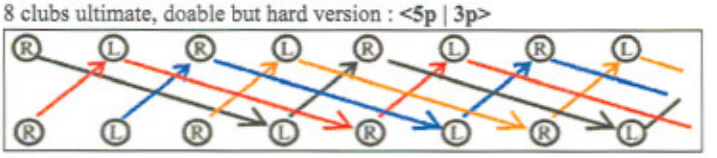
8 ultimate, not so believable : **<4p | 4p>**



8 ultimate, possible versions

A doable solution (but hard anyway) consists in having a juggler throwing very high (triples), and the other very low (singles). The juggler who starts with singles has 5 clubs (at least on the following scheme).

8 clubs ultimate, doable but hard version : **<5p | 3p>**



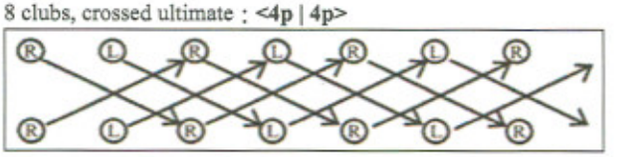
A much easier solution is to have a juggler throwing floating doubles and the other one throwing floating singles, just under the doubles. On the following scheme, both jugglers starts with 4 clubs each.

8 clubs ultimate, "easier" version: **<4.5p | 3.5p>**

Note : In the following schemes, I represented desynchronized rhythms (LH, then RH, LH...). Since in 8 ultimate you juggle 4 clubs separately on each side of the pattern (red lines & orange lines on one side, blue lines & black lines on the other), you can have the matching synchronized version, with RH and LH throws at the same time, in which it's easier to see what's going on in this pattern (even if it's harder to achieve).

There is also a last version, completely different from the firsts (cf. things to know about 8 clubs theory). It consists in crossing every pass (RH−>RH et LH−>LH, see also avoid collisions). You'll have to be desynchronized. The height of the passes is doubles' height, but you can also throw higher singles. Obviously it's much harder with singles.

8 clubs, crossed ultimate : **<4p | 4p>**

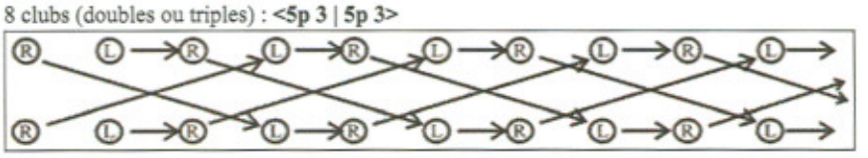


8 clubs 2-count

This rhythm is the first one you will try with eight clubs if you are a regular juggler. If you can easily deal with seven clubs doubles (for the passes) and singles (for the speed), that shouldn't be too hard for you.

Theory would request triples for eight clubs 2-count, the matching siteswap being '5p 3'. Though, most of passers use doubles because it is easier to throw doubles than triples, even if the rhythm is faster. On the other hand, triples will be more spectacular and a good training for nine 2-count.
Assuming you are throwing doubles, it will be the same as 7 clubs 2-count, the only difference being beginning at the same time with four clubs each, and also it's a little faster. Once you'll manage to get it steady, you can try to be more precise for your partner (same height, same spin, same timing): seen from the side, clubs should cross exactly between you two.

8 clubs (doubles ou triples) : **<5p 3 | 5p 3>**

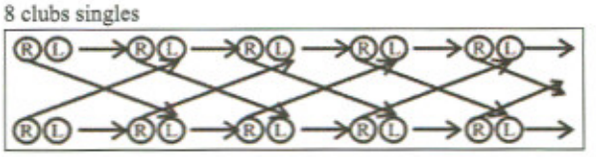


8 clubs singles

Things will start to get harder, and you'll have to become way more precise. The trick is to have your own self and your single pass thrown at the same time. Your two hands throw at the same time. For the rest, I'll let you experience for yourself (the main problem is it's hard to throw good selfs, sometimes because of passes arriving too much on the left.....).

With a little practice, it's possible to throw not exactly at the same time and it's what is shown in the following diagram.

8 clubs singles

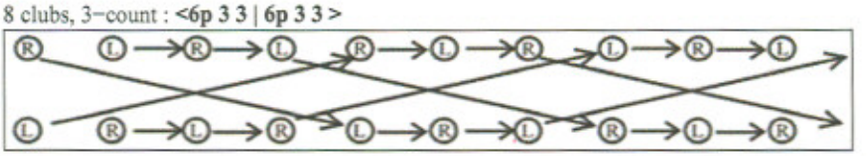


With a lot more practice, on can go from 8 clubs 2-count triples to doubles, and then to singles, and back (the return is easier).

8 clubs 3-count

I'll get back to it as soon as I try it (at first triple passes seem right, as much as a some experience with 4 clubs **633**).

8 clubs, 3-count : **<6p 3 3 | 6p 3 3 >**



8 clubs: symetric synchronous 3-count 4p44

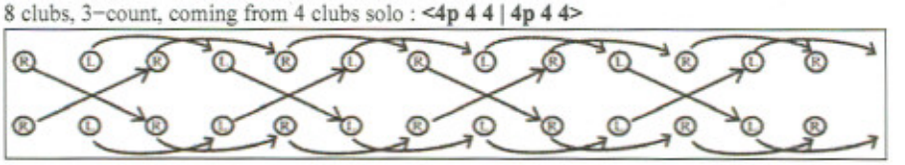
Complete version

The complete version is a real nightmare. Both passers **MUST** be extremely steady with four clubs. On the other hand, the theory is quite simple: each juggler starts with 4 clubs doubles (in the same time), then you throw a pass every 3 throw (double pass)

Each juggler should then do:

- double self RH
- double self LH
- double pass RH
- double self LH
- double self RH
- double pass LH

8 clubs, 3-count, coming from 4 clubs solo : **<4p 4 4 | 4p 4 4>**



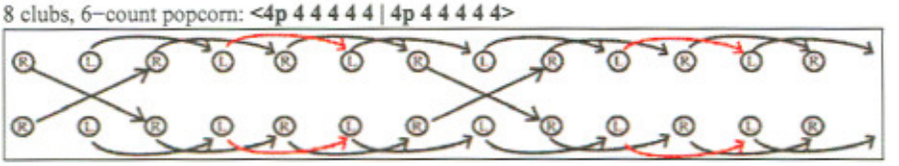
Be careful : On the scheme, it starts with the pass

If you feel really confident (or just for fun with JoePass!), you can try the super-complete version by replacing 2 double selfs in a row by triple-single, thus you get an 8-club popcorn !!
You can notice that this rhythm (just like the following scheme) is a part of a whole family: the rhythms taken from 4 clubs solo.

"Half" version

This one is much more easier, and you will use it as a practice for the whole version. It's all about throwing half of the passes: you pass only either the LH passes or the RH passes. It's in fact a 6-count.

8 clubs, 6-count popcorn: **<4p 4 4 4 4 4 | 4p 4 4 4 4 4>**



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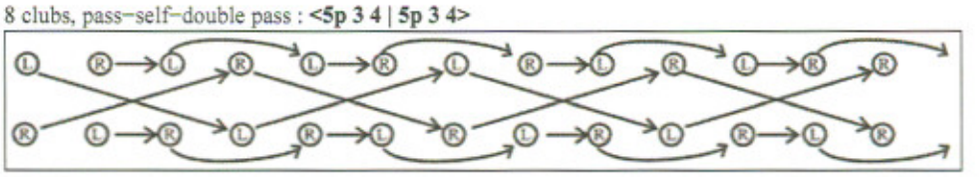
8 clubs 3-count popcorn

Uh... ?????? Let's say we are trying separately and then we'll see. A little bit like 7 clubs popcorn, and also like **534** alone with your 4 little friends.

8 clubs, pass-self-double pass : **<5p 3 4 | 5p 3 4>**

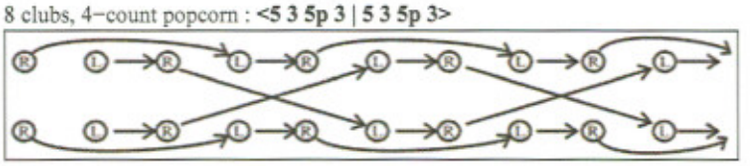


8 clubs 4-count popcorn

This rhythm comes directly from regular 7 clubs popcorn, but it is not so usual with eight clubs, though quite easy to manage. In theory, each juggler throws:

- triple self RH
- single self LH
- triple pass RH
- single self LH

8 clubs, 4-count popcorn : **<5 3 5p 3 | 5 3 5p 3>**



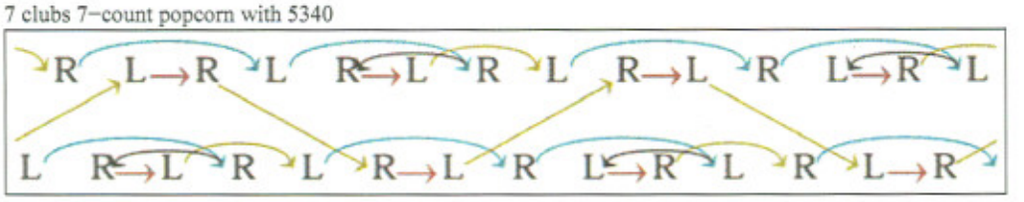
When you practice, you realize it's easier to replace triples (passes and selfs) with doubles (as you would do with 7 clubs popcorn). It's a little faster and lower, but not so ugly to look at.

8 clubs : Jon &Dani 7-count popcorn

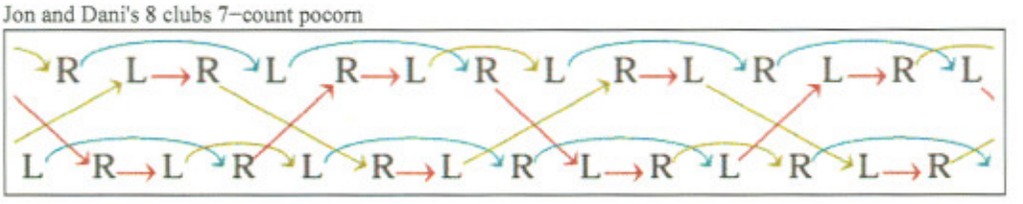
Warning : crazy rhythm that will challenge your physical and mentral abilities

This rhythm comes from a complicated variation of 7-count 7 clubs popcorn in which you uses the 4 selfs to throw 5 3 4 0. To get the 8 clubs version, you will 'just' have to replace 0's by single floating passes (3,5p). Here are the two diagrams, for you to compare both rhythms:

7 clubs 7-count popcorn with 5340



Jon and Dani's 8 clubs 7-count pocorn



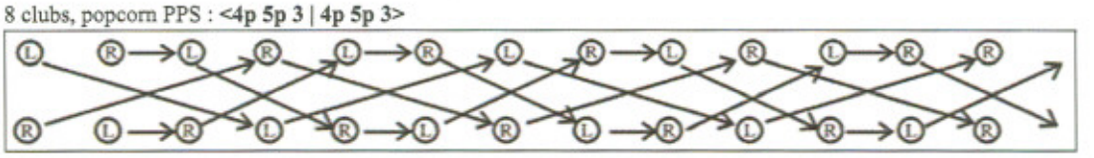
Here is the pattern for J1 (for J2 you'll have to switch crossed and straight passes):
- triple self
- single self
- double floating crossed pass
- triple self
- single self
- double self over the same hand
- single floating straight pass

J2 starts with a triple left hand self, immediately followed by a triple right hand self by J1. The 4 hands siteswap is 10 10 6 6 8 9 7, and each juggler throws 10 6 9 10 6 8 7.

8 clubs: PPS popcorn

I only quote it to be as exhaustive as one can be: since he feats in Charlie Dancey's *Compendium of Club Juggling*, maybe somewhere in another dimension (or in the Gandini's practice gym) people are currently running it.

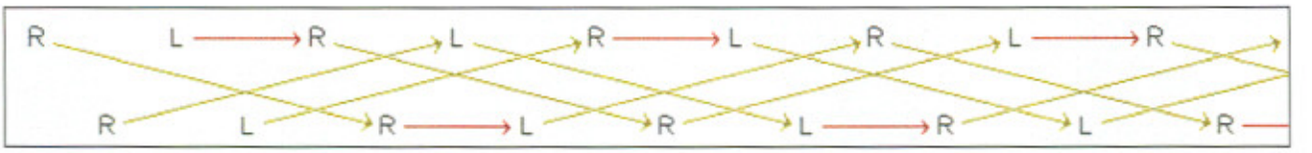
8 clubs, popcorn PPS : **<4p 5p 3 | 4p 5p 3>**



8 clubs: PPS

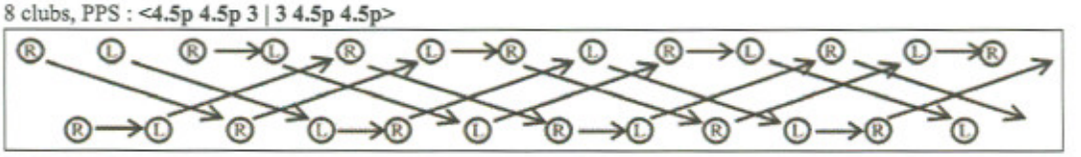
Things start to get really serious now. Let's say it's half way between 7 clubs PPS and 9 clubs 1-count (and a good practice for the latter). One of the jugglers crosses, the other goes straight. All passes are floaty doubles.

The easier start probably has each juggler starting with 4 clubs. The upper juggler throws (starting RH) pass, self, then PPS with crossing passes. The lower throws (starting RH) directly PPS with straight passes half a beat later.



On the following diagram, the upper juggler starts with 5 clubs (3 in RH) throwing pass, pass, self with crossing passes. The lower starts with 3 clubs (2 in RH) and throwing self and then starting the PPS pattern.

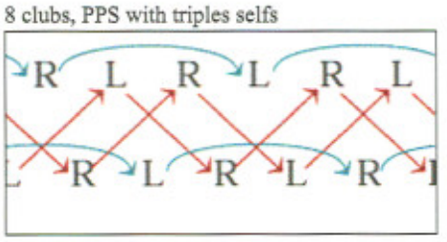
8 clubs, PPS : **<4.5p 4.5p 3 | 3 4.5p 4.5p>**



8 clubs 1077 PPS

Uh... pass, pass, triple self.... something like that. We'll talk about it after a few tries. If you try it, I'll be glad to hear about it (use the comments).
The 4 hands siteswap is 1077.

8 clubs, PPS with triples selfs



ROBOS

Things to know about steals and takeouts:

With all tricks of this kind, it's important that the juggler who's interfering or stealing not make any false movements. Your partner could believe that you're going to take some of the clubs and may drop them. It's better to be sure about what club you're going to take and to intervene right on time.
On the other hand, the one who gets the clubs stolen from him should juggle as if nothing was going to happen. It's not a good idea to throw the club to your partner; he has to take them where they are.
Descriptions are made using the world 'club.' You can use 'ball', 'ring', or whatever equally, but sometimes the way you're going to take the props may differ (and be harder).

Abbreviations used:

LH : left hand
RH : right hand
A : a juggler
B : the other juggler

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Sharing

Stealing and giving back a club from the side

Whilst A is juggling 3 clubs, B will go on their right and take an arriving club by placing their right hand above A's. The important thing then is that A and B remain in a constant rhythm. B has to throw the club again under A's right arm so that it comes back then to A's left hand. Actually, B replaces A's right hand for one catch and throw.

Half sharing

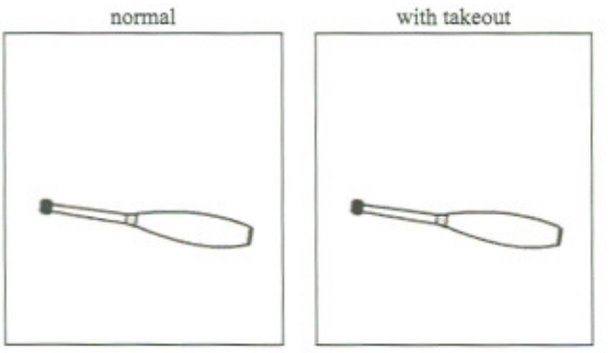
By saying "half sharing", I mean that each juggler manages one club out of two. It is a continuous "steal and give back" of all the clubs from one side. Considering the above situation, B takes with their right hand all the clubs on the right side of A. A will take with their left hand all the clubs coming from the left.The non-juggling arm can be put on the shoulder of the other juggler and can be used to take and give back a hat/cigar/drink travelling between A and B.

Third sharing

Here B takes 1 club out of 3 (always the same club) and A juggles 2 clubs with a hole (in a 3 club pattern). So B starts stealing and giving back a club as described above. Nevertheless he has to recover this club on the other side with his other hand by going quickly behind A. He then starts the same movement again. So B ends up going back and forth behind A's back, throwing and catching the same club.

Claws

The basic movement with one club is shown in the animation below. The club is thrown by juggler A (who is invisible but we have to imagine him on the left), and is then caught by juggler B (on the right of the animation) who replaces it during the movement in A's hand. If A throws a club with their right hand, then it will be caught by the right hand of B, who replaces it in the left hand of A. B has no influence on the trajectory of the club.

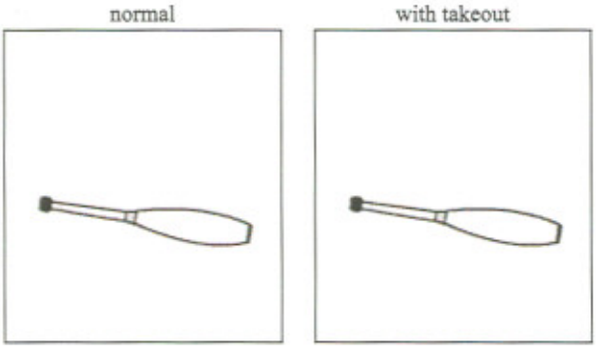


B can then try and do the movement while A is juggling normally, by alternating the right and the left hands.

The main purpose is then for B to catch each club in this way; every club has to have been in their hands. For that, it is necessary that A remains cool and juggles as slowly as possible. Once the pattern is stable, A can start watching elsewhere since B places each club into their hands.

Replacing

Here, juggler B (we can see his hand on the right), is in front of juggler A (we cannot see him on the left) and is taking with his left hand (in pink) a club thrown from A's right to their left hand. In the meantime, B replaces the club they just took with another one (purple) with their left hand and puts it in the left hand of A. Their right arm then goes above the left arm.

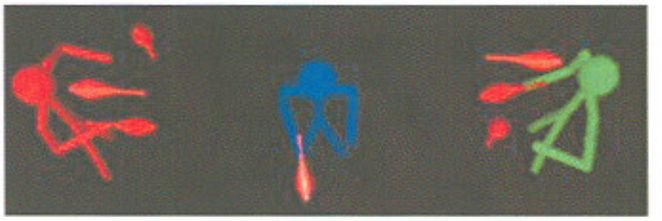


For A, nothing has changed, apart from an exchange of clubs. The movement can be done with every club that arrives to the left hand of A; B making a quick handacross from one hand to another between each takeout (the club taken with the left hand will be given back to A with the right hand the next time). B has then to continue quite quickly, A has to try to slow the pattern and overall keep throwing their clubs at the same height.

If this is successful, B can attempt the handacrosses behind the back. A third juggler can also be added, doing the same as B but on the right hand of A.

Replacing in passing

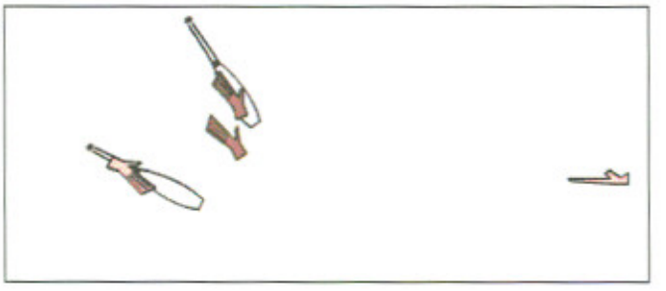
For this steal, 2 jugglers are passing 4−count (you can generalise it after). A third juggler is going to come in the middle of the pattern. The idea is to steal a pass going from one juggler to the other and to replace it with another club. The animations below may give you an idea of the position of the clubs and of what is happening during the movement.



The blue juggler will take with his left hand a pass going from the red juggler to the green one. In the same movement, they will put the club they have in their right hand in the hand of the green juggler. The arms are crossed during this movement, the right arm goes above coming from the top. The club has to be caught by its body (left hand), at the moment where the red juggler has just thrown it, so that the handle may be placed in the green jugglers hand.

normal

with takeout



When juggling a 4−count, the movement can be done every pass with a handacross from one hand to another between every pass.

To complicate further, the blue juggler can "replace in passing" (from the red juggler to the green one), and then replace (on the right hand of the green juggler), then turn 180° and do the same, continually changing direction. Both the green and the red jugglers have to be familiar with the 2 kinds of takeout to manage this pattern, whilst the blue juggler alternates.

Another idea is to add someone else who plays the same role as the blue juggler, replacing just the passes coming from the green juggler to the red one.

Runarounds

The runaround is a "pattern" where two jugglers basically run around each other continuously stealing one club after another (as well as the hat, the cigar and various other things!).

This pattern can be broken down and worked out at each step since neither juggler is continuously juggling 3 clubs. The first steps are excatly the same as those described in side steals.

Slow version

- 1– To begin, A starts juggling normally with 3 clubs (+ hat and cigar), then B comes along to the right of A... (B has no clubs to begin with). B catches in his right hand a club initially destined to be caught by the right hand of A.
- 2– B throws it again below the right arm of A in order to catch the next club (again destined for A's right hand) with their right hand.
- 3– B goes then in front of A in order to catch with their left hand the first club they threw with their right hand.
- 4– A throws throws their last club with their left hand below B's left arm, and goes quickly (one step) behind B to be able to catch the same club with their right hand. Now it's just a matter of switching roles and starting again!

For one complete cycle, each juggler makes two consecutive right hand catches followed by two consecutive left hand catches. There is then a free moment when they can use either (which is available) to steal the hat, then later with the other, steal the cigar.

Fast version

In the fast version, everything goes twice as fast and there is only one catch made by each hand. For this, when B steals the first club with their right hand, they go immediately in front of A to catch the next club which was destined to arrive in the A's left hand. A then throws their last club with their left hand below the left arm of B and moves quickly to catch it again on B's right side (like in the slow version). The pattern continues by switching the roles.

The juggler can still take the hat and the cigar in the fast version, they just need to move faster.

Side steals

The purpose here is to take all the clubs from your partner and the stealing is made according to two criteria: " slowly or quickly" and "starting either from the outside or from the inside". Once you manage either of these techniques, you will be able to attempt a runaround, which is actually a continuous stealing of all 3 clubs.

Slow stealing from the outside (coming from the right)

- 1− To begin, A starts juggling normally with 3 clubs, B comes in (they have no clubs to begin with). B stands to the right of A, and catches in his right hand a club destined for A's right hand.
- 2− B throws it again below A's right arm, in order to catch the next club (again destined for A's right hand) with his right hand.
- 3− B goes then in front of A in order to catch with his left hand the first club thrown with his right hand.
- 4− A then throws his last club with his left hand below B's left arm. Once B has caught this last club with his right hand (after having thrown the one in 2−), he then has 3 clubs.

Please notice:
Obviously it is the same to begin on the left side instead of the right side (and it is better to know how to do so on both sides). I don't describe the "slow inside stealing" here. You can however try it using the same principle as the "fast inside setaling". The details are briefly outlined below.

Fast stealing from the outside (coming from the right)

In the fast version, everything goes twice as fast and there is only one club caught by each hand. When B steals the first club with their right hand, they immediately move in front of A to catch the next club destined to arrive in A's left hand. A then throws their last club with their left hand below B's left arm, who then takes control of all 3 clubs.

Fast stealing from the inside (coming from the right)

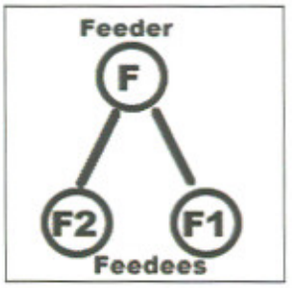
Here B always remains on A's right hand side, but steals the first club from the left side of A with their left hand. To do so, they have to put their arm above A's arms, between the clubs and A's body. The first club is the hardest to take, with their right hand, B then takes the club destined for A's right hand, then waits for A to throw the last club.

REPARTIENDO

Passingdb.com
the Passing Data Base

http://www.passingdb.com

Feeds



When doing a "feed", there is somebody (the feeder F) who's passing to 2 other jugglers (the feedees F1 & F2), facing them at the same time. F passes to F1 and F2 in a pattern which has to be defined. F1 and F2 only pass to F. F1 and F2 usually juggle the same pattern, but staggered since we assume that F is not going to catch 2 clubs at the same time (this assumption is broken with synchronous patterns).
For a more detailed introduction, see the article section of passingdb.

I define a **classical feed** as any pattern with n jugglers where 1 juggler (the feeder) is facing the n−1 others (the feedees, arranged in a line, n being greater than 2). In the case of a 3 persons feed, it's almost always possible to derive an N or W feed from it.

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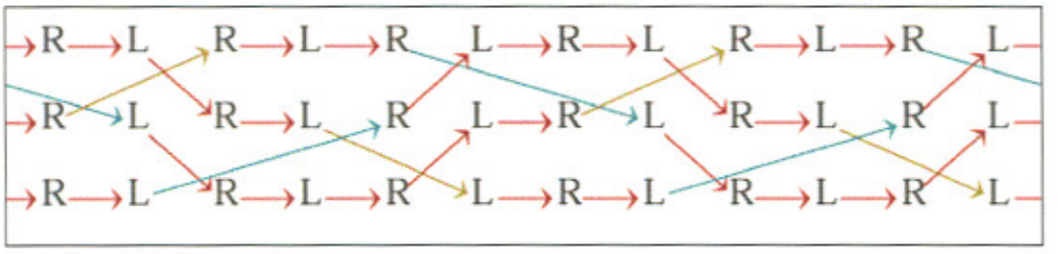
10 clubs funky PPS feed

Credits: first publication by Jon Skjerning–Rasmussen in Kaskade 65

This one looks quite difficult. Here is what Jon said in Kaskade 65 (F1 & F2: feedees, FF: feeder):

In this pattern everybody starts at the same time from the right. F1 stands to the right of F2. FF has 4 clubs and does: crossing double to F1, straight single to F2, self, cross doub (F2), straight single (F1), self. All the feedees' passes are straight and both start with a self before doing their 3–count sequences. F1 does: left single pass, self, self, right trip pass, self, self. F2 does: left trip pass, self, self, right single pass, self, self.



Popcorn feeds

Introduction

The purpose of this page is to give some feed patterns where the feedees or the feeder are doing a popcorn rhythm.

