



Modern Club Passing

July 05, 2026

With this short book (and corresponding website), my goal is to provide an opinionated introduction to the fascinating world of modern club passing. Like many areas of juggling, club passing has its own community that continuously pushes the field and invents and shares new patterns and new styles of passing. I have learned many things from this community and tremendously enjoy patterns that go beyond traditional 6-club four-count (“every others”), 7-club two-count, and two-count/four-count feeds. In passing corners at juggling festivals and at festivals dedicated to passing, it is now common to find ambidextrous 4-handed siteswaps with zaps and triple selfs, and Roundabout-style manipulator patterns of various difficulty with 3 to 5 people.

Getting into modern club passing can be intimidating and overwhelming. There are so many patterns, notations, and video collections that it can be difficult to know where to start, where to go next, and how to even figure out what’s going on. I try to provide a clear guide, laying out possible paths to learn patterns and skills that incrementally build on each other and increase in difficulty. Along the way, I’ll briefly introduce the necessary notation and concepts, which allows sharing and explaining individual patterns more compactly.

I try to curate and guide in a short book, rather than create a comprehensive repository. With this book, you will learn the essentials that are broadly known in the passing community – at any level, you will likely find people to pass interesting and challenging patterns with. You will find plenty of patterns beyond the basics to push yourself, and also gain the skill to find, read, and create other patterns.

What is modern club passing? Modern club passing is ambidextrous. Modern club passing combines passes at different heights (zaps, singles, doubles) with zips, flips, heffs, and triple selfs. Modern club passing is about slowing down and controlling the pattern. Modern club passing embraces manipulator and walking patterns with 3 or more people. Modern club passing is for the passer and not for an audience. Modern club passing constantly pushes the boundaries and tries more challenging patterns, even when they all look the same from the outside. Modern club passing is not a fixed concept but a term I embrace for the kind of passing that I and many others in the community enjoy.

This is book is still work in progress. Feedback is welcome. For those interested in rendering and animating their own pattern: <https://takeout-explorer.modernpassing.deno.net>

– Christian Kästner

PDF and web version with animations at <https://modernpassing.com>



Contents

Getting Started	3
1. Learn to pass / teach to pass	3
Synchronous Passing Patterns	5
2. Introduction to synchronous passing & notation .	5
3. Basic 6-club synchronous passing patterns	5
4. Jim's patterns (sync)	6
5. Common 7-club and 8-club patterns	7
6. Beyond classic synchronous patterns	8
7. Tedious synchronous patterns	10
8. Improve your passing	11
Four-Handed Siteswaps	13
9. Introduction to Four-Handed Siteswaps & Notation	13
10. Beginner four-handed siteswaps	13
11. Doubles	14
12. Heffs	14
13. Zaps	15
14. Trelfs	15
15. Advanced patterns	16
16. Holy grail sequence	17
17. Compatible Siteswaps	18
18. Improve your siteswaps	20
19. A bit of siteswap theory and lore	21
Group Patterns	25
20. Passing with 3+ People	25
21. Feeds	25
22. Static Group Patterns	28
23. Moving Group Patterns	31
24. Large Patterns	37
Manipulator Patterns	39
25. Starting Manipulator Patterns: Concepts and Nicki's 3-Count Roundabout	39
26. Manipulator Pattern Notation	40
27. Roundabout	42
28. Roundabout Variations	43
29. North-Wall Patterns	46
30. Scrambled V and other Scrambled Patterns	48
31. Ambled Patterns	50
32. Zippy and other advanced 4-5 person patterns .	51
33. Siteswap takeout patterns	53
34. Other Ideas	55
Appendix	58
35. Appendix: List of Siteswaps	58
36. Appendix: Bruno's Variations	61
37. Appendix: 8-club one-counts	62

Getting Started

1. Learn to pass / teach to pass

Next: Synchronous passing notation (Ch. 2) or Four-handed siteswap notation (Ch. 9)