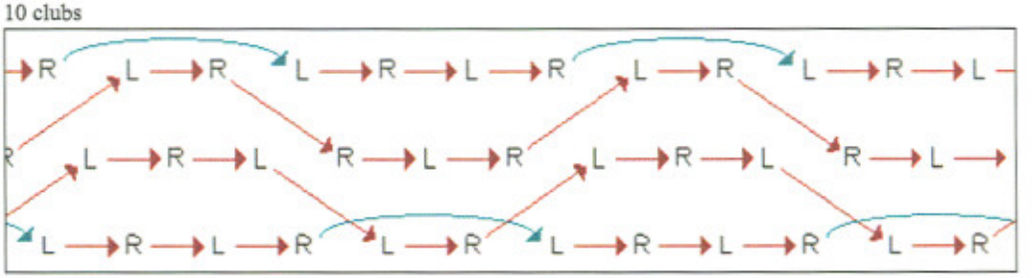
You'd better be familiar with the whole popcorn family and especially with the 6-count popcorn, the 3-count and the 5-count popcorn.

More details may follow, but for now, you're alone with the causals.

Feedees in popcorn

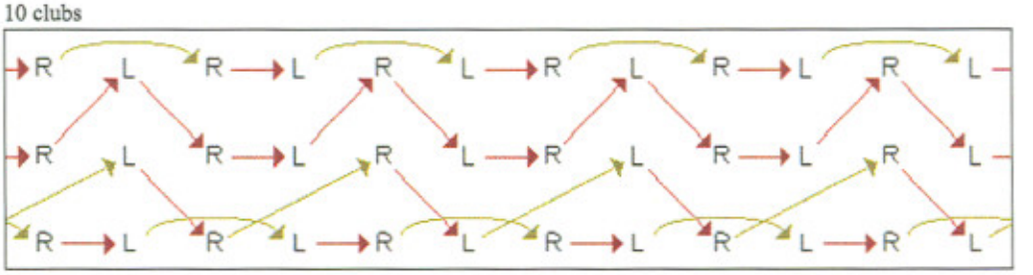
feeder in 3-count, feedees in 6-count popcorn

10 clubs

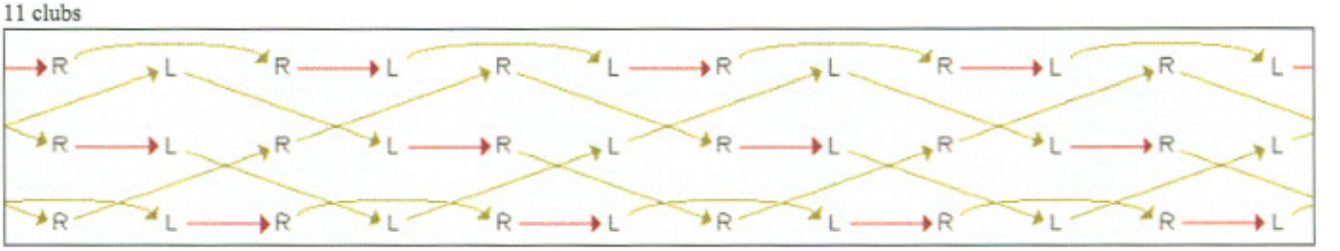


feeder in PPS, feedees in 3-count popcorn

10 clubs

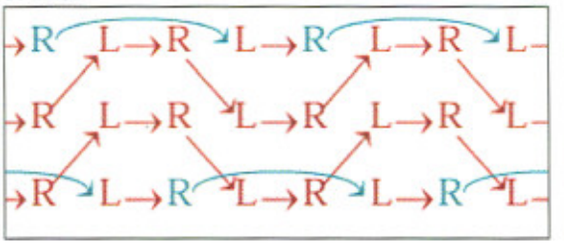


11 clubs

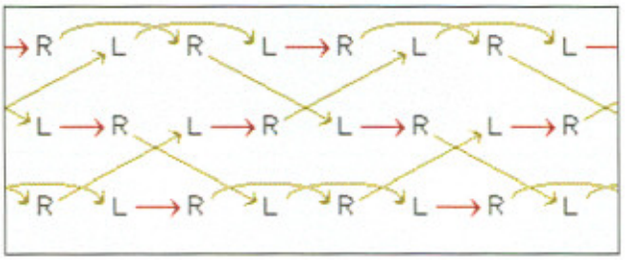


feeder in 2-count, feedees in 4-count popcorn

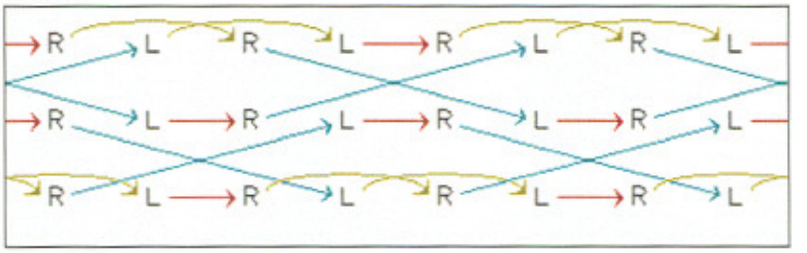
10 clubs



11 clubs

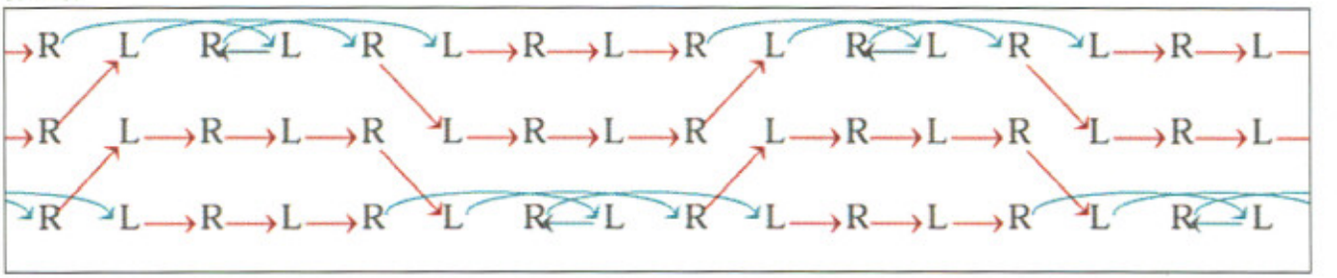


12 clubs



feeder in 4-count, feedees in 8-count popcorn 5551

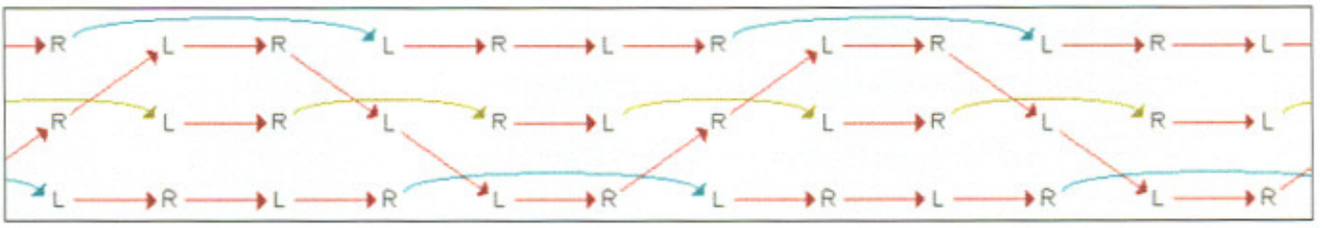
10 clubs



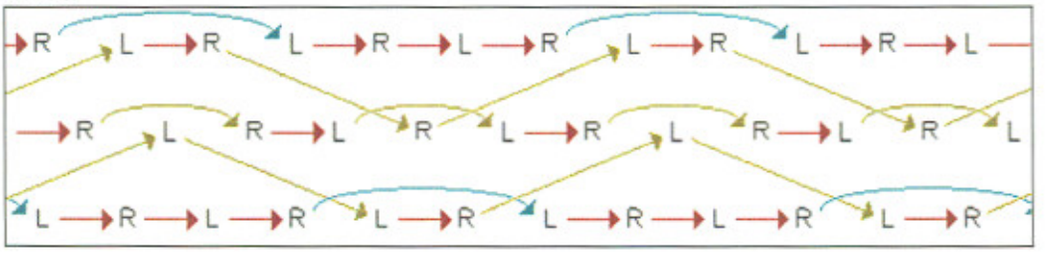
feeder et feedees in popcorn

feeder in 3-count popcorn , feedees in 6-count popcorn

10 clubs

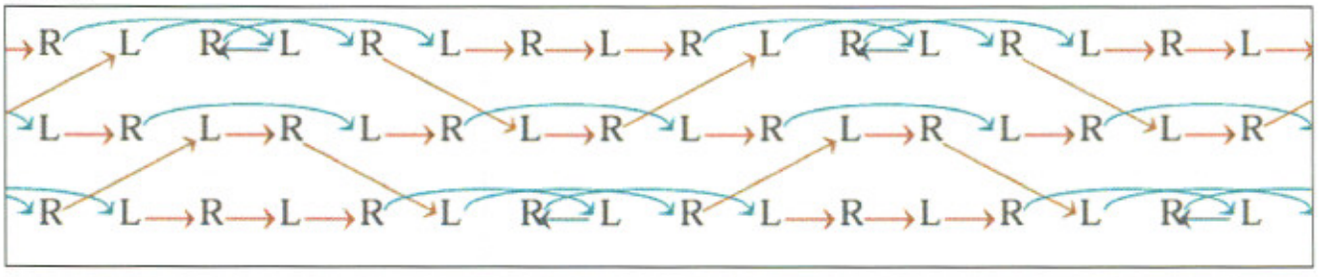


11 clubs



feeder in 4-count popcorn , feedees in 8-count popcorn 5551

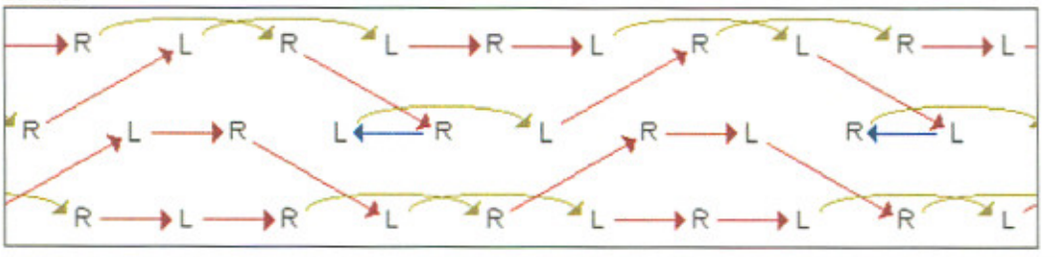
11 clubs



For some added fun

feeder in whynot, feedees in 5-count popcorn

10 clubs



JaSoN's countdown

Credits: first publication by Jon Skjerning–Rasmussen in Kaskade 66

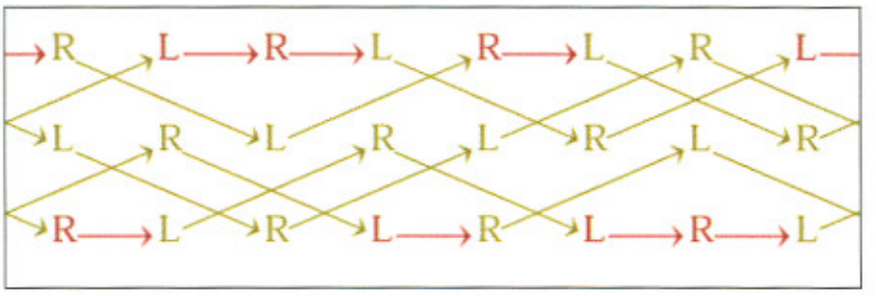
Here is what Jon says about JaSon countdown in Kaskade 66:

This pattern I invented in Rotterdam last year with Simon and Nick, but unfortunately they live in Germany and England, so I haven't had the chance to get it really solid. The pattern has both an 11–club version and a 12–club version (I don't remember which one we did in Rotterdam – but we had it working for a while so it was there were probably only 11 pieces of plastic in the air).

Anyway, warm up by juggling it with 9 clubs. 'Feedee 1' (F1) does pssp–spps while 'Feedee 2' (F2) starts four beats later thus doing spps–pssp (don't get confused by the hyphen – it, doesn't mean anything, is for the people that choose to think of the countdown from 3 as a pssp followed by the reverse: spps). The feeder (FF) does ultimates starting with two inside passes then going into the sequence which is four outside passes, four inside passes etc. This is a nice pattern and can be extended to the n–feed, the w–feed etc. In these cases only the two jugglers on the end do the countdown – all the others are feeding. Well, back to The Real Stuff.

JaSoN countdown: 11 clubs

To do the 11–club version have have the two feedees do the easy end of the Copenhagen Countdown (that is straight double passes and no zips). F1 starts with 4 clubs and does pssp–spps. F2 has 3 clubs and starts at the same time as F1 doing spps–pssp. Both start with the right hand. FF starts at the same time as the feedees but from the left hand and he does ultimates. He does one inside pass before going into the real sequence which is four outside passes (starting from the right) followed by four inside passes (also starting right, of course). All the passes are normal (not floaty) straight doubles as this pattern is synchronous.

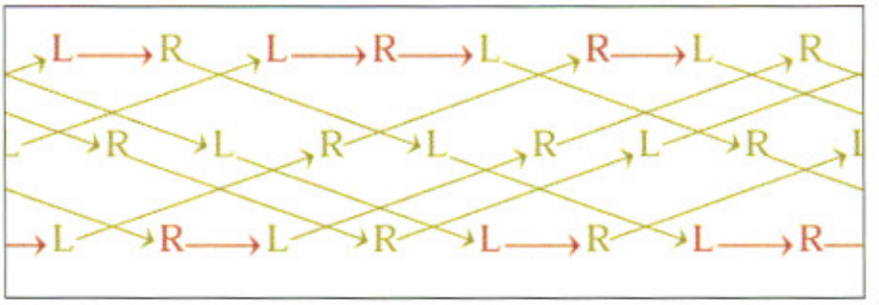


FF is the centre line and F1 is the top line, and F2 is the bottom line. If you don't understand the difference between inside and outside passes imagine that you are walking along the middle line of the causal diagram passing in the direction of the arrow (with the appropriate hand) each time you walk over one of the letters.

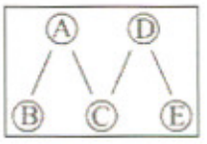
JaSoN countdown: 12 clubs

In the 12–club version all the passes are floaty doubles and F2 (this time equipped with 4 clubs) starts with a left hand pass half a beat before the feeder and a whole beat before F1. FF and F1 both start with the right hand. F2 starts one throw earlier in the throwing sequence thus doing pspps before going into the Copenhagen Countdown sequence. To get this to work FF will be crossing and the feedees doing straight passes (as in the diagram), but it can also be done with FF going straight, and the feedees doing crossing passes. Have fun!

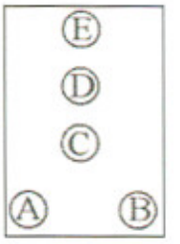
passingdb.com, Feeds



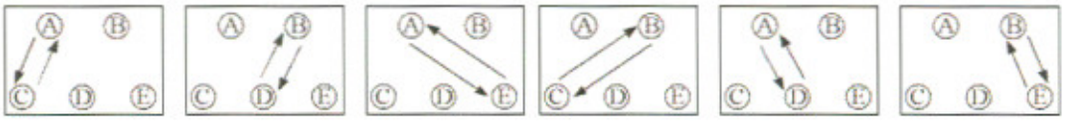
Miscellaneous W-feeds



You can of course use the traditional W-feed positions for these patterns, but all of them can also be done with the jugglers arranged as in the diagram on the right.

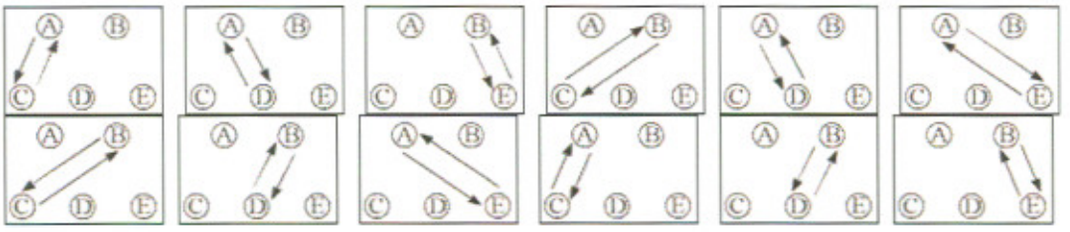


W-feed with 3-count and 2-count



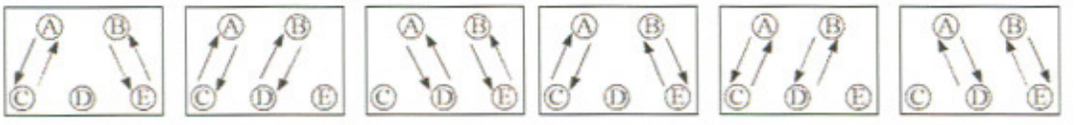
Rhythms:
A & B : 2-count (left hand throws for B)
C, D, E : 3-count

W-feed with 3-count and PPSS



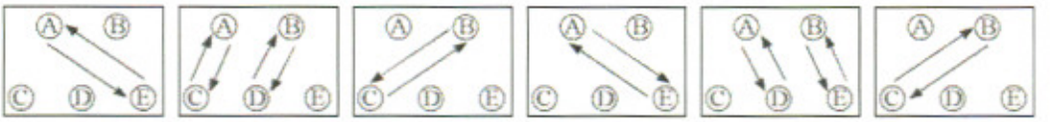
Rhythms:
A et B : chocolate bar (PPSS)
C, D, E : 3-count (waltz)

W feed with PPS and 1-count



Rhythms:
A & B : 1-count (ultimate)
C,D & E : PPS

W-feed with PPS and miscellanous rhythms

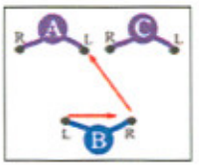


Rhythms:
A & B : PPS
C : SPPSSP (SP–PS)
D : SPSSPS (SSP)
E : PSSPPS (harder to remember)

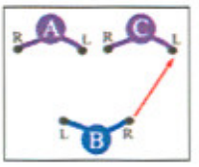
Technofeeds

These passing rhythms are some very interesting slow–fasts with a feeder in a special 1–count. I made some additional diagrams to make it clearer:

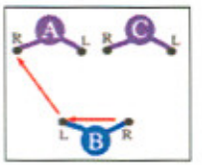
B: feeder
A: feedee 1
C: feedee 2
(RH: right hand, LH: Left hand)



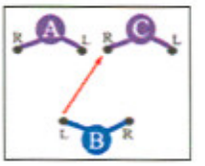
RH pass – LH zip



RH pass



LH pass – RH zip



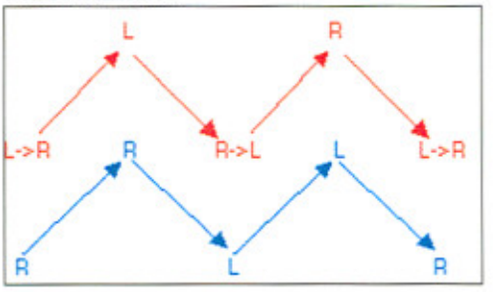
LH pass

In the 2 patterns (8 and 10 club), B starts with 2 clubs in each hand, and won't do the first 2 zips.

8 club technofeed

The feedees do a very (very very) slow 1–count. They should try to throw at the very last moment to make it easier for the feeder.
Feedee 1 (A) does straight passes, feedee 2 (C) does crossing passes.
A & C start with a club in each hand.

8 clubs technofeed

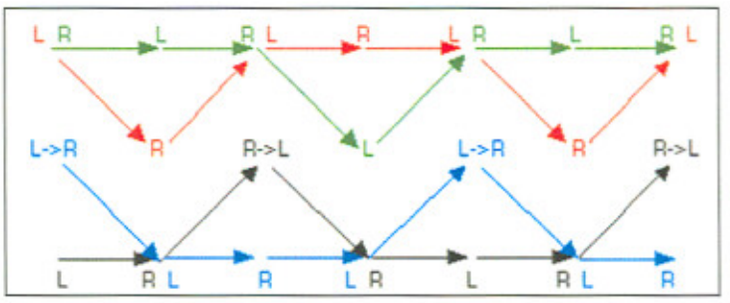


10 clubs technofeed

This time it gets a lot more difficuly for the feedees, they're now doing a rhythm, which, from their point of view, is a 7 clubs 3–count on singles. The feeder does the same thing as in the 8 clubs version.

As in the 8 clubs version, A does straight passes, B does crossing passes. They each start with 2 clubs in the right hand and 1 in the left.

10 clubs technofeed


L R
L
R L
R
L R
L
R L
R
L
R
L->R
R->L
L->R
R->L
L
R L
R
L R
L
R L
R

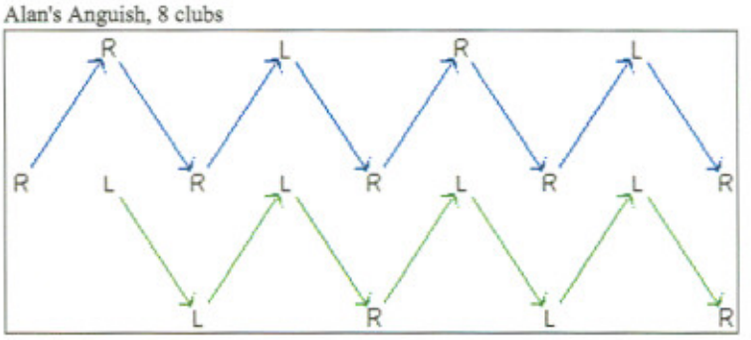
Alan Anguish

Theses rhythms are slow–fasts with feeder and feedees on ultimates (1–count). Therefore, the feedees have to juggle slowly. Here are the 8, 9 and 10 clubs versions.

Alan's Anguish, 8 clubs

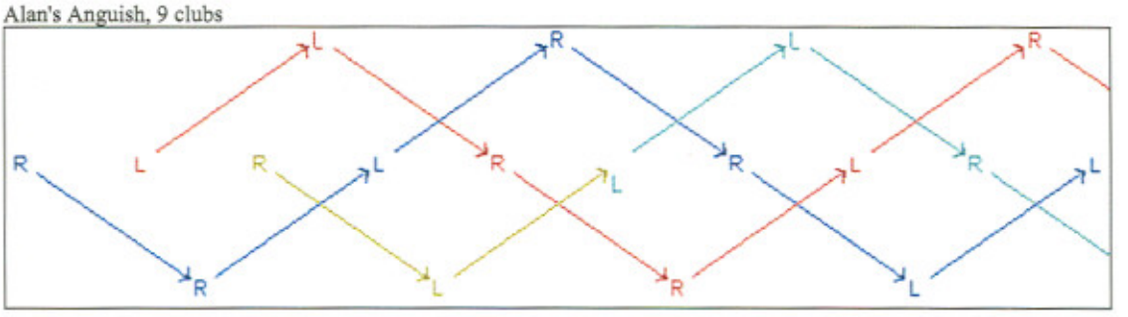
The feeder's sequence is : diagonal, diagonal, tramline, tramline or – to say it differently – outside, outside, inside, inside.
For both feedees it's relatively easy ; each is always aiming toward the same hand (in order to have 4 clubs on each side).

Alan's Anguish, 8 clubs



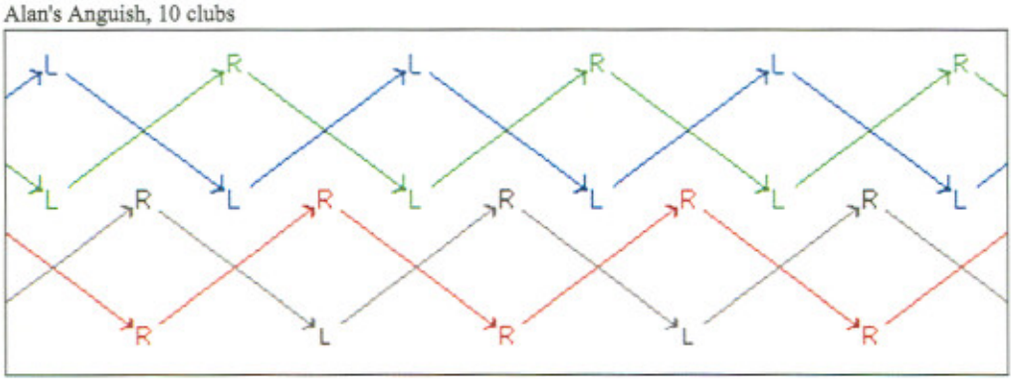
Alan's Anguish, 9 clubs

Alan's Anguish, 9 clubs



Alan's Anguish, 10 clubs

Alan's Anguish, 10 clubs



Martin's Mildness &Martin's Madness

Credits: Created by Martin Frost

Mandatory : being able to juggle Mild Madness

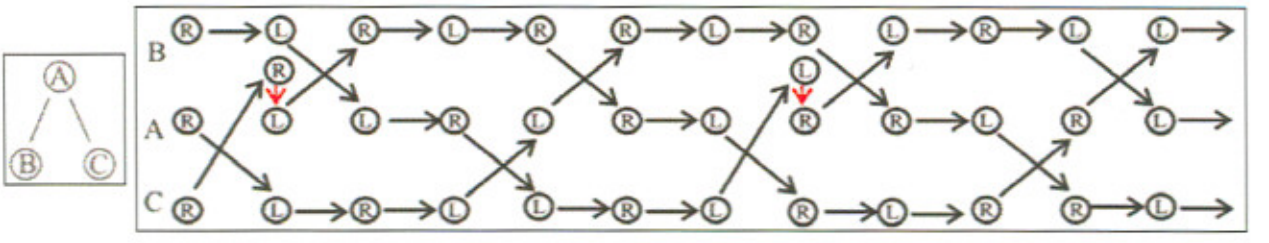
There's two possibilities to juggle Mild Madness as a feeder :

Soft version : Martin's Mildness (tramline passes)

- The feeder is juggling Mild Madness on tramline passes. The general feel of the pattern and the passes' order is the same as in the normal PPS feed.
- The feedees (B & C) are juggling Jim's 3-count on diagonal passes.

The diagrame below isn't really helpful (a bit too messy) but if you understood the general idea, go for it !

Martin's Mildness

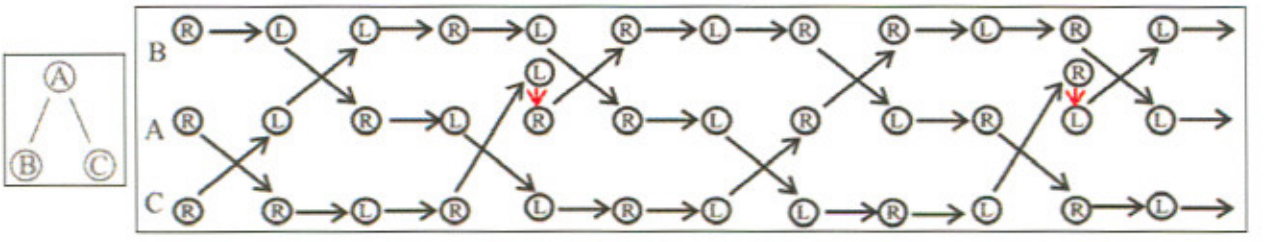


Hard version : Martin's Madness (diagonal passes)

- The feeder is juggling Mild Madness on diagonal passes. The order stays the same – C, B, self, C, B, self – but you need to start with two outside passes (as opposed to the inside throws of the PPS feed) because of the diagonal passes.
- The feedees are juggling Jim's 3-count on tramline passes.

This version is harder because it's more difficult to visualize clearly who gets what, and when. And the inside passes don't feel like they're crossing at all.

Martin's Madness

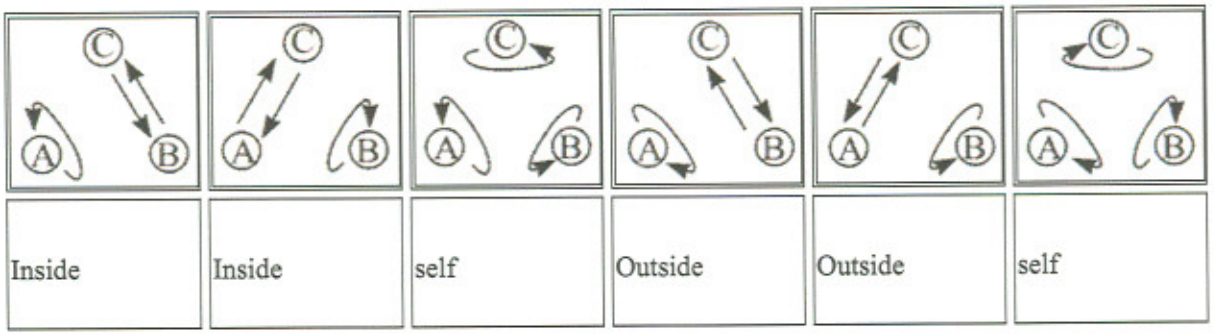


PPS feed (aka 3-count feed)

Credits: Created by Martin Frost

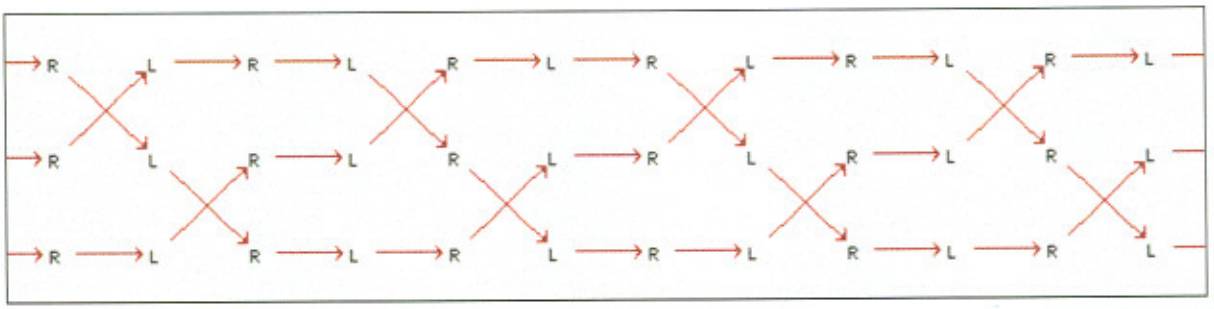
Normal PPS feed

The feeder is juggling a PPS while both feedees are juggling waltzses (3-count). The second feedee starts with a left hand pass (see diagram #2).



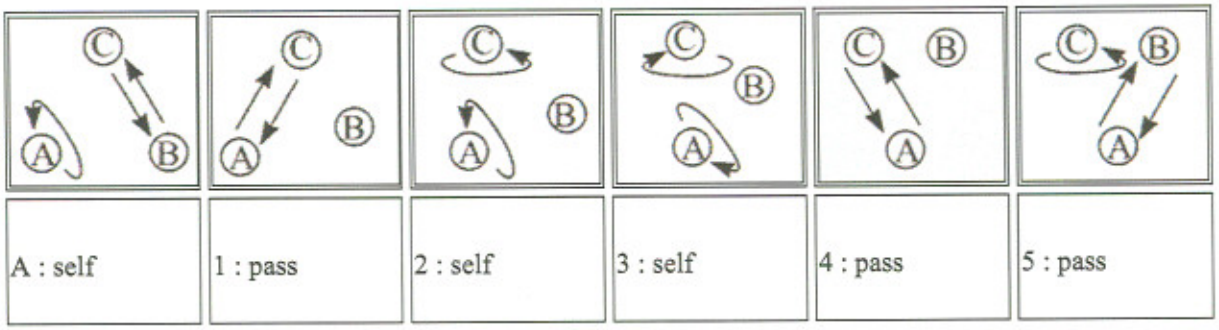
Inside	Inside	self	Outside	Outside	self

We can summarize the pattern with the casual diagram below :



Position change 1 - left feedee

If you are the left feedee (B in this case) and if you leave your position just after a right hand pass, you'll be back on the other side with a left hand pass 5 beats later. What A must do to become the feeder is described below the diagrams.



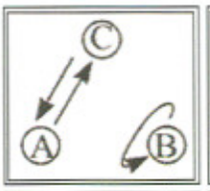
A : self	1 : pass	2 : self	3 : self	4 : pass	5 : pass

A actions :
4 : pass (cf. diagram)

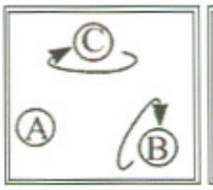
5 : pass (cf. diagram)
6 : self
7 : pass .....

Position change 2- right feedee

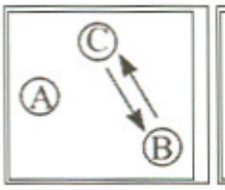
If you are the right feedee (A in this case) and if you leave your position just after a right hand pass, you'll be back on the other side with a right hand pass 4 beats later. What B must do to become the feeder is described below the diagrams .



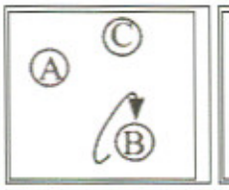
B : passe



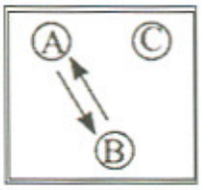
1 : self



2 : passe



3 : self

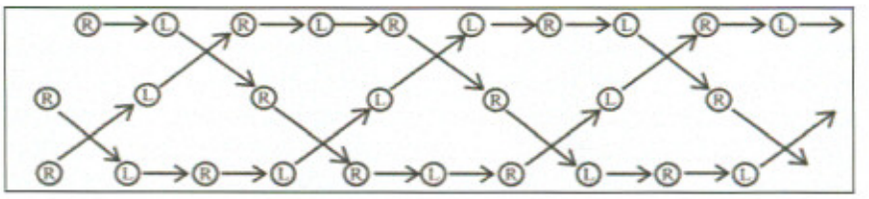


4 : passe

B actions :
4 : pass (cf. diagram)
5 : pass
6 : self
7 : pass ....

Slowfast feed 1−count/3−count

Just a short example of a slow−fast, with a feeder in 1−count and 2 feedees in 3−count.



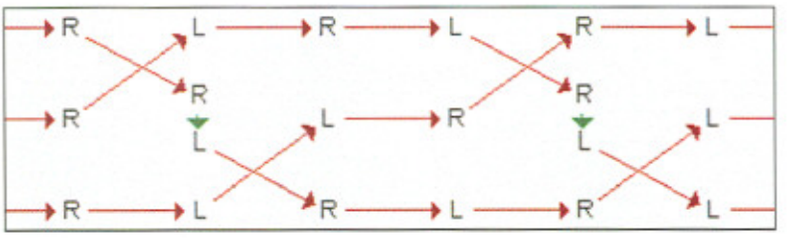
Keith's PPS feed

Author: **Eric Sunshine**

Credits: Created by Keith "the leaf" Hirschman

Keith's PPS feed is an intense feed in which the feeder, shown in the center, performs pass–pass–self and does a handacross every three beats (twice as often as in Martin's Madness). Each feedee performs a 3–count. Feedee A always passes to the feeder's right hand, which means that the passes alternate between straight and diagonal. Feedee B always passes to the feeder's left hand. An interesting feature of this pattern is that the feeder's handacross always occurs in only a single direction, which differs from most patterns in which the direction of the handacross alternates.

One last thing, on the original version, A is the right feedee seen from the feeder's point of view. But you can also try the other way round.



A good training pattern for the feeder is Mild Madness with synchronous change every 3 beats.

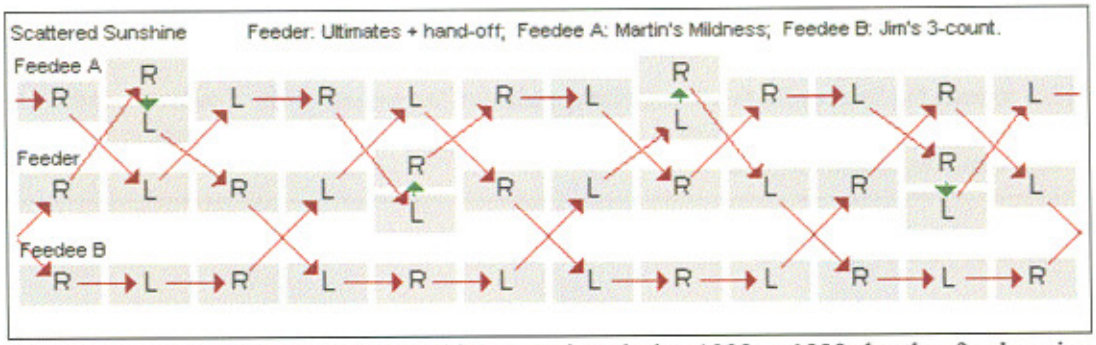
Sunshine Series

Author: **Eric Sunshine**
Credits: Feeds created by Eric Sunshine

This is a set of patterns created at the Mount Clemens Juggling Club (which has the most up-to-date information about them) by Eric Sunshine beginning around 1998 or 1999. Families of these patterns tend to share certain characteristics and, in some cases, the families marry with particularly pleasing results. Many of these patterns were inspired by the Martin's Madness feed, in which the feeder is forced periodically to perform a handacross. A feature of most of the Sunshine series of patterns is that two or more jugglers are forced to perform handacrosss, and in many cases, the feeder must juggle Ultimates (1-count) with a handacross. The skill level required for most of the patterns ranges from Jim's 3-count to 1-count with a handacross.
Also, in all the following feeds, feedee A is on the right, seen from the feeder's point of view.

- Scattered Sunshine (3 jugglers)
- Very Scattered Sunshine (4 jugglers)
- Shattered Sunshine (3 jugglers)
- Shattered Scattered Sunshine (3 jugglers)
- Splattered Sunshine (3 jugglers)

Scattered Sunshine



This pattern was devised by Eric Sunshine sometime during 1998 or 1999 shortly after learning Martin's Madness.

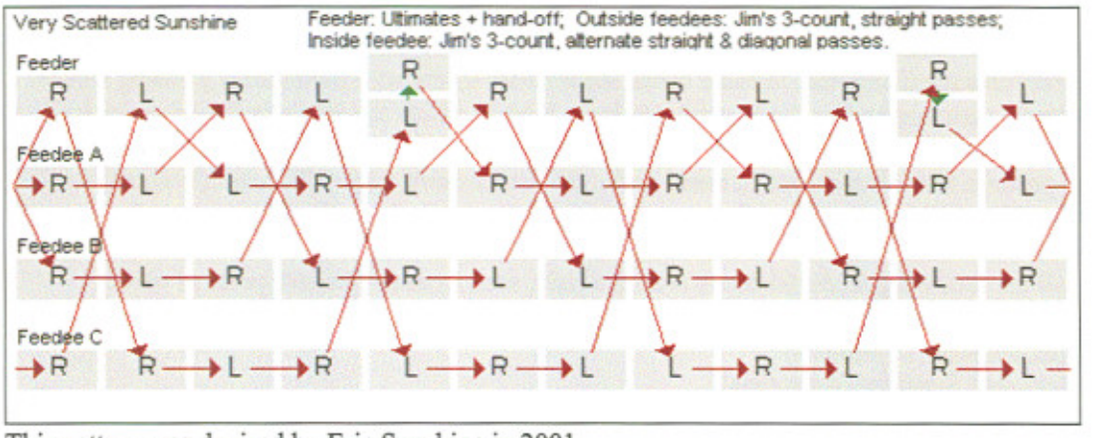
The basic *Scattered Sunshine* feed is a three person pattern in which two jugglers are doing handacrosss every six beats. The feeder, shown in the middle position, performs Ultimates (1-count) with a handacross. Feedee A performs Mild Mildness, which is a pass-pass-self pattern with a handacross. Feedee B performs a modified Jim's 3-count in which passes alternate between straight and diagonal. One way to visualize this pattern is to start with Mild Mildness between the feeder and feedee A, and then add feedee B in place of the feeder's self-throw.

It is possible to train the feedees for this pattern independent of the pattern itself. Feedee A can be trained via Mild Mildness. Feedee B can be trained via a modified Jim's 3-count in which passes alternate between straight and diagonal.

A nice feature of this feed, as with many others, is that it can be extended easily by adding jugglers to each end. For example, if a Jim's 3-count feedee is added to feedee A's end, then feedee A turns into a Scattered Sunshine feeder (that is, Ultimates with a handacross). Adding a 3-count feedee to feedee B's end causes

feedee B to turn into a Martin's Madness feeder. Likewise, it is possible to add a pass–pass–self feedee to feedee B's end, which will cause feedee B to perform Ultimates.

Very Scattered Sunshine

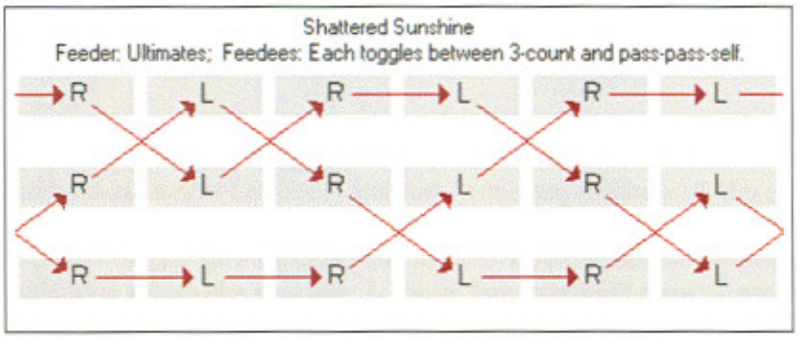


This pattern was devised by Eric Sunshine in 2001.

The basic *Very Scattered Sunshine* feed is a four person pattern. The feeder, shown in the top position, does Ultimates (1–count) with a handacross every six beats. The feedees on the left and right ends, feedees A and C, do standard Jim's 3–count with straight passes. Feedee B, the inside or middle feedee, does a modified Jim's 3–count in which passes alternate between straight and diagonal throws. One way to visualize this pattern is to take the Martin's Madness feed and insert a third feedee in place of the feeder's self–throw.

It is possible to train the feedees for this pattern independent of the pattern itself. Feedees A and C can be trained via standard Jim's 3–count. Feedee B can be trained via a modified Jim's 3–count in which passes alternate between straight and diagonal.

Shattered Sunshine

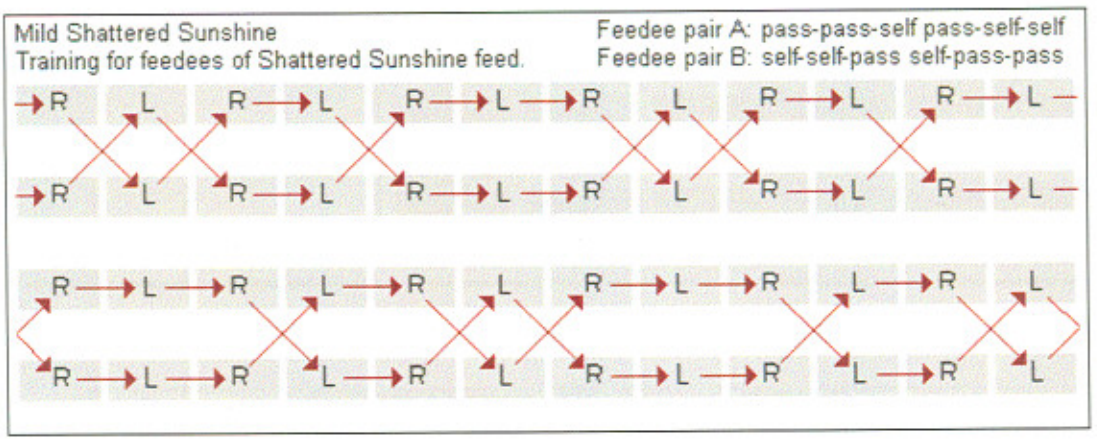


This pattern was devised by Eric Sunshine on 2002/12/11.

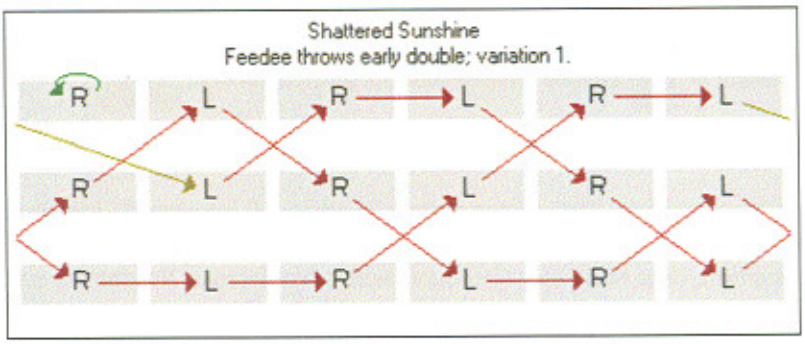
The basic *Shattered Sunshine* feed is a three person pattern. The feeder, shown in the middle, does Ultimates (1–count). Feedees A and B each toggle between 3–count for 3 beats and pass–pass–self for three beats.

It is possible to train the feedees for this pattern independent of the pattern itself. Feedee A is trained via a pass–pass–self–pass–self–self pattern. Feedee B is trained via a self–self–pass–self–pass–pass pattern. Though similar, the feedee positions are inversions of one another, thus it is necessary to train each feedee

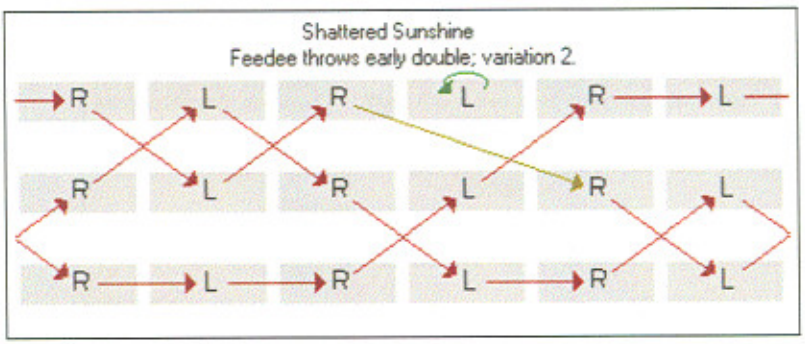
separately. This is illustrated below by two distinct pairs of jugglers in the *Mild Shattered Sunshine* diagram.



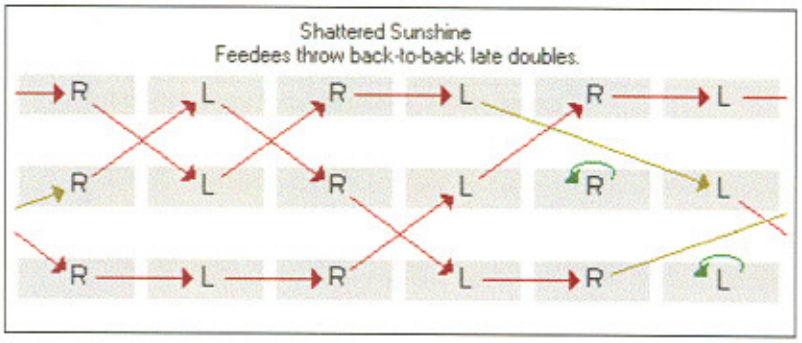
Various site–swap tricks can be thrown in a *Shattered Sunshine* feed. The diagrams below illustrate several such tricks. The first diagram shows how feedee A can throw an early double to the feeder during the feedee's 3–count phase.



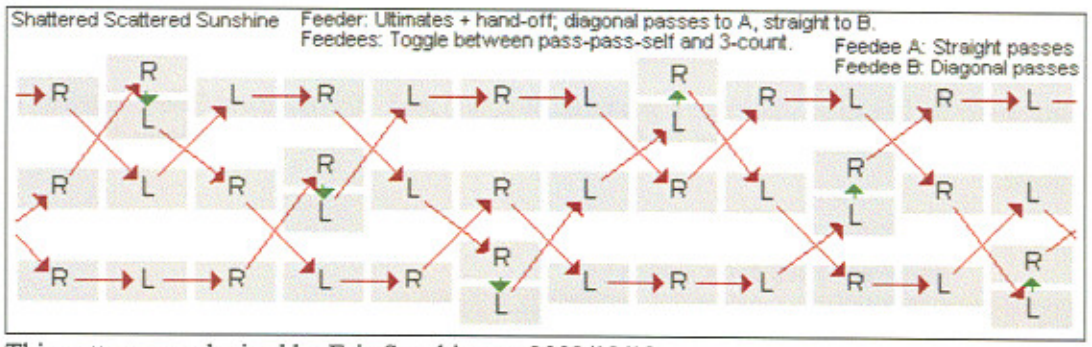
The next diagram shows how feedee A can throw an early double to the feeder during the feedee's pass–pass–self phase.



Finally, the next diagram shows how feedees A and B can cooperate to throw back–to–back late doubles to the feeder. The feedees must cooperate in order to avoid having two clubs arrive at one of the feeder's hands at a given beat.



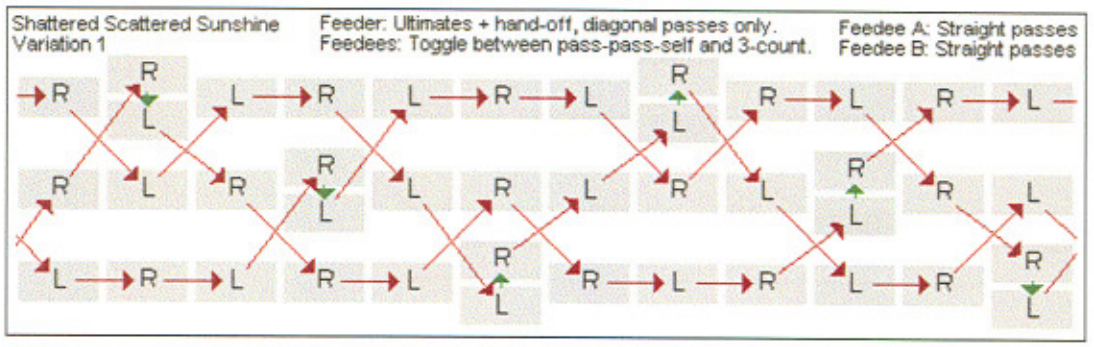
Shattered Scattered Sunshine



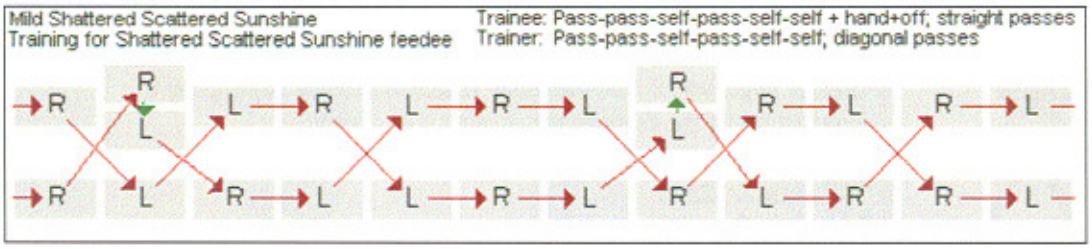
This pattern was devised by Eric Sunshine on 2002/12/12.

The basic *Shattered Scattered Sunshine* feed is a three person pattern in which all jugglers do handacrosss every six beats. This pattern is an elegant marriage of the Shattered Sunshine and Scattered Sunshine feeds. The feeder, shown in the middle position, does Ultimates (1–count) with a handacross. Feedee A's pattern is pass–pass–self–pass–self–self, and throws straight passes to the feeder. Feedee B's pattern is self–self–pass–self–pass–pass, and throws diagonal passes.

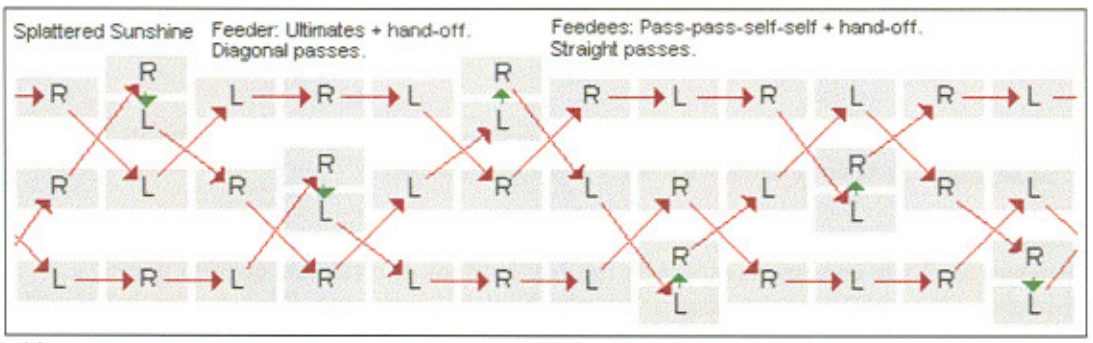
The next diagram shows a simple variation of the basic pattern in which both feedees throw straight passes, and the feeder always throws diagonal passes. This modification is known as *Shattered Scattered Sunshine variation 1*.



It is posible to train the feedees for this pattern independent of the pattern itself. Unlike most training patterns in which two feedees can be trained simultaneously, for *Shattered Scattered Sunshine*, only one feedee is trained at a time. In the *Mild Shattered Scattered Sunshine* training diagram below, the *trainer* throws diagonal passes and performs simple *hurries* rather than handacrosss, while the *trainee* throws straight passes and performs handacrosss representative of the feedee position for *Shattered Scattered Sunshine*.



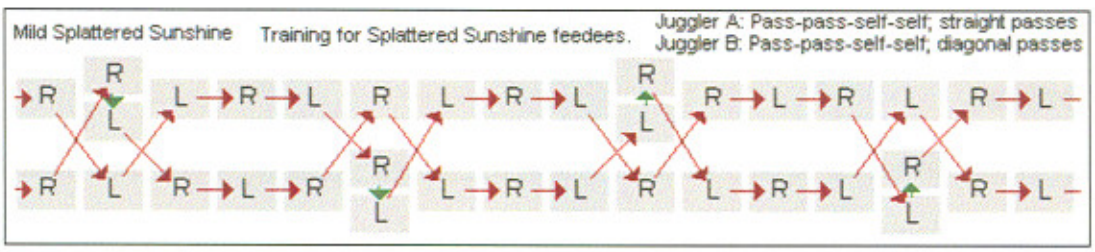
Splattered Sunshine



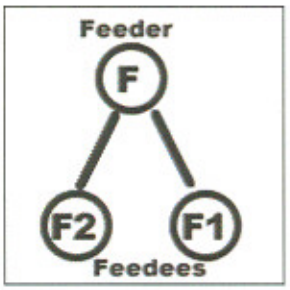
This pattern was devised by Eric Sunshine on 2002/12/17.

The basic *Splattered Sunshine* feed is a three person pattern in which all jugglers do handacrosss. The feeder, shown in the middle, does Ultimates (1−count) with a handacross every six beats, and throws diagonal passes. Feedees A and B each do pass−pass−self−self with a handacross, and throw straight passes to the feeder. An interesting feature of this pattern is the irregular handacross period of the feedees, which toggles between four and eight beats.

It is possible to train the feedees for this pattern independent of the pattern itself. This is illustrated below by the *Mild Splattered Sunshine* pattern. Juggler A throws straight passes. Juggler B throws diagonal passes. Although the trainer pattern does not exactly replicate the irregular handacross period of the actual *Splattered Sunshine* feedee position, it is sufficiently similar to be of use.



2-count feeds



On this page, you'll find the feeds where the feeder is juggling a 2-count while the feedees are passing a 4-count :

- 9 clubs 2-count
- 10 clubs 2-count
- 11 clubs 2-count

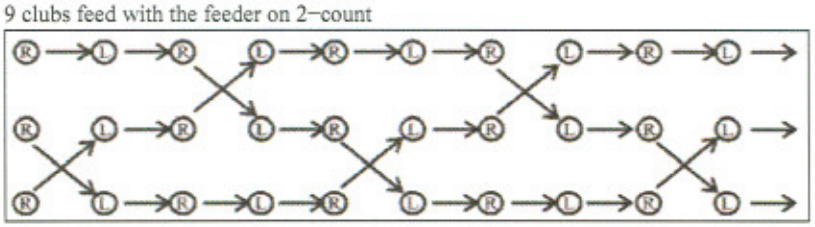
9 clubs

This feed is the easiest of all ; it's also one of the first 3 person patterns tried by newbies. Start by reading the introduction to feeds if you don't know what we're talking about here.

To sum things up :

- All the passes are made on singles (except for the syncopations: early & late doubles, triples, ...)
- Both feedees – C1 and C2 – are juggling a 4-count. While C1 is passing, C2 is making is RH self.
- The feeder is juggling a 2-count and feeds alternatively C1 and C2.
- C1 and C2 can throw any 4-count syncopations (doubles, triples, ...)
- S can throw any 2-count syncopations (provided he makes sure they arrive to the right feedee)
- A good feeder can compensate the errors made by 2 novice feedees.

9 clubs feed with the feeder on 2-count



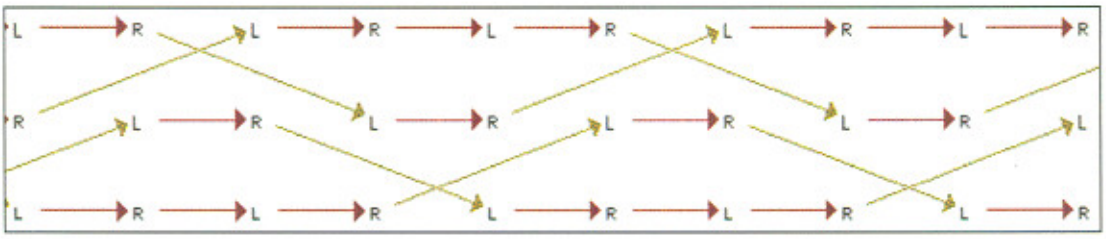
10 clubs

On doubles

The 10 clubs feeds isn't much harder if the feeder is solid on 7 clubs 2-count. Remember these points :

- All the passes are made on doubles.
- The feeder starts with 4 clubs, both feedees with 3 each.
- The feedees "reply" to the passes of the feeder : they wait to see that a pass is coming their way before answering. It means that the pass from C1 to S is thrown a beat after the pass from S to C1.
- There's a risk of collision between the passes from C2 to S and those from S to C1 (see diagram at the top). To avoid this, C2 must aim a bit outside, on the left of S.

10 clubs feed on doubles

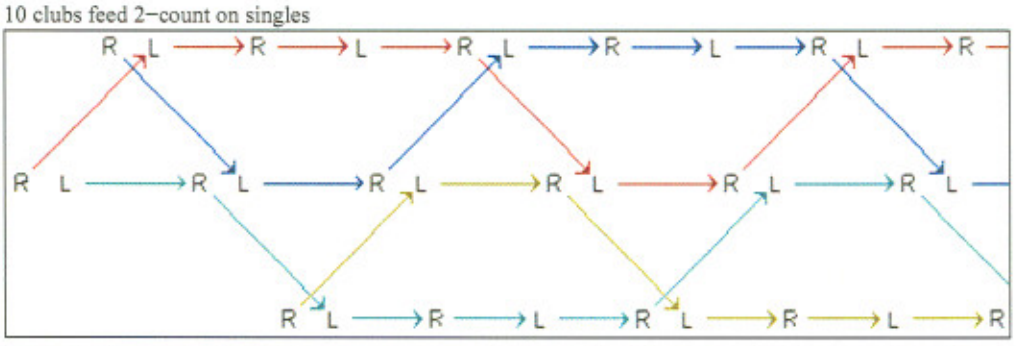


On singles

Since it's possible to juggle 7 clubs 2–count on floaty singles, the same idea can be applied here. Nothing more to say on this except that the collision risk is less important than with doubles.

The causual diagram doesn't help much but here it goes anyway...

10 clubs feed 2–count on singles



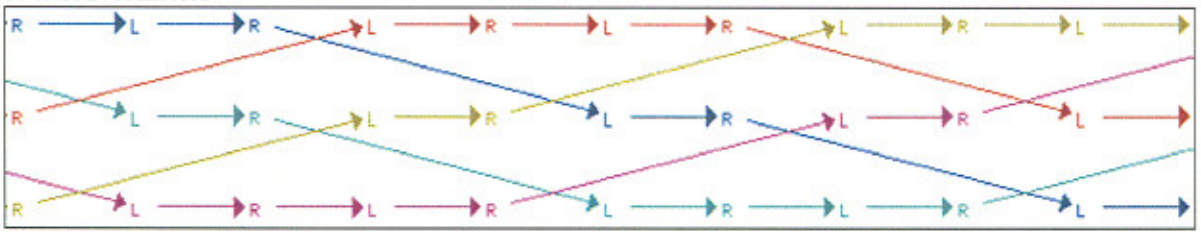
11 clubs

The 11 clubs feed isn't too hard if both C1 and C2 are familiar with the 7 clubs 4–count pattern. The theory (cf. diagram below) says that all the passes should be made on triples but I suggest you to use floaty doubles instead (much easier to master than triples). Remember: putting theory aside can be a good thing now and then...

Features :

- All the passes are made on doubles (or triples if...)
- S – the feeder – starts with 4 clubs, C2 with 4, C1 with 3
- Everyone starts at the same time for synchronisation's sake (otherwise it's gonna be tough for S)
- S starts with a pass for C1
- C1 starts with 2 selfs
- C2 starts with a pass

11 clubs 2–count feed



PPS feeds

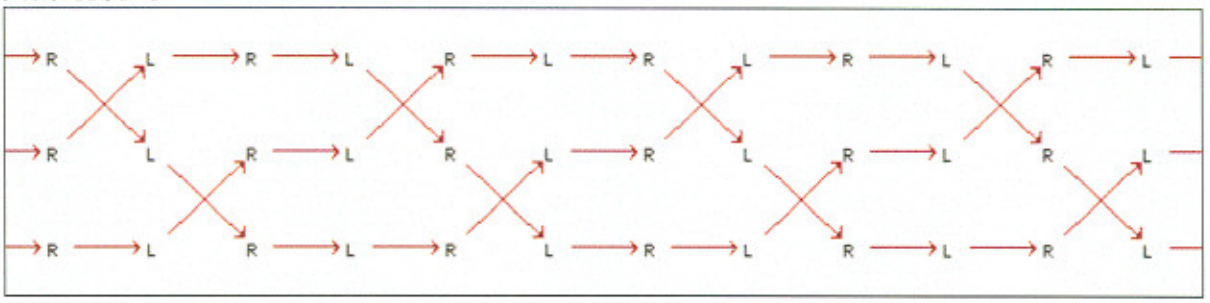
On this page, you'll find various feeds with the feeder juggling PPS while the feedees both run a 3-count :

- 9 clubs PPS
- 10 clubs PPS (7 versions)
- 11 clubs PPS

9 clubs PPS feed

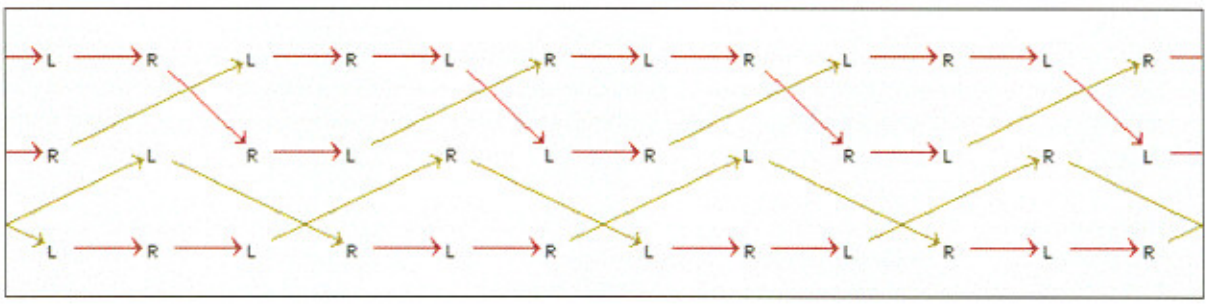
This is just the causal diagram. This feed is explained fully (with position changes) on the 9 clubs PPS feed page.

9 clubs PPS feed

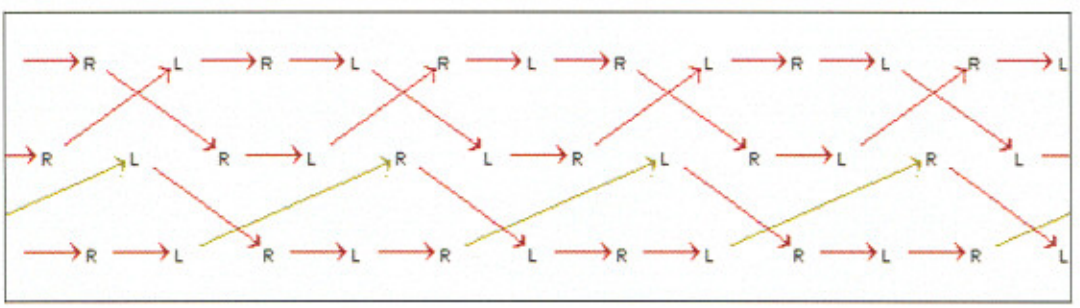


10 clubs PPS feeds

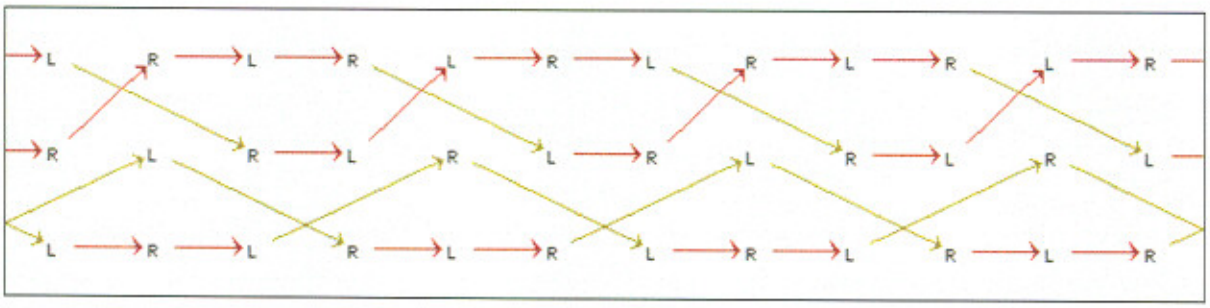
Feeder passing on doubles



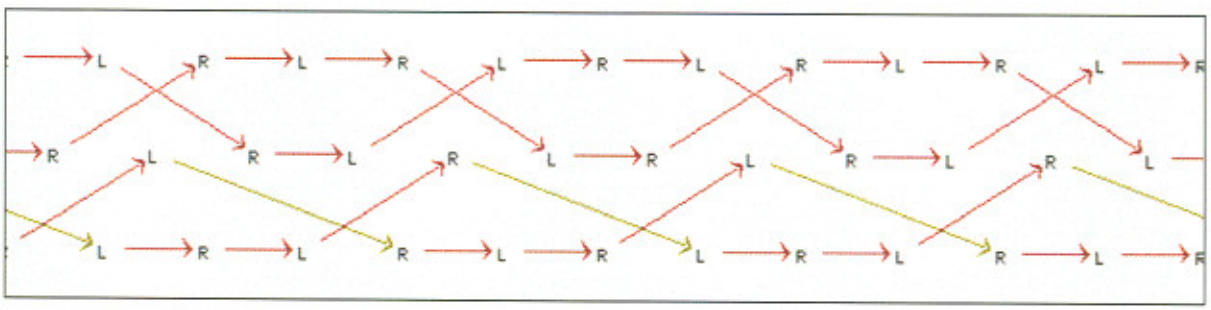
Feeder passing on singles



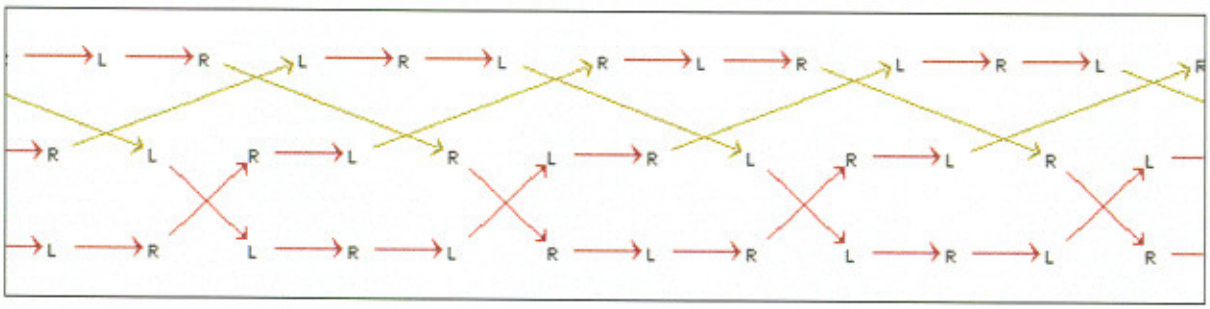
Feedees passing on doubles



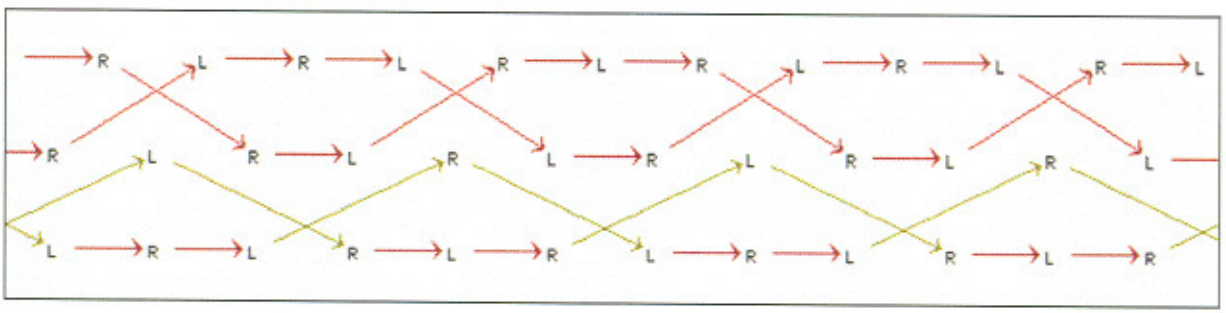
Feedees passing on singles



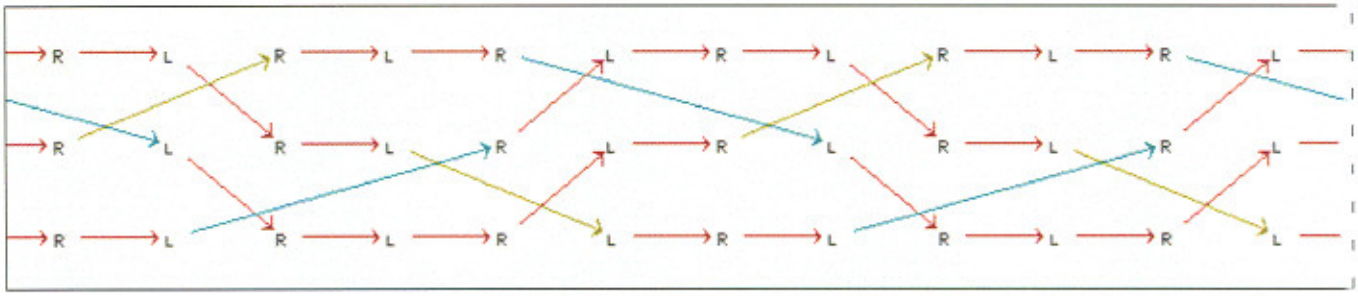
Disconnected PPS feed



Weird PPS feed

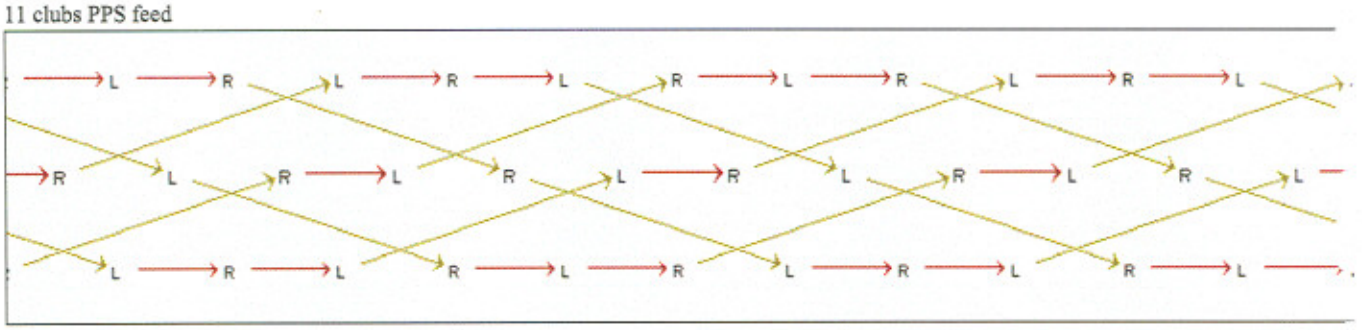


Hardcore PPS feed



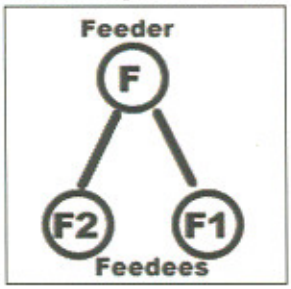
11 clubs PPS feed

11 clubs PPS feed



1-count feeds

Credits: first publication of the dissociation feed by Allen K. on rec.juggling



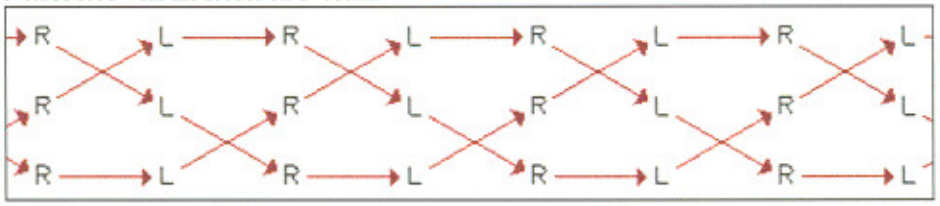
On this page, you'll find the feeds where the feeder is passing on ultimates (1-count) while both the feedees juggle a 2-count. Using ulimates for the feeder is probably one of best way to go for large number of clubs (up to 15 but we'll stop at 12) :

- 9 clubs 1-count
- 9 clubs 1-count, dissociated feeder
- 10 clubs 1-count
- 11 clubs 1-count
- 12 clubs 1-count

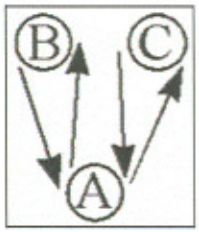
9 clubs

S is juggling ultimates and passes to C1 with his right and and to C2 with his left. C1 and C2 are juggling a 2-count. The main difficulty of this pattern comes from the fact that C2 pass with his left hand and receive with his right (left-handed 2-count). C1 pass to S' left hand, and C2 to S' right hand (all the passes are tramline here).

9 clubs feed with the feeder on 1-count.



Dissociated 9 clubs



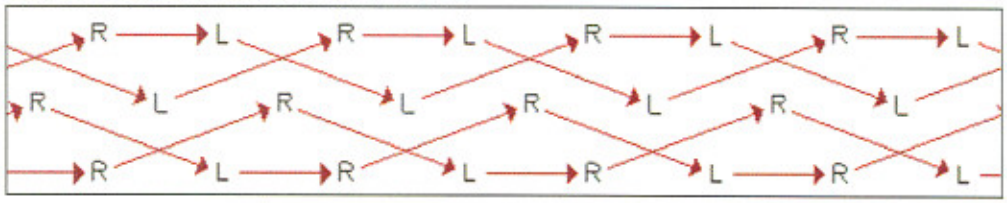
In this pattern, the feeder (A) is juggling 5 clubs with B on the left and 4 clubs with C on the right. A must dissociate his two hands because everything goes faster on the left (the diagram only shows the flightpath of the passes – B & C selfs are not drawn).
A starts with 2 clubs in each hand, B with 2 in the right hand and one in the left, C with 1 in each hand. B and C must start a bit after their first incoming pass from A.

10 clubs

Here, we have 5 clubs on each side of the pattern :
– 5 for C1 and S' left hand
– 5 for C2 and S' right hand

As you can see on the diagram below, the siteswap for each pass is 3.5 so they will be easier to make on floaty singles. C2 (on top) might prefer passing with his right hand (theorically he should use his left), in this case S just need to pass to his left hand.

10 clubs feed massues with the feeder on 1-count

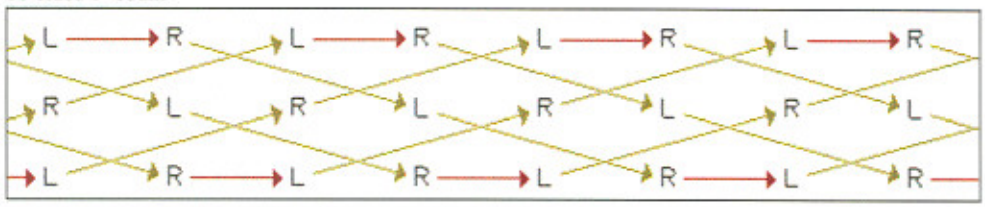


The diagrams shows a non-synchronous version; for a synch version, S need to make his passes from right hand and left hand at the same time.

11 clubs

Just like with 9 clubs, the passes are all tramline. Only the height and the spin is modified ; the passes here should be made on doubles but it's perfectly possible to juggle the pattern on singles too. Faster of course, but somehow easier.
C2 (lowest line on the diagram below) is always passing with his left hand !

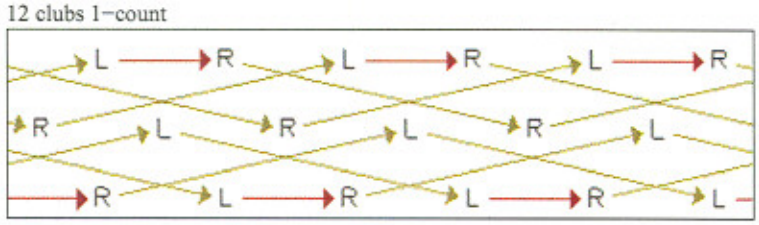
11 clubs 1-count



12 clubs

Same idea as 10 clubs but you need 6 clubs on each side of the pattern (left and right hand sides of the feeder). Using doubles sounds like the best solution. Feedee n°1 (C1) starts at the same time as the feeder's first pass to him, C2 does the same, one beat later. The diagram shows a little staggering but the feedees will easily get back into the right tempo; the feeder has enough problems to deal with.

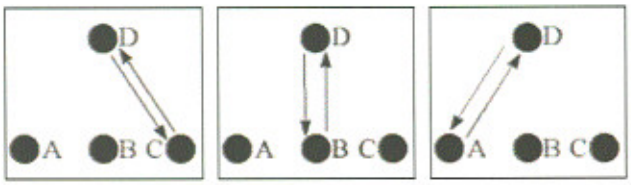
12 clubs 1-count



As with 10 clubs, a synchronized version of this feed is possible.

Line feeds

I've studied here the family of feeds with 3 jugglers as feedees but it's of course possible to add some more people (without forgetting the rhythm modifications needed). The diagrams below show the first 3 passes in a normal feed with the feeder juggling a 2–count.



With the feeder juggling a 2–count

Feeder on 2–count : normal feed (Sweep feed)

D feeds the clubs from left to right then from right to left, i.e. C, B, A, B, C, B, A... A & C are juggling an 8–count and B a 4–count. Note that it's also possible for D to make his passes in front of him while A, B, C are moving laterally on the line (all at the same time) to receive their clubs.

Feeder on 2–count : feed with carriage return (Typewriter feed)

With a normal feed, A and C can get the impression of not passing often enough. In this version, A, B and C are all passing a 6–count. D now feeds the clubs from left to right only (C, B, A, C, B, A...). When the feeder reach the end of the line (A) he turns back to face the first feedee (carriage return). If you want a more dynamic version, try the speed–weave.

Feeder on 2–count : adding some more passes

With any of the two versions above, D and A (for example) can agree to make an additional pass. When he's about to pass with A, D will make his right hand pass (normal) followed immediately (instead of the self) by a left hand pass. The rhythm – for the typewriter variation – is now PPPSPS for D and PPSSSS for A.
It's a nice way to add difficulty for the jugglers who feel at ease with the pattern while keeping it simple for the others. If all (A, B and C) want to pass this way, D will find himself juggling ultimates (see the 1–count feeds below) as in the "feed 2" variation.

Feeder on 2–count : 7 clubs passing

This feed is based on the 10 clubs 2–count feed. You just need to add an extra club (and only one, even if there's more jugglers on the line).

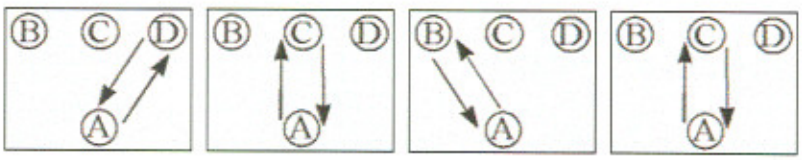
The feeder pass on the same rhythm as in the 7 clubs 2–count for 2 people and can choose to feed whoever he wants. He doesn't even need to decide beforehand the order of the passes because the jugglers in front of him always have the time (one beat) to react and pass a club back when they see a double coming their way.

With the feeder on 1-count (ultimate)

In all these patterns, the feeder is juggling on ultimates. You can have any number of jugglers in front of the feeder (even if the explanations given here are for 3). The main question you need to ask yourself is *who am I going to pass to next ?*.

feeder on 1-count: feed 1

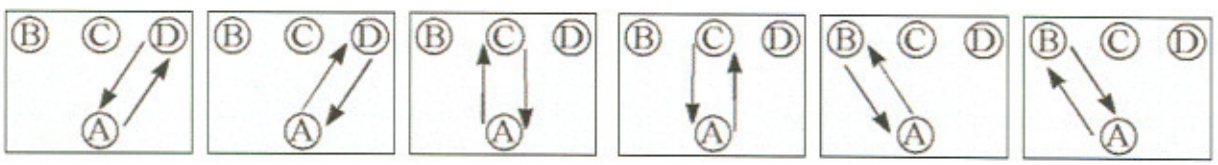
The right and left hands are feeding in the same direction and two consecutive passes can't be sent to the same person.



	Without carriage return:	With carriage return:
B	4-count (PSSS)	Waltz (PSS) This classical feed is also known as the *urban terror feed.*
D		
C	left-handed 2-count (PS)	

1-count feeds: feed 2

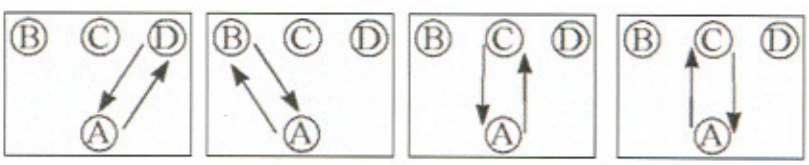
The right and left hands are feeding together the same juggler in front of the feeder. Each left hand pass is sent to the person who received the previous right hand pass.

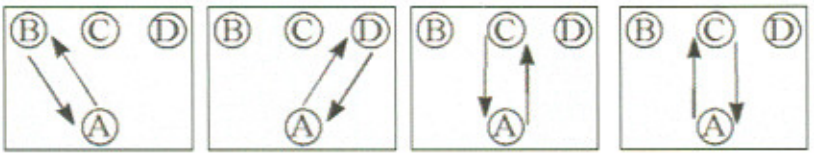


	Without carriage return:	With carriage return:
B	PPSSSSSS (8-count with an extra pass on the second beat)	PPSSSS (Chocolate bar if there's only 2 of them in front of the feeder)
D		
C	Chocolate bar (PPSS)	

1-count feeds: crossing feed

The right and left hand are feeding in different directions.





	Rhythm
B	PSS PSSSS (3–count/5–count alternatively)
D	
C	Chocolate bar (PPSS)

SITESWAP

Numerología

Donde se reúnen el Malabarismo y las Matemáticas.

Introducción

La Numerología se refiere al estudio de las propiedades fisico-matemáticas del malabarismo. Bastante de teoría y muchos ejemplos para practicar. Nada esotérico.

La idea de esta sección es entregar información y consejos para el malabarista que ya maneja 3 o 4 pelotas y le gustaría seguir aprendiendo. Para esto, en las próximas paginas se discuten varios aspecto del "malabarismo teórico". Pero... ¿ Tiene sentido teorizar ? A mi entender, si. Obviamente, si no pensara así no habría escrito todo esto.

El hecho de darse un tiempo para "pensar" el malabarismo nos ayuda a comprender y asimilar las técnicas más complicadas. Podemos distinguir entre los ritmos posibles e imposibles, entre los trucos fáciles y difíciles. Toda esta informacion ayudará a crear esquemas personales de aprendizaje.

Como se verá en las próximas páginas se puede teorizar bastante acerca de ritmos y movimientos para N pelotas en general. Hay que destacar que cada página no es independiente. Para leer cualquiera y entender algo, es importante haber leido las anteriores.

Capítulos

La información está distribuida como sigue:

- Notación Transposicional: Siteswaps. Introducción a la notación. Conceptos básicos.
- Siteswaps Válidos y Ley Cero. Determinación de lo posible y lo imposible.
- Diagramas. Cómo dibujar un SiteSwap.
- Dificultad. Discusión acerca de la curva de dificultad objetos v/s manos.
- Cascadas y Fuentes. Ritmos Fundamentales del malabarismo con N pelotas.
- Híbridos. Una lista de ritmos y secuencias con sus descripciones.
- Teorema de Shannon. Pura matemática.
- La Fábrica de SiteSwap. Método para construir transposiciones.
- Estados. Configuraciones de orden de las pelotas
- Matrices. Combinación de estados y descubrimiento de transiciones.
- Órbitas. Una propiedad interesante de los siteswaps.
- Múltiplex. Introducción a los múltiples.
    - Múltiplex Cuadrados.
    - Múltiplex Redondos.
    - Múltiplex, Ejemplos: Algunos ejemplos de múltiplex cuadrados y redondos.

Notación Transposicional: Siteswaps

La Notación Transposicional o Siteswap describe un ritmo de malabarismo en una sencilla secuencia de números. Cada número representa la cantidad de tiempos que deben transcurrir desde que es arrojada una pelota hasta exactamente el tiempo en que se recoja.

En otras palabras:

Un dígito A dentro de la secuencia transposicional significa que
se lanza una pelota a una altura suficiente como para poderse
realizar A - 1 tiros antes de lanzarla nuevamente.

Ejemplos de secuencias con tres pelotas: 3, 51, 531, 441.

¿ Por qué esta notación y no, sencillamente, escribir el tiempo *físico* necesario ?
La respuesta es obvia: cada malabarista trabaja a la velocidad que le sea más cómoda.

Para aclarar el concepto, pensemos en un ritmo musical: una misma canción se puede interpretar rápida o lentamente, pero la escritura musical es la misma, el ritmo es el mismo; sólo depende de quién la interprete.

De esta manera, la cascada de 3 pelotas la ejecutarán los novatos a gran altura y los más entrenados a la mínima. Sin embargo, el ritmo es el mismo, no ha cambiado. Por lo tanto, la altura de cada pelota, así como el tiempo que pasa en el aire (ambos equivalentes), son puramente accidentales y variarán según el malabarista, los implementos, condiciones climáticas, etc, etc, etc. Para introducir la notación transposicional volvamos a la clásica cascada de 3 pelotas, también conocida como "3 en cascada" o, para abreviar, 3-cascada.
Si arrojo la primera pelota en el tiempo A: ¿ Cuántos tiros debo realizar antes de recoger esta misma pelota ?
Claramente 2, ya que son 3 pelotas (esta respuesta está basada en la intución, y resulta la más natural. Sin embargo, sabemos que existen muchas formas de malabarear con 3 pelotas).

Luego, tenemos la sencilla ecuación A - 1 = 2 => A = 3 .Por lo tanto el tiempo que describe el lanzamiento de la primera pelota es "3". Para la segunda será exactamente el mismo y así sucesivamente. Por lo tanto, la notación trasposicional del 3-cascada se escribe "333333...". Para abreviar, se notará como "3". A pesar de que las secuencias transposicionales son de gran ayuda al resumir y transmitir ritmos malabares, su principal característica, la síntesis, nos hace perder información. Por ejemplo, en el ritmo 3-cascada podemos agregar muchas variantes: pasar una pelota por la espalda, debajo de la pierna, etc. Además, ritmos ópticamente muy distintos como 3-cascada, el 3-cascada "reverse" (arrojando las pelotas de afuera hacia dentro) y el "half shower" con 3 ("media lluvia", una pelota por dentro y otra por fuera) se anotan exactamente igual: 3.

Es por ésto que se debe tener en cuenta que las transposiciones nos entregan ayuda en el aprendizaje de ritmos y no de trucos.

Significado de cada Número

Para entender un patrón se debe tomar en cuenta que:

- Un **0** implica un tiempo en el cual la mano está vacía. Es buen ejercicio reemplazarlo por un golpe en la pierna; o dos ceros seguidos se pueden cambiar por un aplauso.
- Un **1** es un pase de mano a mano, conocido como feed. En este tiro no se puede realizar nada más que ese movimiento (no hay tiempo para otra cosa!).
- Un **2** tiene dos interpretaciones: en acuerdo estricto con la definición debería ser un tiro muy corto en la misma mano, pero como resulta muy difícil de coordinar, en la práctica se interpreta como un tiempo en el cual la mano mantiene la pelota sujeta. Es muy semejante al 0.
- Del **3** en adelante, los números concuerdan exactamente con la definición y no necesitan

mayores explicaciones.

Siteswaps Válidos

Una vez inventada la notación transposicional, surgió inmediatamente la inquietud por calcular las secuencias que realmente representaban ejercicios malabarísticos.

Por ejemplo, la secuencia 32 no es válida ya que:
Pelota 1 : 0 --> 0 + 3 = 3
(Se lee: "La pelota 1 es arrojada en el tiempo 0 y atrapada en el tiempo 3")
Pelota 2 : 1 --> 1 + 2 = 3
Lo que significa que dos pelotas llegan a la misma mano, en el tiempo 3.

De ahí nace la primera propiedad que se le exige a un transposición:

La suma entre el dígito k-ésimo y su posición k no puede repetirse para ningún dígito de la transposición.

Por ésto, transposiciones tales como 543 no son válidas pues 5 + 0 = 4 + 1 = 3 + 2, en cambio la permutación 453 cumple que 4 + 0; 5 + 1 y 3 + 2 son todos distintos.

El principio matemático recién descrito corresponde a una propiedad física muy simple y obvia: afirma que dos objetos no pueden caer en la misma mano, al mismo tiempo. A esto llamaremos la "ley cero" de la notación transposicional.

De la afirmación anterior de debe tener en cuenta:

Primero que nada, la ley cero no es siempre verdad. Hay muchos ejemplos de malabaristas que pueden pasar 2, 3 y hasta 4 pelotas de una mano a otra en algunos trucos. Sin embargo, toda la teoría transposicional se basa en este principio y lo asumiremos como cierto de aquí en adelante. Por otro lado, se verá que puede "extenderse" la notación para que abarque unos casos especiales donde se quiebra la ley cero.

En segundo lugar, es importante destacar que la ley cero debe entenderse al pie de la letra, sobre todo en el verbo "caer". Con esto quiero explicar que como el tiro descrito por el número "2" no implica un lanzamiento, tampoco implica una atajada, por lo tanto, no hay caida. Luego un tiro "2" y otro tiro cualquiera si pueden llegar al mismo tiempo a la misma mano.

Y lo tercero también corresponde aun análisis semántico: "la misma mano" se refiere exactamente a eso, una mano en particular. Nada dice con lo que ocurra en las otras dos manos.

La utilidad de estas precisiones se verá reflejada principalmente cuando se analicen los multiplex, pero es bueno tenerlas en mente desde el comienzo.

LEY CERO DE LA NOTACIÓN TRANSPOSICIONAL:
Dos objetos no pueden caer en la misma mano, al mismo tiempo.

La condición *física* anterior, implica una condición *matemática* necesaria para que una secuencia sea válida. Puedes ver la demostración en el Apéndice Matemático:

Para toda secuencia transposicional el promedio de los dígitos que la componen debe ser igual al número de objetos utilizados.

Como el promedio de 3 y 2 es 2,5, claramente 32 no es una transposición válida. ¿ Quién puede malabarear con 2,5 pelotas ?Es fácil ver que la transposición 66661 se ejecuta con (6 + 6 + 6 + 6 + 1) / 5 = 25 / 5 = 5 pelotas.

Diagramas

Una forma bastante útil para entender el significado de una transposición es crear un diagrama de semicírculos sobre un eje graduado. Cada semicírculo representa el viaje que realiza la pelota hasta ser atrapada. Por otro lado, los números que gradúan el eje cumplen la doble función de marcar los tiempos del ritmo, así como indicar si se usa una u otra mano.Veamos el caso del ritmo 3-cascada.

IMPORTANTE. Los supuestos que siguen no son estrictos, pero sirven para fijar ideas.

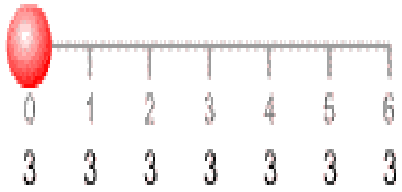
El malabarista parte con 2 pelotas en la mano DERECHA y 1 en la IZQUIERDA. Lo anterior implica el primer tiro es con la mano DERECHA.

La primera pelota se arroja en el TIEMPO 0. Por lo tanto, los números PARES (0, 2, 4, ...) identifican a la mano DERECHA; los números IMPARES (1, 3, 5, ...) representarán a la mano IZQUIERDA.

Cascada de 3 objetos. Transposición: 33333...

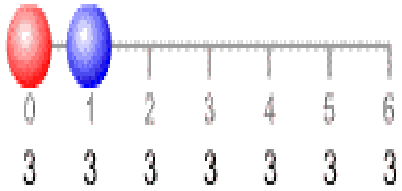
PRIMERA PELOTA

La primera pelota parte en el tiempo 0 y es recogida en el tiempo 3.
Por lo tanto va de mano derecha a mano izquierda.



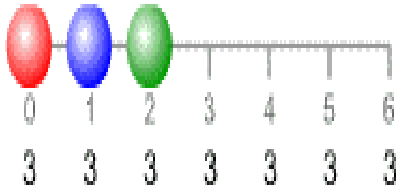
SEGUNDA PELOTA

La segunda pelota va de 1 a 4; es decir, 1 + 3 = 4,
donde el 3 es el número asignado por la transposición.

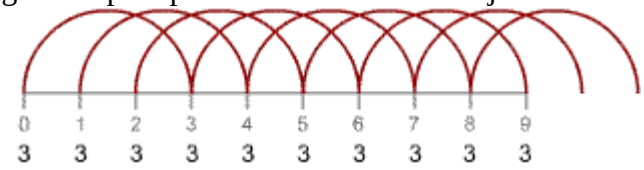


TERCERA PELOTA

Como la tercera viaja de 2 a 5, el ciclo está completo.
El resto es sólo repetición de lo anterior.



Un diagrama típico para una cascada de 3 objetos tiene la forma:



En resumen: Un diagrama transposicional representa una trasposición mediante semicírculos de diámetro (A), partiendo desde el punto cero y asignando a los números pares e impares una mano, respectivamente.

Dificultad

Por un momento dejaremos los SiteSwaps, para ver un poco de la teoría referente a la dificultad asociada a malabarear con muchos objetos.
En el libro "Enciclopædia del Malabarismo con Pelotas" aparece una pequeña descripción del nivel de dificultad D que puede tener el malabarismo con M manos y P pelotas. Como primera aproximación se sugiere la medida D = P / M, pero claramente no refleja la realidad, porque predice que es igual malabarear con 2 pelotas en una mano que con 4 en las dos. Obviamente eso no es cierto. Charlie Dancey propone la ecuación:

```
D = P / ( M/P + M )
```

Que genera las siguiente tabla:

Tabla de Dificultad, v1

Número de Manos	Cantidad de Objetos 1	2	3	4	5	6	7	8	9	10	11
1	0.5	1.33	2.25	3.2	4.17	5.14	6.13	7.11	8.1	9.09	10.08
2	0.25	0.67	1.13	1.6	2.08	2.57	3.06	3.56	4.05	4.55	5.04
3	0.17	0.44	0.75	1.07	1.39	1.71	2.04	2.37	2.7	3.03	3.36
4	0.13	0.33	0.56	0.8	1.04	1.29	1.53	1.78	2.03	2.27	2.52
5	0.1	0.27	0.45	0.64	0.83	1.03	1.22	1.42	1.62	1.82	2.02
6	0.08	0.22	0.38	0.53	0.69	0.86	1.02	1.19	1.35	1.52	1.68

A partir de esta tabla, se puede ver que jugar con 3 pelotas en una mano (2,25) es algo más difícil que jugar con 5 pelotas en las dos manos (2,08), lo cual por mi experiencia podría afirmar que es cierto.Creo que es una buena aproximación, sin embargo no considera el número de personas que participan en el ejercicio. Obviamente es más difícil que dos personas se pongan de acuerdo que una coordine sus manos. Otra variable importante es la dificultad del ejercicio que se realiza. Por ejemplo, el "shower" es mucho más difícil que la cascada.

Como mejora a la fórmula anterior, propongo 2 cambios:

- Elevar al cuadrado los valores para destacar el hecho de que la escala de aprendizaje no es lineal.
- Normalizar la tabla a la dificultad de malabarear tres pelotas con dos manos (es decir, que D(3, 2) == 1).

Por lo tanto la función de dificultad queda:

```
D( P, M ) = (P/( M/P + M ))² / F
```

Donde F es el parámetro de normalización y se calcula como F = D(3, 2). Por lo tanto, la nueva tabla será:

Tabla de Dificultad, v2

Número de Manos	Cantidad de Objetos 1	2	3	4	5	6	7	8	9	10	11
1	0.20	1.40	4.00	8.09	13.72	20.9	29.64	39.95	51.84	65.3	80.33
2	0.05	0.35	**1.00**	2.02	3.43	5.22	7.41	9.99	12.96	16.32	20.08
3	0.02	0.16	0.44	0.9	1.52	2.32	3.29	4.44	5.76	7.26	8.93
4	0.01	0.09	0.25	0.51	0.86	1.31	1.85	2.5	3.24	4.08	5.02
5	0.01	0.06	0.16	0.32	0.55	0.84	1.19	1.60	2.07	2.61	3.21
6	0.01	0.04	0.11	0.22	0.38	0.58	0.82	1.11	1.44	1.81	2.23

De esta manera, malabarear con 3 pelotas en 1 mano es 4 veces más difícil que 3 en 2 manos; o por ejemplo para una persona malabarear con 4 pelotas es más o menos el doble de complicado que con 3 pelotas.

Ahora, es importante recalcar que La tablas anteriores deben considerarse sólo como una referencia.

No obtante, la secuencia natural de aprendizaje para un malabarista que todas las tablas predicen está bastante de acuerdo con la realidad. El avance de un malabarista "típico" sería:

3 pelotas	2 pelotas	4 pelotas	5 pelotas	3 pelotas	6 pelotas	4 pelotas
2 manos	1 mano	2 manos	2 manos	1 mano	2 mano	1 mano

Y así para los números que siguen.

Cascadas y Fuentes

La figura que requiere menos energía para ser malabareada corresponde a una cascada para números pares y una fuente para números impares de objetos.

Cascadas

Dada la condición de los promedios (ver Notación Transposicional), se tiene que una secuencia con un único dígito N siempre representa una transposición de N objetos.
En otras palabras, siempre representa un ritmo factible con N objetos.

A partir de la experiencia y algunos estudios, se ha encontrado que estos ritmos son los más "naturales" para el malabarista, por razones de simetría, constancia, etc.
Por estos, han recibido nombres especiales: Cascadas y Fuentes.

Cuando el número N es IMPAR, la transposición N recibe el nombre de "**cascada**".
La figura que forma es semejante al símbolo de infinito. O sea, malabarear con 3 pelotas es muy semejante a jugar con 5, 7 ó 9, sólo cambia la altura y rapidez en arrojarlas.

En general, como N es impar se puede escribir N = 2M + 1. Se reparten M + 1 objetos en la mano más hábil y M en la otra. Así, tenemos (M+1) + M = 2M + 1 = N objetos.

Fuentes

Para los números PARES aparece la figura conocida como "**fuente**". Se utiliza para jugar con 4, 6, 8, etc. Es más difícil que la cascada, sobre todo para números mayores que 4, debido a que las manos tienden a "independizarse" y trabajar por separado, ya que no comparten ningún objeto.

La fuente admiten dos formas de realizarla: asincrónica, arrojando una pelota con cada mano por vez, o sincrónica, arrojando dos objetos en cada ciclo, lo que implica que también se deben recibir de a dos (lo cual es un poco más difícil).

En todo caso, para el malabarismo con números pares N = 2M, habrán M pelotas en cada mano.

La gran mayoría de los malabaristas con clavas, aros y pelotas parten de cascadas y fuentes como base de la rutina, y van agregando otros trucos y ritmos.

Híbridos

Todos aquellos ritmos que no son ni cascadas ni fuentes, son llamados genéricamente "híbridos", pero los más populares tienen nombres propios. Para crear tus propios ritmos, revisa la Fabrica de SiteSwap y Estados y Matrices. Si no consigues descubrir cuál es la forma del ritmo que inventaste, escribe la transposición en algún Simulador.

Lo ritmos más conocidos son:

Shower

¿ Han visto dibujos animados malabareando ? Esa es la idea. La pelotas son lanzadas siempre como parábolas altas con una mano y pasadas con la otra. En números, siempre tendrá la forma "A1", donde A es un número impar. Por ejemplo, para 3 pelotas es "51", para 4 será "71" y así...

Half - Shower

Como el anterior, pero la mitad... Es la misma idea, pero los tiros altos no son tan altos, y en vez de pasar directamente la pelota de una mano a la otra, se lanza pero con muy poca altura. Este ritmo es particularmente cómodo para números pares de objetos. Para 4 pelotas la transposición es "53", para 5 es "73", para 6 puede ser "75" (fácil) o "93" (difícil), etc.

Flash

En una cascada o fuente, arrojar todos las pelotas con sufiente altura de manera que ambas manos queden libre por un tiempo del ritmo. Si tenemos N pelotas, un flash se escribe: (N+2) (N+2)...(N+2) 0 0 donde el numero (N+2) se repite N veces. Para 3 pelotas, el siteswap es "55500", para 4 es "666600", para 5 es "7777700" y asi...

Cuncuna

Formando una cascada, se deben lanzar todas las pelotas con una sola mano, mientras la otra mano sostiene sólo una pelota. Esto se repite alternadamente. Tiene la forma de una línea de pelotas que se van persiguiendo.
En números, la secuencia es: (N+1) 2 (N+1) 2 ... 2 (N+1), donde siempre se alternan los términos (N+1) y 2, con (N-1) el número de dígitos de la transposición. Necesariamente debe comenzar y terminar con un (N+1). Para 4 pelotas es "525", para 5 es "72727", etc.

?

Este ritmo, que no sé como llamarlo. Para los número impares puede considerarse como una "caja lenta".
Es buenísimo para aprender a malabarear con N+1 pelotas, jugando con N pelotas. La idea es generar una secuencia de la forma: (N+1) (N+1)...(N+1) 1, donde (N+1) se repite (N-1) veces. Para 3 pelotas es el simpático "441", para 4 es "5551", para 5 pelotas será "66661", para 6 "777771", etc.

La siguiente lista está ordenada por número de objetos y número de dígitos de la transposición. Por lo tanto, la dificultad de movimiento está en completo caos.

Nº	Siteswap	Descripción
1	1	Cascada de 1 (?).
	300	El ejercicio básico para malabarear con tres objetos. En interesante incluir un aplauso cuando la pelota está en el aire (en el '00').
2	2	Fuente de 2.
	31	Lo que cualquier persona que no sabe malabarear hace con dos pelotas.
	40	Dos en una mano. Variaciones: círculos hacia adentro, hacia afuera, en columnas. Practicarlo con ambas manos para dominar las 4 pelotas.
	312	Bastante simple.
	3203	Un bonito truco con 2 pelotas.
	510	Sencillo ejercicio para lograr el "shower" con tres pelotas y en ambas direcciones.
3	3	Cascada de 3.
	51	El famosísimo "shower" (ducha) de 3 pelotas. Típico de los dibujos animados donde los objetos de mueven en círculos y no en parábolas (¡Qué diría Newton!).
	713151, 7131	Variaciones del "shower". El segundo resulta más interesante.
	60	Tres en una mano. Círculos hacia adentro, hacia afuera, en columnas, en cascada. Practicarlo con ambas manos para dominar las 6 pelotas.
	423	Bastante sencillo. Se dice que es el principio del "borrachito" (mill's mess), pero aun no lo confirmo.
	441	Parecido a la "caja", pero más simple. Otro buen ejercicio para la fuente de 4.
	531	Un ritmo difíl de entender, pero muy bonito. Requiere bastante práctica.
	603	Un simple ejercicio para depurar los tiros altos.
	4440	El mejor ejercicio para aprender a jugar con 4 pelotas. importante practicarlo con ambas manos e incluir el típico golpe en la pierna durante el '0'.
	8040	Muy difícil. Son tres pelotas en una solo mano, una muy larga y la siguiente muy corta.
	50505	Cuncuna de tres pelotas. Buen ejercicio para manejar 5 pelotas.
	555000	Flash de 3 pelotas. Generalmente se incluye como parte del ritmo 3, ya que es difícil mantenerlo por mucho tiempo. Sin embargo, es importante manejarlo para poder jugar con 5 pelotas. Incluir 2 aplausos en el '000'.
4	4	Fuente de 4.
	53	"Half shower" (media ducha); como su nombre lo indica, es una versión más lenta (y más fácil) del shower.
	62	Lo indico por razones netamente decorativas. No tiene mucho sentido, pues corresponde al tres en una mano, pero incluyendo una pelota muerta en la otra.
	71	Shower de 4 pelotas.
	80	Cuatro en una mano.
	453	Un bonito ejercicio de cuatro pelotas. Es muy fácil de alternar con la fuente.
	525	Una "cuncuna" para aprender con 5.
	633, 83333	Una especie de caja de 4 pelotas, mezclada con una cascada de 3.El segundo es similar a la anterior, pero obviamente más difícil.
	66251	Este ritmo lo inventé de pura suerte, tratando de pasar de un fuente a un shower. Es extremadamente asincrónico.
	7272721	Una clase de cuncuna para aprender con 7.

	9151	Parecido al 7131, pero con 4 pelotas. Presenta bastante dificultad y debe intercalarse con el shower.
5	5	Cascada de 5.
	73	Half-Shower de 5 pelotas.
	91	Shower de 5 pelotas. Muy rápido.
	66661	Muy parecido al 441 con 3 pelotas, pero obviamente mucho más difícil.
	666660	Marcar ritmo de 6, pero con 5 pelotas.Lo mismo de siempre: cambiar el '0' por un golpe en la pierna.
6	6	Fuente de 6.
	75	Half-Shower.
	93	Otro Half-Shower, pero mucho más difícil.
	7777770	Marcar 7, pero con 6 pelotas.
7	7	Cascada de 7.
	95	Half-Shower de 7.
8	8	Fuente de 8.

Teorema de Shannon

El teorema de Claude E. Shannon (de la MIT) relaciona cada uno de los lugares por los que pasa un objeto al ser malabareado y el tiempo que permanece en dicha posición.

Analicemos el recorrido completo que realiza una pelota. Por recorrido completo, se entiende cada una de las etapas (o lugares) por donde pasa la pelota entre dos lanzamientos o recogidas de la misma mano.

Para fijar ideas, usemos el ciclo delimitado por dos lanzamientos y dos manos:

La pelota se arroja de la mano 1 a la mano 2. Diremos que pasa un tiempo F en el aire.

La pelota es recogida por la mano 2, donde descansa un tiempo D.

Se arroja nuevamente la pelota, pero ahora de la mano 2 a la 1. Nuevamente, permanece en el aire un tiempo F.

Por ultimo, es recogida por la mano 1, y esta sujeta un tiempo D.

Listo! Este es un ciclo completo. Ahora la idea es medir el tiempo completo que tarda un ciclo -sumando los tiempos parciales- desde el punto de vista de las manos y, por otro lado, de las pelotas.

Punto de Vista de las Manos

Tenemos que D es el tiempo que una mano sostiene una pelota.
El tiempo que la mano permanece vacía lo llamaremos V. Se debe notar que V no tiene por que ser igual a F. Basta pensar que para un malabarista que juega con 5 pelotas, cada mano debe arrojar al menos 2 pelotas antes que llegue la primera que se arrojó. Por lo tanto, el tiempo que la mano permace vacía es muy inferior al tiempo que pasa una pelota en el aire.

Entonces, el tiempo total para 1 mano que sostiene una pelota y luego la arroja debe ser D + V. Como esto se repite para las N pelotas, hasta que el ciclo esté completo, la cantidad total será:

```
( D + V ) * N
```

Punto de Vista de las Pelotas

Para las pelotas, la idea es muy similar a lo anterior. El tiempo que demora 1 pelota en hacer el recorrido completo es D + F. Pero la pelota debe pasar por las H manos antes de completar el ciclo, por lo tanto, el tiempo total que demora es:

```
( D + F ) * H
```

Como ambas cantidades deben ser iguales, las igualamos y obtendremos el Teorema de Shannon:

```
( D + V ) * N = ( D + F ) * H
```

Razón de Permanencia

Una de las cantidades importantes que sean medido experimentalmente, es la llamada "razón de permanencia" o "dwell time" en inglés.
La idea es relacionar el tiempo que la mano tiene una pelota con el tiempo que la mano pasa vacía. Esto se otiene calculando D / V.
Se ha encontrado que los valores habituales para este número varian entre 0.5 y 0.8, es decir, la mano sostiene una pelota entre 3/4, 2/3 y 5/8 del tiempo.

Se ha encontrado que los mabaristas novatos tienden a razones de permanencia grandes, es decir, mantienen los objetos en sus mano por un tiempo mayor que los mas expertos.

Volvamos al Teorema de Shannon:

```
( D + V ) * N = ( D + F ) * H
```

Diviendo todo por D, queda:

```
( D + V ) * N = ( D + F ) * H \ :D
( 1 + ( V / D ) ) * N = ( 1 + ( F / D ) ) * H
```

Para un malabarista novato que juega una cascada con 3 pelotas, tendremos que la pelota permanece sólo un 55% del tiempo en la aire:

```
H = 2, N = 3, V / D = 0.5   =>   F / D = 1.25
```

En cambio, para un malabarista experto, haciendo cascada de 7 pelotas, cada pelota permanece un 84% del tiempo en la aire!

```
 H = 2, N = 7, V / D = 0.8   =>   F / D = 5.30
```

Fabrica de Siteswaps

Procedimiento o Algoritmo

Ya conocemos los SiteSwaps. Ahora la idea es poder construirlos. El método que se propone es una traducción libre de la Web SiteSwaps: A Guide For The Perplexed , hecha por Colin Wright y Andrew Lipson.

El algoritmo es el siguiente:

Primero debemos definir el largo de la secuencia. Dibujar ese número de casillas.

Elegir y escribir un número en dicha casilla.

Contar ese número de casillas hacia delante, y marcar esa posición.
Si las casillas se acaban, se partir desde el principio.

La única regla que se debe cumplir es que nunca pueden haber dos marcas en una misma casilla.

Ejemplo

Pero mejor veamos un ejemplo. Supongamos que deseamos construir un ritmo de largo 5:

```
-  -  -  -  -
```

El primer tiro será un 4. Podría haber sido cualquier otro, pero como yo decido...
Ya que hay un 4 en la primera posición, escribimos un 4 y marcamos la casilla que se encuentra 4 espacios hacia adelante.

```
  4  -  -  -  -
             * <-- casilla marcada
-->  1  2  3  4
```

Para el siguiente número, tenemos nuestra primera restricción: no podemos escribir un 3, 8 , 13, etc. En general, cualquier múltiplo de 5 más 3. Póngamos entonces un 5.

```
  4  5   -  -  -
     *        *
  4  5 ->1  2  3
```

Notar que como la secuencia se termina cuando he contado sólo 3 casillas, sigo contando desde el principio.

Ahora escribiremos un 1:

```
  4  5  1  -  -
     *     *  *
```

A esta altura no voy a explicar cómo se cuenta, porque supongo que la idea esté clara... espero.

Ahora un 4 es válido.

```
  4  5  1  4  -
     *  *  *  *
```

Y para la última casilla no tenemos muchas posibilidades: 1, 6, 11, etc. Generalizando, valen múltiplos de 5 más 1. Escribamos un 1:

```
  4  5  1  4  1
  *  *  *  *  *
```

Listo! Tenemos nuestro Siteswap completo: "45141". Para saber con cuántas pelotas se malabarea, usamos la propiedad de los promedios:

```
  ( 4 + 5 + 1 + 4 + 1 ) / 5 = 15 / 5 = 3 pelotas.
```

Este método es muy simple y está estrechamente relacionado con los Diagramas Transposicionales. Su único defecto es que tenemos muy poco control sobre el número de objetos que necesitará la transposición para ser "malabareable".

Estados

En lo que sigue, se supone que el lector tiene algunos conocimientos sobre los SiteSwaps o Notación Transposicional. El nuevo enfoque a través de estados y matrices constituye una propuesta complementaria a los Siteswaps, bajo un punto de vista distinto: transiciones entre estados. La idea final es obtener un método poderoso y flexible para construir ritmos transposicionales y encontrar los caminos para pasar de unos a otros.

Estados

Un estado se define como la configuración en que están los objetos para algún instante de tiempo. ¿ Complicado ? No, para nada. Supongamos que estamos malabareando una cascada con 3 pelotas, o sea, una transposicion "...33333..." o "3", simplemente. Si ya hemos arrojado cada una de las pelotas una vez, tendremos el siguiente estado:

```
- - - - C B A
```

Es así porque la primera pelota que lanzamos, A, está a punto de llegar a la mano, es decir, le queda sólo un tiempo del ritmo para ser atrapada.
La segunda pelota, B, le queda un poco más de tiempo y C acaba de ser arrojada.

Ahora, imaginemos que la pelota A en vez de arrojarla con un 3, la tiramos con un 5. La nueva configuración o estado será:

```
- A - - C B
5 4 3 2 1 <--
```

Notar que todos las letras se han movido 1 espacio hacia la derecha, ya que pasó un tiempo del ritmo. Además, los estados son infinitos hacia la izquierda, porque podemos arrojar una pelota tan alto como se nos ocurra.

Para ilustrar lo anterior, la próxima pelota, B, la lanzaremos con un 7:

```
- - B - - A - - C 7 6 5 4 3 2 1 <--
```

El siguiente paso es muy simple. La verdad es que realmente no nos interesa cuál pelota se lanzó. Por esto, cambiaremos las letras por 1's y las rayas por 0's

Los estados quedan representados:

```
      - - - C B A  =>  0000111   o 111, simplemente.
      - A - - C B  =>  010011    o 10011.
- - B - - A - - C  =>  001001001 o 1001001.
```

Tal como en los números que conocemos, los ceros a la izquierda son irrelevantes y pueden haber tantos como se quiera. En particular, ninguno, para simplificar la notación.

Se concluye, entonces, que del estado 111 podemos pasar al estado 10011 arrojando un 5, y de ahí al estado 1001001, lanzando un 7. Pero NO es válido lanzar un 1 o un 2 desde el estado 111, pues esos lugares ya estan ocupados.

Por último, un pequeño truco: Cada estado lo asumiremos como un número escrito en binario. Si calculamos dicho número, pero en base 10, los estados quedan mucho más simples, pero no más entendibles.

```
111      =>   7
10011    =>   19
1001001  =>   73
```

Los curiosos pueden revisar el Apéndice Matemático para traspasar números binarios a decimales y viceversa.

En el capítulo que sigue, Matrices, se utilizan los estados para obtener transiciones entre patrones.

Matrices

En este capítulo se introducen las "Matrices de Estados", propuestas por Martin Probert en su libro "Malabarismo con 4 Pelotas" ("Four Ball Juggling"). Lo que se describe a continuación es una traducción libre del artículo publicado por Charlie Dancey, "Siteswaps, State Diagrams, and New Ideas", que aparece en la JIS.

MATRICES

A partir de los Estados, es posible construir una Tabla -o Matriz- donde escribiremos los estados posibles y los lanzamientos que son válidos para pasar de un estado a otro.
Para 3 pelotas, tomando como un tiro máximo un 5, la Matriz de Estados tiene esta forma:

28								5		x
26						5			x	
25					5			x		
22			5				x			
21		5				x				
19	5				x					
14			4	x		3		2		0
13		4	x		3			1	0	
11	4	x			2	1	0			
7	3	2	1	0						
	7	11	13	14	19	21	22	25	26	28

Ahora! ¿ Qué demonios representan las "X" ? Simplemente nos ayudan a encontrar los caminos dentro de la matriz. Un camino, o ruta, representa un ritmo que puede ser infinitamente complicado y puede tener ciclos. Veámoslo con un ejemplo:

Partimos con una cascada de 3. Siempre arrancamos de la esquina inferior-izquierda, que es el ritmo "natural" para ese número de pelotas y corresponderá a una cascada o una fuente. En ese momento se nos ocurre arrojar un 5:

28							5		x
26						5		x	
25					5			x	
22			5				x		
21		5				x			
19	5				x				
14	↑		4	x		3		2	0
13		4	x		3			1	0
11	4	x			2	1	0		
7	3	2	1	0					
	7	11	13	14	19	21	22	25	26

Para saber en cual estado quedamos, podemos consultar la primera columna. Entonces, ahora estamos en el estado 19. ¿ Qué sigue ? Buscamos en esa fila la X que nos indicará la columna con los próximos lanzamientos válidos. Avanzamos hacia la derecha.

28								5		x
26						5			x	
25					5			x		
22			5				x			
21		5				x				
19	5			→	x					
14	↑		4	x		3		2		0
13		4	x		3			1	0	
11	4	x			2	1	0			
7	3	2	1	0						
	7	11	13	14	19	21	22	25	26	28

La Matriz nos indica que podemos lanzar un 2, un 3 o un 5. Tiremos otro 5...

28								5		x
26						5			x	
25					5			x		
22			5		↑		x			
21		5				x				
19	5			→	x					
14	↑		4	x		3		2		0
13		4	x		3			1	0	
11	4	x			2	1	0			
7	3	2	1	0						
	7	11	13	14	19	21	22	25	26	28

Volvemos a avanzar hasta la X de esa fila...

28								5		x
26						5			x	
25					5		→	x		
22			5		↑		x			
21		5				x				
19	5			→	x					
14	↑		4	x		3		2		0
13		4	x		3			1	0	
11	4	x			2	1	0			
7	3	2	1	0						
	7	11	13	14	19	21	22	25	26	28

Y nuevamente un 5...

28								5	→	x
26						5		↑	x	
25					5		→	x		
22			5		↑		x			
21		5				x				
19	5			→	x					
14	↑		4	x		3		2		0
13		4	x		3			1	0	
11	4	x			2	1	0			
7	3	2	1	0						
	7	11	13	14	19	21	22	25	26	28

Ahora, la única posibilidad es un 0, porque es el único número de la columna.

Y nuevamente un 0...

28								5	→	x
26						5		↑	x	
25					5		→	x		
22			5		↑		x			
21		5				x				
19	5			→	x					↓
14	↑		4	x	←	3		2		0
13		4	x		3			1	0	
11	4	x		↓	2	1	0			
7	3	←	1	0						
	7	11	13	14	19	21	22	25	26	28

Y hemos vuelto al principio. Hemos construido un camino dentro de la matriz que se describe como la transposición:
... 3 3 3 5 5 5 0 0 3 3 3 ...
Lo que es un clásico "flash" de 3 pelotas.

Se debe notar, que podriamos haber repetido el flash tantas veces quisieramos. Eso es un ciclo dentro del camino.

El flash, representado por estados:

```
           3        5         5         5         0         0
Decimal:  ---->  7  ---->  19  ---->  25  ---->  28  ---->  14  ---->  7
Binario:  ---> 111 ---> 10011---> 11001---> 11100---> 1110 ---> 111
```

Tanto el estado 28 como el 14, en binario, son números que terminan con un 0. O sea, en ese tiempo del ritmo, no atraparemos ninguna pelota y, por lo tanto, el único tiro válido es un 0.

Lo que hemos conseguido con esto, es un método muy simple para crear ritmos transposicionales. Y no sólo ritmos infinitos y repetitivos, sino que la matriz también nos entrega los tiros necesarios para efectuar las transiciones correctas entre un ritmo y otro.

Por ejemplo, traten de calcular "al ojo" cómo se escribe la transposición para pasar de una cascada de 3 pelotas (siteswap=3) a 3 en una mano (siteswap=60), y cuando se den por vencido usen una matriz que contenga los tiros entre 0 y 6 para 3 pelotas.

Órbitas

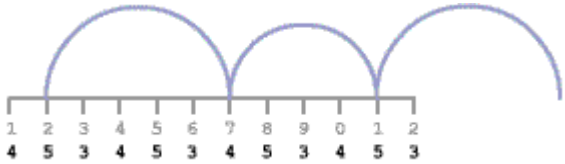
Las órbitas corresponde a siteswaps válidos dentro de siteswaps.

Veámoslo con un ejemplo: Partamos del siteswap para cuatro pelotas descrito por la secuencia "**453**".

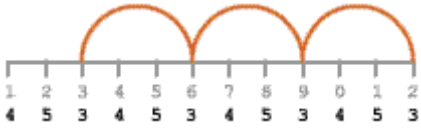
Diagrama del SiteSwap. Transposición: 453

Pelota 1.

Pelota 2.

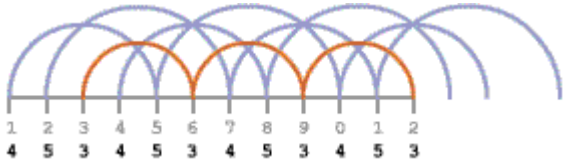


Pelota 3.



Pelota 4.

Todas.



La pelota 3 está marcada con rojo porque del diagrama se puede apreciar que siempre es arrojada con un tiro de valor 3, en cambio las otras tres pelotas (pelotas 1, 2 y 4) son arrojadas sólo con tiros de valor "**4**" y "**5**".
A esto llamamos una órbita dentro de un siteswap: un subconjunto de números de la transposición que mantienen en él un cierto número de objetos y que conforma por sí mismo un siteswap válido.

Así, podríamos descomponer el siteswap "**453**" en dos siteswaps distintos: el "**450**" para tres objetos y el "**003**" (ó "**300**") para un sólo objeto. La superposición de ambos crea el siteswaps "**453**" para cuatro objetos.

Lo interesante es que las órbitas son totalmente independientes unas de otras. Algunas variaciones a las órbitas del "**453**" son:

- Cambiar el siteswaps de la pelota número 3, por un siteswap de dos objetos como el "**600**". Con esto, la superposición queda como "**456**", que también es un siteswap válido, pero ahora para 5 elementos.
- Duplicando el ritmo, podemos pasar del "**300300**" al "**600000**" y el total queda como "**546450**" ó "**645054**".
- Modificar el "**450**" por el "**330**" (para dos objetos) y el total será "**333**" ó "**3**" que es la clásica cascada de 3 pelotas.

Cambiar el "**450**" por el "**360**" y el siteswap superpuesto será "**363**" ó "**633**" con lo cual hemos separado la primera órbita en dos órbitas, con lo cuál, ahora tenemos 3 órbitas distintas.

Podemos ver que las modificaciones en las órbitas generan nuevas transposiciones también válidas. Claramente se aprecia que el quitar una órbita a un siteswap genera cierta cantidad de ceros en el ritmo. Esto se explica porque quitar una órbita es quitar todos los objetos que pertenecen a ella. Por el contrario, si un siteswap contiene un cierto número de ceros, significa que es suceptible a ser superpuesto con otro para agregarle órbitas, con lo que le agregaríamos elementos.

Por ejemplo, veamos el "**flash**" de tres objetos, cuya transposición es "**55500**". La idea es que mientras las tres pelotas están en el aire, podríamos ser capaces de ocupar las manos libres malabareando con más objetos. La primera posibilidad es superponerle el siteswap "**55000**" ó "**00055**" para dos objetos, con lo cual se obtiene la cascada de cinco objetos "**55555**" ó "**5**", simplemente. Otra opción, un poco más entretenida, es superponerla con el "**64000**" lo que da "**55564**" ó "**64555**".

Ahora, la pregunta que surge es: ¿ Qué propiedad deben cumplir las modificaciones a las órbitas para que los siteswaps nuevos sean válidos ? La respuesta es muy sencilla: que las modificaciones a la órbita no deben salirse de la órbita. Esto es por la misma definición de una órbita; debe contener siempre el mismo número de objetos, es más, una órbita debe contener siempre a los mismos objetos. Cualquier quiebre a esta regla producirá una falta a la ley cero de los siteswaps y, por lo tanto, una colisión de objetos.

Para terminar hay que destacar dos hechos: Primero, existen transposiciones que no tienen órbitas, como por ejemplo, el "**441**" para tres elementos. Segundo, existen siteswaps donde cada elemento tiene su propia órbita, independiente de todos los demás objetos. Los ejemplos de esta familia corresponde a todas las fuentes y las cascadas para cualquier número de objetos. Quizás es por esto que es tan fácil pasar una cascada o una fuente a un ritmo híbrido que desde un híbrido a otro híbrido.

Múltiplex y Multiplexiones

La multiplexación es el acto de arrojar más de un objeto en un bit del ritmo.

Por bit se entiende cualquier punto de lanzamiento (y de atrapado) de un objeto en un ritmo de malabarismo (se supone que el tiempo entre atrapar y volver a arrojar un objeto es insignificante con respecto al tiempo que éste pasa en el aire).

Para entender bien la definición de los múltiplex, hay que recordar nuevamente un punto importante: Se mantiene la idea de que sólo un objeto puede caer en una mano en un momento dado. Esta restricción, que no es siempre verdadera, fundamenta toda la teoría de los siteswaps (ver ley cero) y es suficientemente general para que la aceptemos como verdad. Como siempre olvidaremos aquellos ejemplos patológicos en que no se cumple.

No obstante lo anterior, nada dice acerca de atrapar dos objetos al mismo tiempo, pero con distintas manos. O arrojar más de un elemento por tiro. Esta observación hará la diferencia entre las dos clases de multiplexaciones que existen.

En este punto debo aclarar que en todo el material que he conseguido (todo en inglés) no se hace gran mención a la diferencia entre las dos familias de múltiplex; por esto, no tienen nombres propios. Sin embargo, como las propiedades cambian entre unos y otros es muy importante destacar esta diferencia, los voy a tratar en capítulos distintos. Para identificarlos, se usarán nombres derivados de la notación misma que, al principio, parecerán antojadizos y ridículos, pero luego se descubrirá su origen.

- Múltiplex Cuadrados

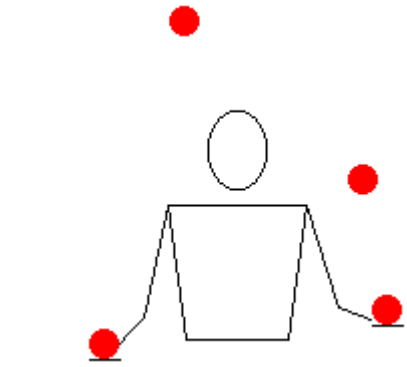
Múltiplex Cuadrados

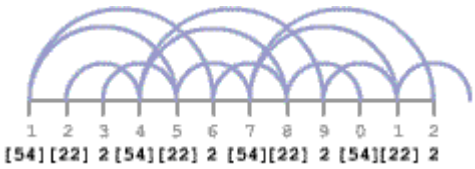
Los múltiplex cuadrados corresponden al acto de arrojar varios objetos con la misma mano.

Para seguir con la idea de las transposiciones o siteswaps, los escribiremos como secuencias de números, pero ahora estarán agrupados por paréntesis cuadrados dentro de la secuencia.

Así, cada número agrupado por un paréntesis representará un objeto distinto que es arrojado por la misma mano en un mismo bit, y el tiempo que permanezca en el aire está caracterizado por dicho número.

Para aclarar ideas, vamos con un ejemplo: el "[54][22]2". Este es un ritmo clásico para cinco pelotas.





Primero que nada verifiquemos la condición del promedio:

`5 + 4 + 2 + 2 + 2 = 15 / 5 = 3!!!!!`

Pero acabo de decir que es un ritmo clásico de cinco pelotas. ¿ Qué pasó entonces ?

Lo que ocurre es que en un múltiplex todos los número encerrados en un paréntesis se consideran como 1 sólo al calcular el promedio en un múltiplex cuadrado. Esto tiene sentido porque sólo 1 mano arroja esos objetos, es decir, los lanzamientos ocurren en el mismo bit del ritmo.

Por lo tanto en vez de dividir por 5 lo hacemos por 3 y el promedio modificado queda:

`5 + 4 + 2 + 2 + 2 = 15 / 3 = 5, que es correcto.`

Ahora, estudiando el diagrama del siteswap podemos observar que efectivamente llegan dos líneas a la misma mano al mismo tiempo.
¿ Dónde queda la ley fundamental de los siteswaps ?
Lo que ocurre es que un tiro "2" lo definimos como un descanso de la mano con objeto, por lo tanto

no implica ningún lanzamiento y, obviamente, ninguna atrapada, así que la ley permanece intacta.

Con esto hemos encontrado otra propiedad de los multiplex: el número 2 en una transposición nos sirve como descanso y, además, nos ayuda a acumular objetos en una mano para arrojarlos en múltiplex.
De hecho, es fácil demostrar que el número 2 es el único "tiro" que satisface esta propiedad (por su definición) y tiene importancia diametral en todos los múltiplex existentes.

Un análisis lanzamiento por lanzamiento sería:

[5 4] La primera mano lanza dos objetos: uno con tiempo de "5" (por ser impar va a parar a la mano contraria) y otro con un "4" que debe caer en la misma mano.

[2 2] La segunda mano debe espera algo de tiempo para que el objeto lanzado en "5" le llegue. Por lo tanto no arroja ninguno de los dos objetos que sostiene. Esto se representa por el doble "2".

2 A continuación la primera mano espera un bit con un "2" hasta que el "4" que lanzó al comienzo retorne.

Por último, para este ritmo en particular, debemos destacar que es una mezcla entre el "522" de tres pelotas (cascada lenta) y el "420" de 2 pelotas. De hecho, si fusionamos los ritmos, número a número, quedaría: "[54][22][20]", pero el cero no aporta nada así que lo volamos: "[54][22][2]" y el último paréntesis tampoco sirve para nada: "[54][22]2".

Así, hemos construidos un múltiplex a partir de dos siteswaps válidos, justamente lo que habíamos definido como órbitas.

Múltiplex Redondos

Los múltiplex redondos corresponden al acto de arrojar varios objetos con manos distintas.

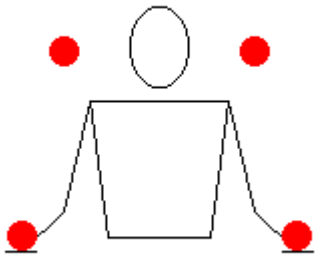
Para diferenciarlos de los múltiplex cuadrados se anotan con paréntesis redondos y separados por comas. Como la mayoría de los mortales tenemos sólo 2 manos, los múltiplex redondos simpre tendrán la forma de parejas de números, o "pares ordenados" (si tuvieramos tres manos, serían tríos de números, etc. Ojo que para los pases entre dos, tenemos en total 4 manos: ¿ Cómo se ocupan los múltiplex en este caso ?).

La característica principal de estos múltiplex es que coordinan los movimientos de las manos: deben actuar al mismo tiempo. Por esto, los diagramas que muestran los lanzamientos ya no tendrán el mismo significado, porque hasta ahora habiamos considerado que las manos actuaban una por vez. Ahora lo harán en conjunto.

Así, cada bit del diagrama representará a las dos manos. Si hacemos que ambos lanzamientos partan en el bit 0 (cero) significa que ambas manos atrapan o lanzan sólo en los bits pares de la transposición, porque una pelota que llega a un número impar no podrá ser atrapada por ninguna mano. De igual manera, si elegimos el bit 1 como punto de origen, todos los tiros deberán llegar a número impares.

Por lo tanto, la primera condición que imponen el malabarismo de múltiplex redondos es que sólo se pueden efectuar lanzamientos pares. Así, siempre llegarán a un bit del ritmo donde exista una mano para atraparlos.

Nuevamente vamos con un ejemplo: el "(4,4)", la fuente sincrónica de 4 pelotas.



Revisando la condición del promedio:

`(4,4) => (4 + 4) / 1 = 8 / 1 = 8 pelotas!!!`

Pero de la animación se ven que sólo son cuatro objetos. Nuevamente debemos hacer que la teoría calce con la realidad: como en cada tiro de un múltiplex redondo arrojamos objetos con ambas manos, el total de tiros que se efectúan son el doble que los paréntesis que intervienen en la transposición. Luego:

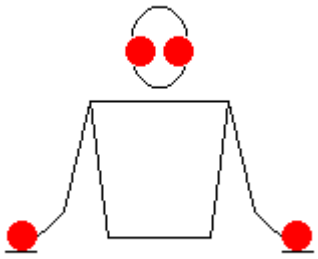
`(4,4) => (4 + 4) / (1*2) = 8 / 2 = 4 pelotas.`

En el caso de un múltiplex más complejo, como el "([86],2)(2,[86])", el número de objetos se calcula:

`([86],2)(2,[86])  =>  ( 8+6+2 + 2+8+6 ) / (2*2) = 32 / 4 = 8 pelotas.`

Del diagrama del siteswap podemos ver que las líneas se superponen siempre. Esto es debido a que las manos actúan al unísono. Además, la mitad de los bits son inútiles porque en esos tiempos no ocurre nada (sólo los bits pares importan).

Una variante del mismo ritmo es el "wimpy" de cuatro objetos:



Debemos notar que este ritmo es muy parecido al anterior y, de hecho, se anotan casi exactamente iguales. El casi lo aportan las x's (equis) que van detrás de los números.

El significado de esas x's es muy sencillo: una X en un múltiplex redondo implica que el objeto cambia de mano. ¿ Por qué complicarnos escribiendo X's ? Lo que ocurre es que la definición de los múltiplex redondos, los lanzamientos con números impares están prohibidos, así que para que un objeto pueda ir de una mano a la otra, debemos añadir este símbolo a nuestra notación.

Por otro lado, los dos ejercicios presentados, el "(4,4)" y el "(4x,4x)" , que su diagrama de transposición es idéntico.

Finalmente, un problema físico: teóricamente cuando intervienen un par de X's en un múltiplex redondo puede ocurrir que ambos objetos deban ocupar el mismo sitio en el espacio en algún momento. En el ejemplo corresponde al zénit de la trayectoria. Como esto es imposible, y para

salvar técnicamente el problema hay dos soluciones:

Una posibilidad es arrojar los objetos en distintos planos, es decir, uno más adelante que el otro. Esta solución no es muy aconsejable porque en general es una buena costumbre mantener los objetos en el mismo plano, en la medida de lo posible. Probaca que el malabarista y sus planos de juego empiecen a rotar. Esto último se puede remediar cambiando continuamente los planos (una delante, una atrás y viceversa).

La otra solución, la más popular, es arrojar uno de los objetos levemente más alto que el otro. Esta diferencia debe ser mínima para no perder el ritmo de juego, pero es fácilmente alcanzable con un poco práctica. Cuidado con caer en ritmos "cojos".

Ejemplos de Múltiplex

Los múltiplex son especialmente atractivos para números grandes de objetos, pero también hay algunos entretenidos para 3 y 4 pelotas. Por otro lado sirven como descanso y variante para el malabarista extenuado de practicar con muchos objetos y, además, son ideales para iniciar rutinas.

A continuación presento una lista de múltiplex que sirven como ejemplo de lo escrito anteriormente y como ejercicio. Les aseguro que todos están probados (i.e. son posibles de realizar).

La lista contiene trucos con bíplex o dúplex, tríplex, cuádruplex y en los últimos se mezclan ambas familias de múltiplex; y se agregan transiciones y otras hierbas.

No incluyo las animaciones aquí mismo para no hacer más pesada la página, pero al hacer click en el siteswap se abre una ventana con su respectiva animación.

Nº	Siteswap	Descripción
3	(6x,2)(2x,2x)(2,6x)(2x,2x)	Ritmo lento de 3 pelotas. En velocidad parecido al 522 (cascada lenta)
	1. (4,4)(4,0) 2. (4x,4x)(4,0) 3. (4,4)(4x,0)(4,4)(0,4x) 4. (4x,4x)(4x,0)(4x,4x)(0,4x)	El típico 2/1 de tres pelotas, en 4 versiones distintas.
	[654]00033333323[22]0	Partida con tríplex.
	(4,2x)(2x,4)	Box o Caja.
4	[54][22]2	5 pelotas con bíplex en ritmo de 3
	[75]121	Multi-Shower.
	1. (6,6)(2x,2x) 2. (6x,6x)(2x,2x)	Variaciones de la Fuente y el Wimpy.
5	[54][22]2	Dúplex: 5 pelotas con bíplex en ritmo de 3.
	[54]24	Dúplex: Variación del anterior
	[97]121	Shower con multiplex de 2 pelotas
	[654]2555525[22]2	Tríplex.
	[7654]20555555525[22]2[222]2	Partida con múltiplex de 4.
	55555525[22]5[222]0[7654]015	Cuádruplex en cascada de 5.
	[87654]00055555525[22]5[222]0[2222]0	Partida en quínquplex.

	[b9753]00121[97]121[97]121[22]1[222]1[2222]1	Partida en quínquplex a shower en bíplex (Viktor Kee)
	([86],[86])(2x,0)(0,6)(2,2)([86],[86])(0,2x)(6,0)(2,2)	4/1 con feed.
	([6x4x],[6x4x])(6x,0)(2,2)([6x4x],[6x4x])(0,6x)(2,2)	4/1 cruzado.
	(6x,6x)(6x,6x)(6x,0)(6x,6x)(6x,6x)(0,6x)	Seudo-Wimpy, Versión 1.
	(6x,6x)(6x,2)(6x,6x)(2,6x)	Seudo-Wimpy, Versión 2.
6	(6,6)	Fuente sincrónica
	(6x,6x)	Wimpy
	[75][22]2	Ritmo de 3 pelotas, con bíplex.
	[86][22]2[22][75][22]2	Versión del 342 de 3 pelotas, pero con bíplex.
	[322][32][322][32][654][62]	Partida para 6 pelotas:
	6666666622[22][32]	Cascada 3 -> 6 pelotas -> Cascada 3
	(8,8)(4,4)	Hi-Low fuente sincrónica.
	(8,4)(4,8)	Hi-Low fuente asincrónica.
7	[654][22]2	7 pelotas con tríplex en ritmo de 3.
	([66x],2)(2,[66x])	7 pelotas en dúplex en ritmo de 5.
8	([86],[86])(2,2)	4 en cada mano, tiros de a 2, sincrónico.
	([86],2)(2,[86])	4 en cada mano, tiros de a 2, asincrónico.

SITESWAP
PARA 4 MANOS
(PASSING)

url of this page: http://www.passingdb.com/articles.php?id=9

4 hands Siteswaps

Author: JiBe

This notation is used in certain specific cases:

- It only describes patterns for 2 jugglers (which is where we get 4 hands), referred to here as J1 and J2.
- The patterns in question must be asynchronous. As per the explanation of causal diagrams page, these are patterns with a delay of 0.5 (with passes like 3.5p, 4.5p... in normal siteswap). This means that J1 and J2 never throw at the same time.

Since J1 and J2 don't throw at the same time, one might think of it as nothing more than a single imaginary juggler with 4 hands throwing the clubs one after another in the following order: RH-J1 (J1's right hand), RH-J2, LH-J1, LH-J2.

Thus we can assign numbers to each throw as we did in normal siteswap and obtain the following table showing the correspondence between the two:

4-handed siteswap	Description	Normal siteswap equivalent
0	empty hand	0
1	impossible	0.5p
2	hand-across	1
3	impossible	1.5p
4	pause	2
5	almost impossible--very fast pass	2.5p
6	normal self	3
7	lofty single pass	3.5p
8	double self (straight across)	4
9	lofty double pass	4.5p
10	triple self (crossing)	5
11	lofty triple pass	5.5p

Remarks :

- **All normal siteswaps are valid 4-hands siteswaps**. And that was actually the primary goal of this notation: finding an interpretation for passing of nomal one person siteswaps. You can take a siteswap generator, tell him not to use 1, 3 or 5's, and generate all possible asynchronous rhythms for 5 to 9 clubs.

- Divide by 2 to obtain the equivalent in normal siteswap.
- All even numbers are selfs, while odd numbers are passes.
- You will notice that I did not specify whether the passes are crossed or not. That's OK- if J1 does 7,9,11 crossed, then J2 does 7,9,11 straight across.
- I marked certain passes as being impossible. This is true in a normal configuration, but it could, however, be possible to do them as a hand-across in back-to-back, for example (for 3 and 5).
- Note that if 10 can easily be confused with a 1 followed by a 0, 1's are almost non-existent in 4-handed siteswaps. So 10, 11, 12, etc. are always read as ten, eleven, twelve, etc. in this type of siteswap, unless specified explicitly. They are sometimes replaced by a,b,c...
- You can find some more advanced stuff on the subject in Norihide Tokushige's article: passing siteswap.

How to use it and examples

When faced with a 4-handed siteswap, first we have to know to whom the sequence applies--the 4-handed juggler, J1, J2?

Normally, there's a sequence for the virtual juggler: $S_1\ S_2\ S_3\ S_4\ S_5$ ...
and it is specified: *where J1 does* $S_1\ S_3\ S_5$ ... *and J2 does* $S_2\ S_4$ ...

You can draw a table to associate each number with the hands of each juggler if you still need to convince yourself:

S_1	S_2	S_3	S_4	S_5	...
RH-J1	RH-J2	LH-J1	LH-J2	RH-J1	...

example 1 : 966 (3-count with 7 clubs)

The 4-handed siteswap is 9 6 6 9 6 6 9 6 6 ....
J1 does 966, J2 does 696 (just like 966).

The pattern is 966 in which J1 and J2 do 966 (lofty double pass, self, self).

example 2 : 96677 (asynchronous bookends)

The 4-handed siteswap is 9 6 6 7 7 9 6 6 7 7 ...
J1 does 96767, J2 does 67967 (identical to 96767).

The pattern is 96677 in which J1 and J2 do 96767 (lofty double pass, self, lofty single pass, self, lofty single pass).

example 3 : 9629669669969929 (Copenhagen countdown)

The 4-handed siteswap is 9 6 2 9 6 6 9 6 6 9 9 6 9 9 2 9
... J1 does 92696992, J2 does 69669699.

The pattern is 9629669669969929 in which J1 does 92696992 and J2 do 69669699. Don't feel obligated to try it, it's just to have an example where J1 and J2 don't do the same thing (this is

because the length of the sequence is an even number).

url of this page: http://www.passingdb.com/articles.php?id=3

Causal Diagrams & Siteswaps

Author: JiBe
Credits: causal diagrams were invented by Martin Frost

Introduction

Causal diagrams are (in my opinion) the simplest way to code and understand a passing pattern with 2 (or 3, after that it becomes complicated and messy) jugglers. Siteswaps allow for coding the same type of information in a format more easily digestible by simulators. The way I see it, the two notations complement one another, and that's why I'm presenting them together.

Siteswaps for passing

<N1 N2 N3 N4 | M1 M2 M3 M4>

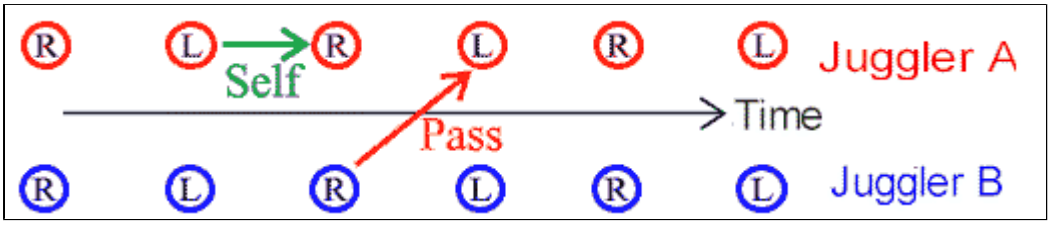
A passing siteswap consists of two sets of numbers (N for one side, M for the other) between brackets: '<...>' and separated by ' | '.

Each of the sequences describes the throws of one juggler. By default, these are integers, as in a solo siteswap (but you will see that this is not always true). A throw that is a pass will be indicated by a p after the number (ex.: 3p for a normal single self). When you get to the end of the sequence, go back to the beginning as in solo siteswaps (instead of writing "a b c a b c a b c a b c ..." we settle for "a b c").
If the sequence is especially long, it may be separated into 2 (or more) parts in the following format:
<N1 N2 | M1 M2>
<N3 N4 | M3 M4>

When the two jugglers do exactly the same thing (at the same time or staggered), the rhythm is called symmetrical (Christophe's "symmetrical passing patterns"). Thus sometimes we only need to write one sequence.
Ex.: **5p 3 3 3** instead of **<5p 3 3 3 | 3 3 5p 3>**

For those who know nothing about solo siteswaps, take a look at the recommended sites posted on the links page.

Causal diagrams



A two-person causal diagram is made up of two lines. Each line represents one of the jugglers. On these lines are written the letters R and L, which represent the two hands of each juggler:

- R = Right hand
- L = Left hand

Next, we add arrows between the letters (hands), which represent a throw, whether a self (staying on the same line) or a pass (crossing lines).

Time progresses from left to right, from which it follows that the arrows point toward the right: first one throws and *then* one catches. That explains the alternation of L's and R's on each line; in a normal juggling pattern, one's hands throw one after the other.

For each circle (letter), there will be an arrow coming in and another arrow going out, i.e. one incoming pass and one outgoing pass (cf. the examples below; the first explanatory diagram don't show this because it is not a complete diagram). This illustrates the fact that one must throw a club in order to be able to receive another. The incoming club is the **cause** of the next throw.

Different types of arrows and what the numbers mean

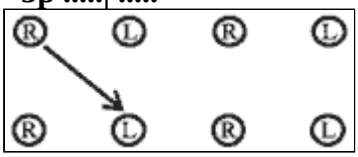
The explanations given here follow (for now) the normal rules of siteswap, which state:

- an odd throw (1, 3, 5..., i.e. handacross, singles, triples) go from Right Hand to Left Hand (or RH to LH). This is shown by R->L or L->R (pass or self) arrows.
- an even throw (2, 4, 6..., i.e. doubles, quadruples, etc.) go from Right Hand to Right Hand (or LH to LH). This is shown by R->R or L->L arrows.

Beware however, contrary to the ladder diagrams, the arrows do not lead to the time when the same club will be thrown again. The arrow points at the moment when the club is caught (if it had been thrown there), combined with the moment when another club is thrown to take its place.

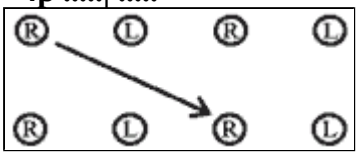
Passes

<3p .....| .....>



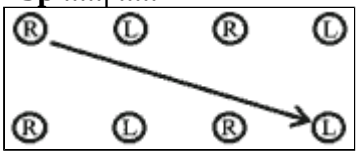
A single pass (single spin) that goes straight across (R to L)

<4p .....| .....>



Double pass

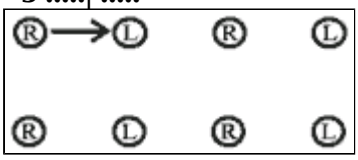
<5p .....| .....>



Triple pass (it's easy to imagine what quadruple passes would look like...)

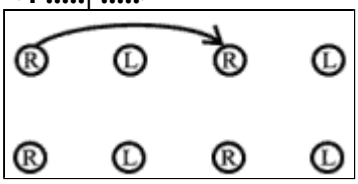
Classic selfs (3, 4, 5...)

<3 .....| .....>



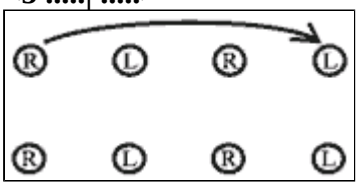
Normal single self.

<4 .....| .....>



A double (which then comes back to the hand that threw it).

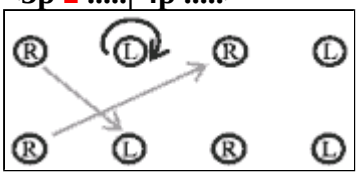
<5 .....| .....>



A triple self (changing hands)

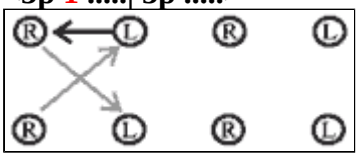
Bizarre selfs (0, 1, 2)

<3p 2 .....| 4p .....>



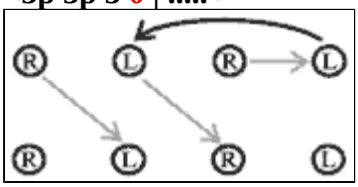
Keep one club in hand (the arrow won't always be drawn). When no club arrives for a given hand, one may hold the club for another beat. That's a chance to do a flourish, thumb twirl...

<3p 1 .....| 3p .....>



A handacross. The arrow goes backward (back in time)!!! That's because this handacross is the cause of the previous throw: you have to free the right hand for catching it.

<3p 3p 3 0 | ..... >

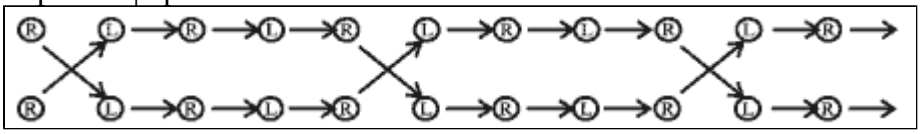


An empty hand (no need to throw). Again, the arrow goes back in time: in order for the hand to be empty, one must have made an earlier throw with the same hand. That's the cause that makes it possible to catch the incoming club.

Some examples

4-count or every other

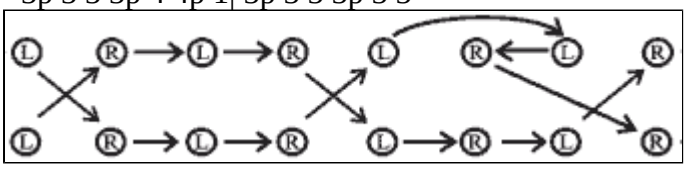
<3p 3 3 3 | 3p 3 3 3>



This is the most common pattern (every other). The jugglers pass at the same time and always with the right hand. There are 3 selfs between each pass.

3-count with a 441

<3p 3 3 3p 4 4p 1| 3p 3 3 3p 3 3>

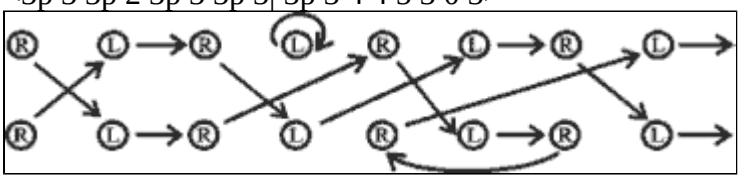


Waltz: jugglers pass at the same time and alternate between right and left hands.

Here one of the jugglers, upon receiving a pass does: - self double (4) - crossing double pass (4p) - handacross (1, the arrow pointing left)

2-count with doubles and triples

<3p 3 3p 2 3p 3 3p 3| 3p 3 4 4 5 3 0 3>



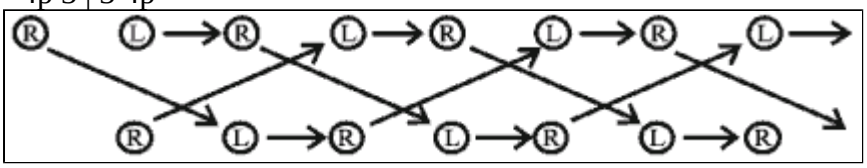
Here, the bottom juggler does the traditional right-left-triple in 2-count.

The first double, thrown at the same time as a regular pass, arrives late (a double takes longer to get there than a single). The top juggler therefore has a pause (a 2) with his left hand (which otherwise would have received a regular pass).

When someone throws a triple, there is no pass coming to the right hand, which will then be empty two counts later (at which point the arrow goes backward: a 0).

Standard 7 clubs in 2-count

<4p 3 | 3 4p>

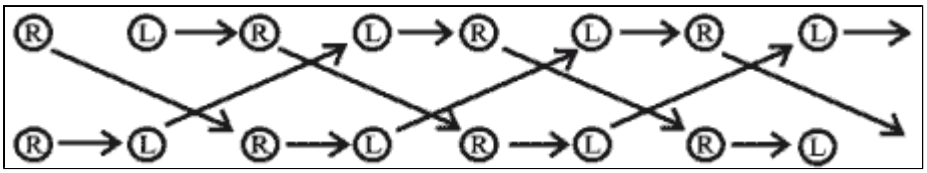


Here you will begin to grumble, and with good reason: why are 4's (doubles, all the passes) not made as crossing passes (R to R or L to L, as before)?

It's because the two jugglers are no longer doing exactly the same thing at the same time. The R's of the top juggler correspond to the bottom juggler's L's. There is a staggered start, which is not indicated by siteswap notation (on Joepass! you would enter it as "#jugglerStartLeft 2").

Crossing 7 clubs in 2-count

<4p 3 | 3 4p>



This is crossing 7 clubs in 2-count which follows the rules stated above. The jugglers throw with the same hand at the same time, but one of them must make left-handed passes.

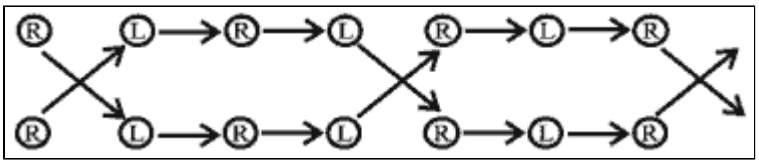
Staggered starts

You have seen in the previous examples that the two jugglers don't always throw with the same hand at the same time. According to the time delay between both their right (or left) hands, I categorize rhythms into three families (not counting hurries or 'galloped patterns').

Siteswap does not take staggered starts into account. Therefore, sometimes there are several ways to juggle certain sequences (cf. <4p 3 | 3 4p> in the examples above).
Be also aware that the new rules stated under are valid only for passes. Selfs throws will always follow the usual rules.

Family 1 : Delay=0

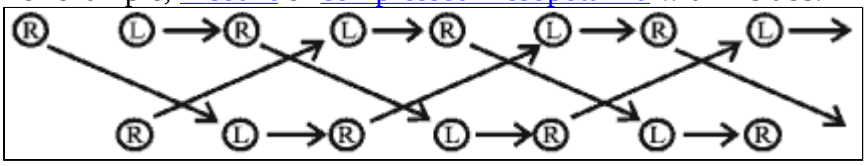
This includes 4-count, 3-count, 2-count, 1-count with 6 clubs, 4-count or crossing 2-count with 7 clubs...



In this family, the standard siteswap rules apply:
- even passes (4, 6... i.e. doubles, quadruples...) cross: R->R or L->L
- odd passes (3, 5... i.e. singles, triples) go straight across: R->L or L->R.

Family 2 : Delay=1 count

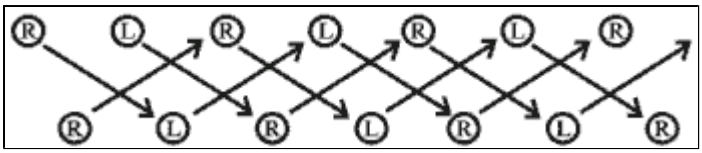
For example, 2-count or compressed mesopotamia with 7 clubs.



Note that the 1-count delay means that when A throws with the RH, B throws with the LH. In this family, the standard siteswap rules are reversed:
- even passes (4, 6... i.e. doubles, quadruples...) go straight across: R->L or L->R
- odd passes (3, 5... i.e. singles, triples...) cross: R->R or L->L

Family 3 : Delay=0.5 count

These are essentially 7-club patterns-- 3-count, ultimate--but also some with 6 clubs--whynot?--as well as 8 and more.



In this family, the rules change completely; since the delay is no longer a whole number, neither are the passes. The passes are now written as 3.5p, 4.5p, 5.5p...
In practice, you may choose to do either doubles or singles for 3.5p (which is between 3 and 4 - I know, you could've figured that out on your own).

A second new element is that in this case, one juggler makes all crossing passes, while the other makes all straight passes (without changing the numbers). Thus we have: If N (=3.5p for example) is a crossing pass for J1, it is straight for J2. And N+1 (4.5p in this case) is therefore a straight pass for J1.

A special siteswap notation may be applied to these patterns: 4-handed siteswaps.

I know that some people won't agree with this classification system. However, if the diagrams are new for you, this may be less confusing.
FYI, some points to consider:

- It is not necessary to differentiate delay = 0 from delay = 1. In effect, both jugglers throw at the same time, but not necessarily with the same hand. However, I find that in practice, the feel is completely different.
- There are many other patterns for which the delay is neither 0, 1, nor 0.5. It's possible to have a delay of 0.3 for example. I suspect that such patterns are permutations of other patterns belonging to the families previously described in which jugglers throw their passes higher or lower than normal (but I could be wrong). One might even say that a pattern with a delay of 0.5 in which the two jugglers pass in 3.5p is a permutation of a pattern with delay=0 in which one juggler throws singles (3p) and the other doubles (4p).

Properties

Siteswap : properties

The **total number of clubs** equals:
(average of the numbers in the two sequences)*(number of jugglers).

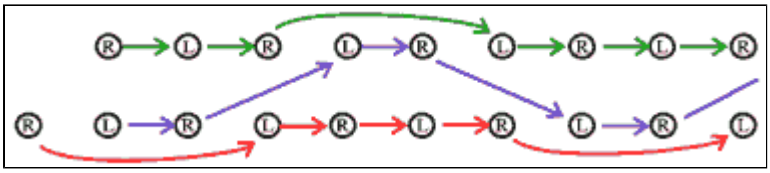
For example, for <3p 4 4 1 | 3p 3 3 3 > :
average = (3+4+4+1+3+3+3+3)/8 = 3 (24/8)
and the **number of clubs** = 6 (3*2, i.e. 3 clubs per juggler).

One could also calculate the number of clubs juggled by each juggler (with his corresponding sequence) as in normal siteswaps. When doing this, one often ends up with numbers like 3.5 clubs per juggler (for regular 7 clubs).

Causal diagrams : properties

In order to calculate the **number of clubs** in a causal diagram, we must first find (and define this notion) the number of causal lines present in the diagram. In the example below, the three causal lines are clearly shown (one blue, one green, one red). This should be enough to understand the

concept of causal lines. One may also make a vertical line and count the number of arrows that it crosses, but in this case arrows that go from right to left (hand-across and empty hand) should be counted as negative.



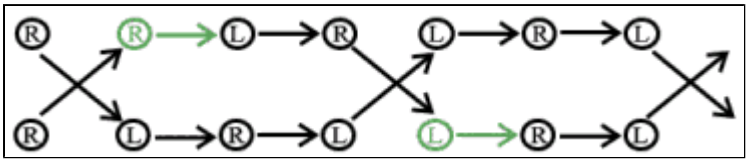
So we have: number of clubs = (number of lines) + (total number of hands).
In the case of 2-person passing patterns, there are 4 hands.

Here: number of clubs = 3 + 4 = 7 (it's a popcorn with 7 clubs).

In short, the lines represent the number of objects in the air at a given time, as opposed to those which jugglers hold in their hands (which is how we get the formula).

Moving on

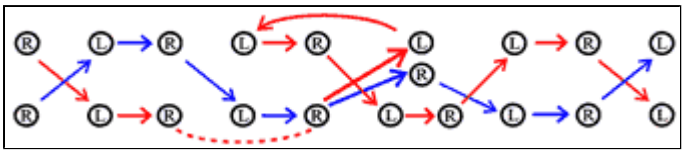
Hurries



A hurry is often defined as throwing twice in a row with the same hand. This often happens because someone catches the club in the "wrong" hand.

Here I've shown the hurries in green, breaking the alternation of RLRLRL... by sometimes having 2 R or 2 L in a row.

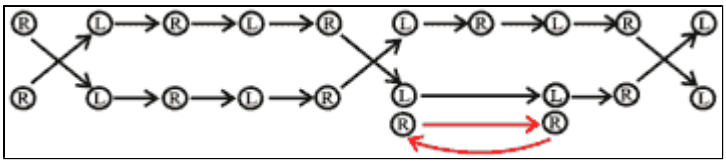
Multiplexes



Here I've tried to represent a duplex in a 2-count pattern (6 clubs). The bottom juggler catches two clubs in his right hand and throws them back two counts later.

The diagram's ambiguity comes from the fact that one line (the red one) is broken. We should agree on a way of dealing with this, perhaps by introducing a new arrow (like the dotted one) in the diagrams.

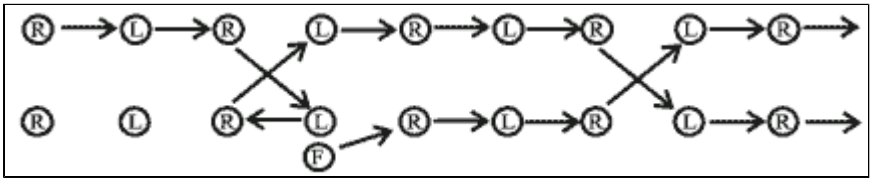
Various self patterns



If desired, one may add an extra line to show self patterns which necessitate, for example (as is the case here for columns) synchronous throws. Note that the line (red loop) thus created does not intervene in the calculation of the number of clubs in the pattern (we have simply created a problem for ourselfs by throwing a club even though nothing forced us to do so).

Note: Most jugglers do this pattern by throwing synchronous doubles, handacross, pass (not synchronous doubles, hand-across, **self**, pass). When making a clear diagram, you can see that theoretically that triples should be thrown, but by taking some liberties in throw height, it still works with doubles.

Kickups



A kickup is the action of picking up and "throwing" (in a self or a pass) a club with one's foot. A circle with an F (for Foot) suffices for this type of diagram. In this case, you create a new line since you add another club to the pattern.

Thus you can play with the diagrams, doing what you want with them. Feel free to take some initiative!

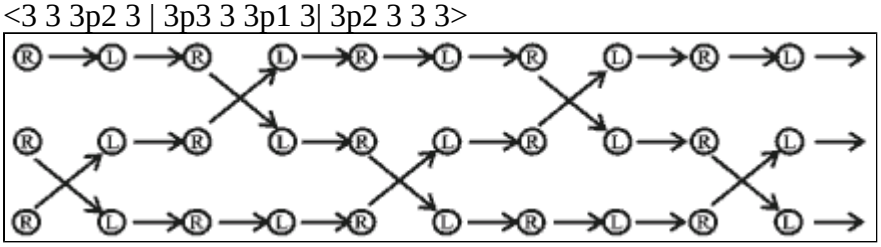
More jugglers

Adding jugglers is simple, both for the diagrams and for siteswaps. In the diagrams, all you have to do is add a line for each new juggler.

For siteswap, you add a sequence of numbers for each juggler (still using a '|' (pipe) to separate each juggler). On the other hand, you must identify which juggler should receive which passes, so we write 3p1 to note a pass thrown to juggler number 1 (The jugglers need to be numbered first).

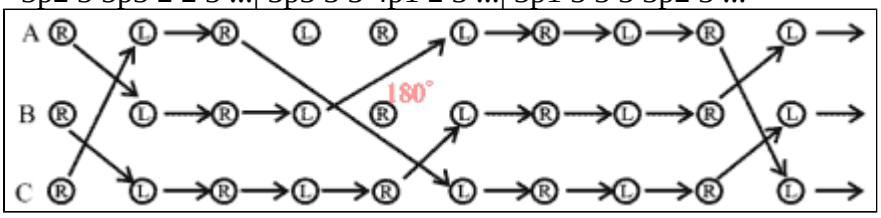
Classic feed

<3 3 3p2 3 | 3p3 3 3p1 3| 3p2 3 3 3>



Line with a turn

<3p2 3 5p3 2 2 3 ...| 3p3 3 3 4p1 2 3 ...| 3p1 3 3 3 3p2 3 ...>



url of this page: http://www.passingdb.com/articles.php?id=46

4-Handed Siteswap

Author: Christoph Schumacher
Credits: Kaskade 74

Siteswap is a compact notation that describes some aspects of juggling patterns. It can also be used to describe certain passing patterns, as I will explain in this article.

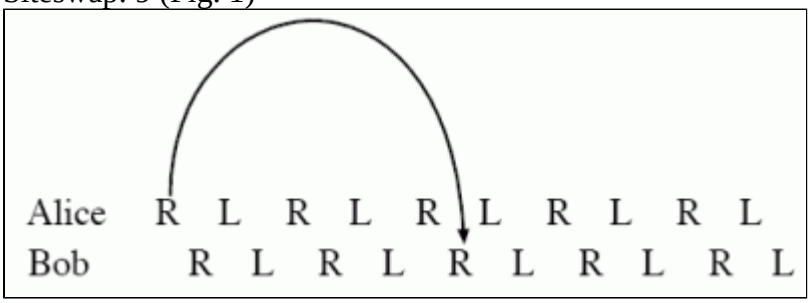
How to use siteswap as notation for passing patterns

A siteswap tells you how many throws in the future a club should be thrown again. (In principle, siteswaps can be juggled with any objects, so whenever I write “club” you can imagine your favourite prop instead.) Consider the following example:

Let’s observe Alice and Bob while they pass 7 clubs in a waltz rhythm. They are standing opposite each other (and looking up slightly). The order in which their hands throw is
1) Alice right,
2) Bob right
3) Alice left
4) Bob left
and then again from the beginning.

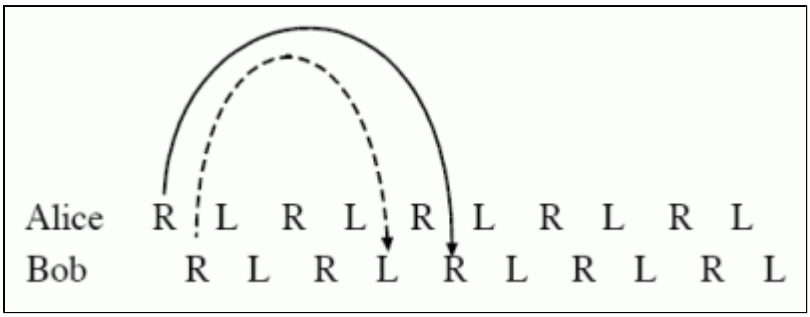
Alice throws a floaty double cross pass with her right hand to Bob’s right hand. Before Bob throws this club again, he makes two other throws with the right hand. Fig. 1 shows how this is represented in a juggling diagram. *(Note that in a juggling diagram you draw an arrow between two consecutive throws of a club. In a causal diagram, by contrast, the arrow only goes as far as the throwing beat on which the club is caught. Thus, causal diagrams are better for showing what the juggler does and sees, whereas juggling diagrams come closer to illustrating what siteswap tells us.)*

Siteswap: 9 (Fig. 1)



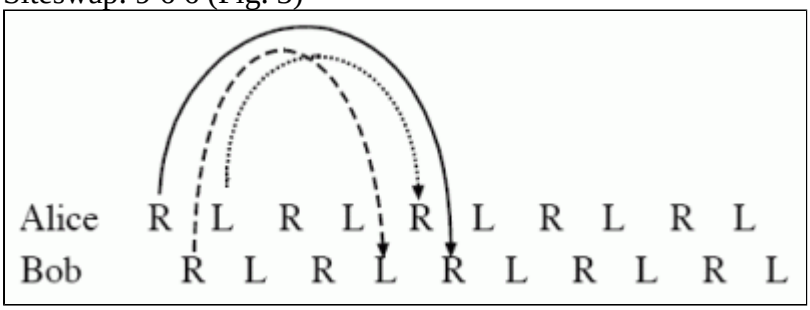
The first number in the siteswap for this pattern is therefore a 9, as you can work out by counting the number of throws between two throws of the same club.
Now it’s Bob’s turn to do a single self, i.e. a throw from his right hand to his own left hand.

Siteswap: 9 6 (Fig. 2)



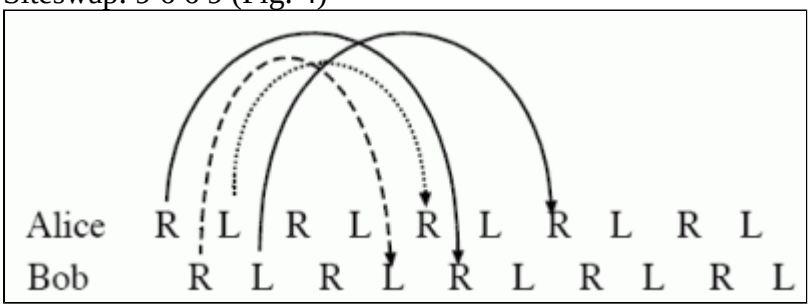
In two-handed siteswap a single self would be a 3, but this is a passing pattern, so here the number is 6. It is twice as big because Alice does a throw in between each two throws of Bob's, and her throws are counted too.
Now Alice does her self…

Siteswap: 9 6 6 (Fig. 3)



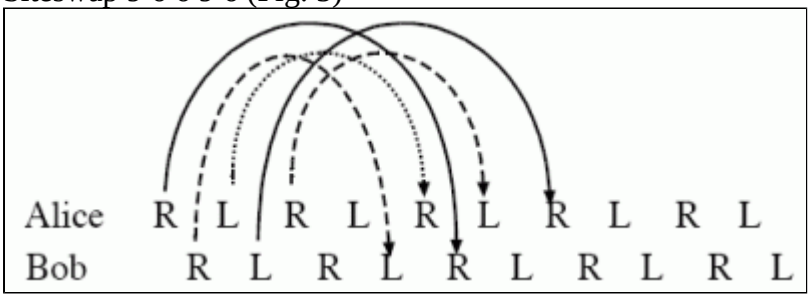
…followed by a floaty double pass from Bob…

Siteswap: 9 6 6 9 (Fig. 4)



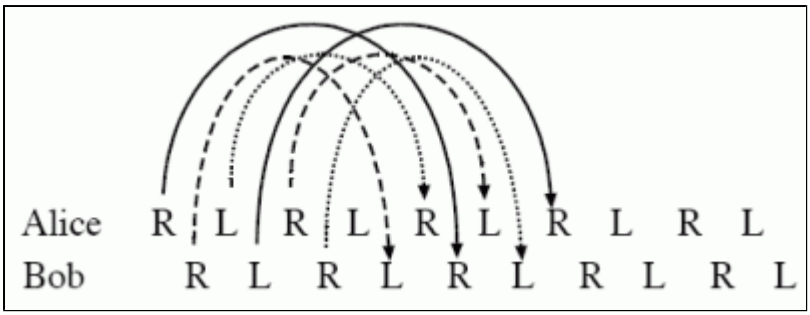
…which also leads to a point 9 throws ahead, this time from Bob's left to Alice's right hand. You will notice that you cannot tell simply from the number 9 whether it is a straight pass or a cross pass. In order to know that, you have to know who throws it. Next is a single self from Alice…

Siteswap 9 6 6 9 6 (Fig. 5)



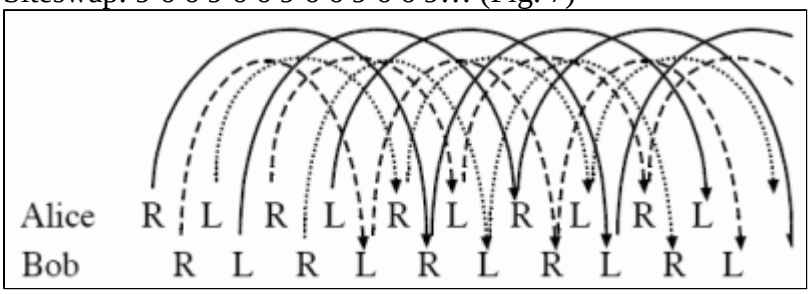
…and another single self from Bob.

Siteswap: 9 6 6 9 6 6 (Fig. 6)



There seems to be a recurring pattern here: 966. And indeed, that's exactly how it goes on.

Siteswap: 9 6 6 9 6 6 9 6 6 9 6 6 9… (Fig. 7)



OK, the juggling diagram starts to get confusing when the numbers are that high, but that is where causal diagrams come in.

How can you pass siteswaps?

The first thing you have to know about siteswap is that the number of clubs you need to throw a siteswap is equal to the average of the numbers in the siteswap. For example, in the 966 waltz you need (9+6+6)/3 = 7 clubs.

With the aid of a juggling diagram, or simply by counting the hands in the right order, you can translate the siteswap numbers into throws.
0: the hand stays empty
2: hand the club across to your own other hand (the handacross or zip)
4: strictly speaking, this is a quick throw to the same hand, but you could also do a flourish or simply hold onto the club for one beat (a hold)
6: a basic three-club cascade throw (a single self)
7: a floaty single pass, with Alice throwing straight but Bob throwing across (as in 7 club one count passing)
8: a double-spin throw into the same hand, as in the 4-club fountain (also known as a straight double self)
9: a floaty double pass, this time with Alice throwing across but Bob throwing straight
A=10: a triple to your own other hand (triple self)
B=11: a floaty triple pass in the direction of a 7

Floaty passes are slightly higher – and therefore stay in the air longer – than passes in synchronous patterns, in which the partners throw at the same time. What about the missing numbers, 1, 3 and 5? A 3 would be a very fast pass, and a 1 would be a very, very, very fast pass, but in practice they are virtually impossible to do if you and your partner are standing the normal passing distance apart. (But of course, you could stand in a different position, e.g. back to back, and hand the club across.) A 5 is a flat pass, and it also has to be pretty quick. (5s can be dangerous too. I have been given a black eye by a stray flat pass.)

From the point of view of the pattern as a whole, the throws are made in the order prescribed by the siteswap, but you have to remember that each individual juggler only does every other throw. To illustrate this point, you could think of the siteswap 86277 like this:
Alice: 8-2-7-6-7-8-2-7-6-7-
Bob: -6-7-8-2-7-6-7-8-2-7

You will notice that Alice always throws 82767. This juggler-specific sequence of numbers is called the local siteswap. Bob's local siteswap is 67827. To distinguish it from local siteswaps, the siteswap of the pattern as a whole is called the global siteswap.

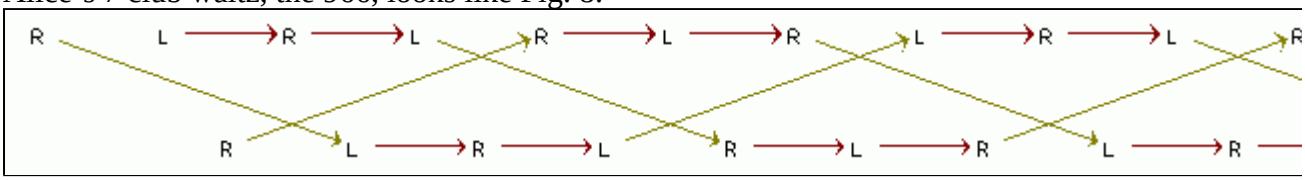
Here are three points to remember about local and global siteswaps:
1. If the period of the global siteswap is even, the local siteswaps are half as long as the global siteswap. For example, a global 777726 breaks down into a local 772 and a local 776.
2. Local siteswaps are not necessarily valid siteswaps! For example, the average of 776 is not a whole number, so 776 can't be a siteswap.
3. Many jugglers divide the numbers of the local siteswap by two in order to make the self throws look the same as the selfs you are familiar with from interpreting siteswaps as two-handed patterns. In that case, the passing throws contain decimals, so there's no danger of confusion.

Here is a (far from complete) list of interesting passing siteswaps:
- An amusing three-club pattern: 720
- 5 club 1 count: 744 (try to do a flourish on every 4)
- Programming: 777726
- The following patterns can be thrown unannounced into the previous pattern, allowing you to "program" your partner: 7777266, 77772 (but they can also be fun in their own right, especially 7777266)
- Why not: 86277 (see ***Kaskade*** No. 73, part 17 of this workshop series)
- Not why: 86772
- Maybe, also known as What the heck: 86727
- Two patterns related to 96677, as yet unnamed: 79662 and 96672
- Two 6-club patterns with long pauses to play around in: 79464 and 96474
- I found this siteswap on a number-plate in Sweden: 972
- 7 club 1 count: 7
- 7 club 3 count, also known as the waltz: 966
- French 3 count, also known as 3-count popcorn: 786
- The preceding two patterns can be combined to produce: 966867
- 7 club 3 count with triples against singles: 7B6666 (remember: A=10, B=11)
- A very fast, high popcorn-like pattern: 9A2 (can also be thrown as a trick in the waltz: … 9669A6962966…)
- Two 7 club PPS variations: 777786 and 777966
- Two 7 club PPSPS variations: 77786 and 77966
- 7 club 5 count: 96686
- 5 count popcorn with triple-single: 7A666
- 5 count popcorn with columns (straight double selfs): 78686
- 7 count popcorn (according to Gandini's definition) with columns: 7868686
- 7 count popcorn: 966A666
- Five patterns with zips: 88892, 99692, 89792, 97892 and 978972
- 8 club 1 count: 97 (can be thrown with either straight or cross passes)
- Three 8 club PPS variations: 996, 978 and A77
- Ollerup: 9969968
- 8 club 5 count popcorn: A6969
- Two 8 club patterns which contain the same throws: 9A678 and 97A86

You can construct more 7 club patterns out of 7, 86, 966, … For example: 9669667. Suitable building blocks for 8 club patterns are 8, 97 and 996. For example: 97978 and 97996, two variations on the 8 club PPPPS. Incidentally, I cannot do all of the patterns listed here.

If you understand causal diagrams, you can convert siteswaps into causals. As in the juggling diagram, the hands of the jugglers are represented schematically by R and L. Causal diagrams also include arrows, but here they go from the point in time when a hand throws a club to the point in time when it is caught again.

In order to draw a 9, you therefore count 9 (global) throws into the future and then jump back to the previous throw of the target hand that you have just identified by counting. This is where the 9 is caught, so this is where the arrow points to in the causal diagram. As a causal diagram, Bob and Alice's 7 club waltz, the 966, looks like Fig. 8.



Can siteswaps handle more than two people?

In theory, yes. But there are practical difficulties. If you want to keep to so-called vanilla siteswaps, in which only one club (at the most) is thrown at each point in time, adding more people makes synchronisation increasingly difficult. And you have to be able to throw "four-thirds" passes, which are somewhere between a normal single pass and a floaty single pass.

In Ollerup, Ross successfully used vanilla siteswap to describe a three-person pattern called the Shamrock: 50673955. Suse, Flo and Jochen stood in a triangle, fairly close together, and almost took the clubs out of each other's juggles. The hands throw in the following order:
1) Suse right,
2) Flo left,
3) Jochen right,
4) Suse left,
5) Flo right,
6) Jochen left

and back to the beginning. Using siteswap they succeeded in adding an extra club to the pattern. The new siteswap was 58673955. Needless to say, we tried to develop some more interesting patterns for three people. One promising candidate is 75355, known as the Birdsmash, but it still needs time to mature.

To be able to describe more – and above all synchronous – passing patterns, we need to be able to allow for more than one club to be thrown at a given point in time. There are various extensions of siteswap for dealing with these situations.

url of this page: http://www.passingdb.com/articles.php?id=47

4-Handed Siteswap II

Author: Christoph Schumacher
Credits: Kaskade 75

Yet another article about siteswap? Don't worry, this is the last siteswap article in the passing series (for the time being). Following on from the article in the last ***Kaskade***, I'm going to answer two more questions about siteswap: How do I work out how to share out the clubs at the start? and How can I find all the siteswaps that contain my favourite states?

How do I work out how to share out the clubs at the start?

A siteswap describes an ongoing juggling pattern, but how do I get into the pattern in the first place?

With two-handed juggling patterns there are transitional throws. For example, the Gandinis sing "… 3335711711711…" This sequence of numbers contains the siteswap 711. But to get into that two-handed pattern, they first throw a transitional 5 before continuing with 711.

The same principle applies to passing patterns. However, you can eliminate a lot of initial throws – i.e. transitional throws at the beginning – by working out how best to share the clubs between the jugglers.

One way of working out the optimal starting distribution of clubs is to translate the siteswap into a causal diagram. See my previous article for instructions on how to do that. With a little practice, you can work out how the pattern starts by studying the causal diagram.

But there are other approaches. As an example, let's look at the siteswap 972. First we work out the initial state, which is most easily done by writing the siteswap a few times, drawing a vertical line and then counting how many places after the line the clubs have to be thrown again. At these places we write a 1, whereas all the others get a 0 (see Fig. 1). In other words, after the 9 we count nine places on, from the 7 we count seven,… and write a 1 each time we land beyond the vertical line. When we have as many 1's as there are clubs in the pattern, we fill in the remaining spaces with 0's. Remember: the number of clubs is equal to the average of the siteswap: (9+7+2)/3 = 18/3 = 6.

The 01-sequence 1111011 from Fig. 1 is the state of the siteswap 972 before the digit 9. Let us agree to note the states in this order, rather than in the reverse order, so as to avoid any confusion.

The state contains the information we want. To read it, write down the hands under the state, in the order in which they throw. Now all you have to do is count the 1's over each hand and you already know how you have to start. Alice holds one club in her right hand and two in her left, whereas Bob gets two clubs in his right and one in his left.

However, there are some patterns that you cannot get into by optimally sharing out the clubs at the start. Instead, you need an initial throw to get you started. One such pattern is 9A2 (see Fig. 2). The problem is that Alice's right hand starts with two clubs and has to throw one of them right at the start. Yet before the second club can be thrown, another club has to pass through precisely this hand. This club comes from her left hand.

Sometimes you can avoid the initial throws by starting the siteswap at a different point – because, after all, the state can change after every throw. I'm sorry I don't have a patent recipe for working out what the best starting point is, but a good rule of thumb is: start directly before a lot of high

throws. In passing patterns it's often a good idea to start with a pass – that way your partner doesn't have to wait so long. In the worst case you'll just have to write down all the states of the siteswap and choose the best one.

With 9A2 that won't work, though. A starting throw is needed for all three of the possible initial states. Probably the most comfortable solution is to throw a self (6) from left to right instead of the first handacross (2) from left to right. You can determine these starting throws systematically using the pick-a-pattern procedure (see below). (See Fig. 3)

How can I find all the siteswaps that contain my favourite states?

The method described here imitates the pick-a-pattern procedure developed by Martin Probert. It can be used to construct not only siteswaps but also the transitional throws that you have to do between patterns with different initial states if you want to avoid gathering in the clubs before each new pattern and sharing them out among the hands again. In addition, you can use it to work out starting throws for siteswaps like 9A2, because starting throws are simply transitional throws at the start.

Let's assume we want to find a siteswap with period 5 and the initial state 110101101. There are six 1's in the state, so the pattern will contain six clubs. It is helpful if we draw up a table like in Fig. 4.

The top line is the initial state and the bottom line shows the end state, moved five places along. In order to construct a siteswap, the top and bottom lines should be identical. For a transition between two patterns, they will naturally be different. All the 1's from the initial state that come after the vertical line should be directly above 1's in the end state, because otherwise there won't be a siteswap or transition that fits.

Below each 0 before the line in the initial state and above each 1 in the end state that does not have a 1 above it in the initial state, write a series of declining numbers ending in 0. Letters are used as abbreviations for double-digit numbers: A=10, B=11, etc. This gives us exactly five rows of numbers, and before the vertical line we have a square.

From this square, select five numbers, one from each row and each column. If you read the selected numbers from left to right (292A7 in our example), you will get a siteswap with the desired period and the right initial state, or – as the case may be – the transitional throws from the initial to the end state. When choosing numbers, you can try to avoid difficult throws (like the 1, 3, C and D in the example). However, your choice should include at least one odd number, otherwise there won't be any pass throws.

Incidentally, I have only just discovered the siteswap 292A7 myself, and I haven't actually done it yet – but I plan to, as soon as I get the chance. Let's find a suitable way of getting into this siteswap. To avoid additional starting throws, I can rotate the siteswap to A7292.Then, as you should now all be able to work out for yourselves, Alice has only one club in each hand (yet she is the juggler who starts – with a triple self), while Bob gets two clubs in each hand, and his first throw is a single cross pass.

There are other ways of making the start of a siteswap easier. For example, the 7-club waltz 966 (discussed in the last issue) has the initial state 1111111. If you write the hands underneath, you find that Alice has two in each hand, while Bob has two in the right and one in the left. According to the list of throws from the last article, Alice starts with a double cross pass (9) and B begins with a self (6). He could just as well not bother to throw this self, but could miss out a beat and simply start with his first pass. However, this pass would have to come from the left hand. To save him that trouble, Alice – even though she is the one who starts – could throw a straight pass, and Bob, in return, could

throw a cross pass. The same principle applies to the 7-count Popcorn 966A666.

The pick-a-pattern procedure gives us a way of counting all the siteswaps with a given period p and a given state. The number we are looking for is equal to the number of possible ways of setting up rooks on a “chessboard” with p x p squares so that they cannot take each other. We could even the limit the number of throws allowed, which would enable us to count only the passing siteswaps, for example. In that case, the chessboard would have holes in the corresponding places. If you have a suggestion on how to calculate that number, or have any questions or suggestions on siteswap, or simply have a nice new passing pattern you want to share, please contact me!

References:

In addition to the references I gave in the last issue of ***Kaskade***, here are three more:
The Gandini Juggling Project’s website: http://www.gandinijuggling.com
Martin Probert first published the Pick-a-Pattern procedure in his book *Four Ball Juggling, From Simple Patterns To Advanced Theory*: http://website.lineone.net/~m.p/contents.html
In his article on “Juggling Polynomials”, Lute Kamstra determines the number of possible siteswaps with a given period and a given initial state: http://db.cwi.nl/rapporten/abstract.php?abstractnr=952

Fig. 1. Working out the states for 972

Fig. 2 The initial state of 9A2

Fig. 3 Constructing the starting throws for 9A2

Fig. 4 Constructing a siteswap