5-club one-count

The most effective way to teach beginners passing is to teach them *5-club one-count*. Especially if one passer is more experienced, it is possible to teach almost everybody passing within minutes and get them to experience success, even if they have never tried to juggle clubs before. As it allows for more control and feedback and trains both hands equally, this approach is much more effective than the traditional approach of first requiring a solo cascade pattern and then learning 6-club four-count (Ch. 3) as the first pattern. This approach was first introduced by Amiel Martin and published on passingpedagogy.com. It has since been widely taught in workshops.



passingpedagogy.com

In the following, I assume a more experienced *teacher* and a less experienced *student*. While it is easier to get to success with a more experienced *teacher*, who can throw good passes and recover from weak responses, the same sequence also works with two beginners.

Step 1: Practicing passing throws in isolation. The teacher has a single club, the student has two empty hands. The teacher throws a lofty crossing pass from the right hand with a single spin. Ideally the student can catch the club comfortably with the right hand at about shoulder height. The student then throws a lofty straight pass back to the teacher, from the student's right hand to the teacher's left hand. This is followed by a lofty crossing pass from the teacher's left hand to the student's left hand, and finally followed by a lofty straight pass from the student's left hand to the teacher's right hand.

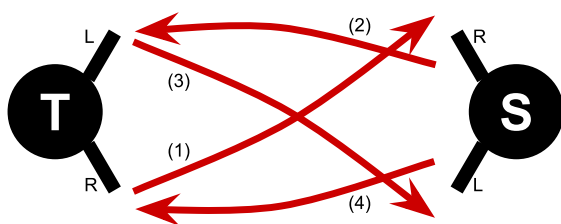


Illustration of the four passes between the teacher (T) and the student (S).

Use this first step to practice passes, watch them land, and correct with the next throw if needed. Passes will often be too spinny, too short, too fast, or too low. Passes should be lofty and should be caught with an open hand facing the other passer roughly at shoulder height, maybe 10 to 20 cm (4-8 inches) diagonally in front of the shoulder. It is a good exercise for the teacher (a) to hold the empty hand where they want to catch the club as a reference point for

the student to aim for, and (b) to provide feedback on what to correct.

[TODO: Photo of where to catch]

When throwing the pass, *avoid spinning the club from the wrist* – keep the wrist fixed. Adjust height and length of the throw primarily by controlling how much to move the lower arm (bending at the elbow) and when to release the club. For extra far throws, the upper arm might also be involved (moving from the shoulder joint), but that is rarely needed. If the club is not spinning enough, correct by throwing it higher, not by spinning it more. Without wrist spin, it does not matter much where exactly to grip the club; usually grab it anywhere comfortably at the handle, though some people like to slide it down to the knob for every pass.

[TODO: Photo or graphic with the path of a club]

Step 2: Responding to a pass with a pass. The teacher has a single club in the right hand and the student has one club in each hand. The teacher throws a lofty crossing pass and the student responds by throwing a lofty straight pass from the right hand back to the teacher's left hand, before catching the club with the now empty right hand. Students often want to throw their responding pass very early – delay it as long as possible – it is thrown when the incoming club starts to descend, more than halfway across the pattern. The responding pass is thrown *underneath* the incoming pass, not outside of it. Once both clubs are caught, the teacher repeats the sequence on the other side.

The teacher needs to throw lofty passes that are high and wide enough for the student to comfortably pass underneath – good lofty crossing passes are more critical for the pattern than good straight passes, which is why we have the teacher throw them. The student's straight passes should be wide enough that the teacher can comfortably pass on the inside. If there are collision problems, the incoming pass is likely too short or too low. The student may need a few attempts to get comfortable with the timing while still throwing good responding passes; practice on both sides, and go back to step 1 if needed. Find a rhythm that is slow and comfortable.

Step 3: Continue the pattern. Adding one more club, both teacher and student now start with one club in each hand. The teacher again starts with a lofty crossing pass, the student responds with a straight pass, and now the teacher continues by responding with another lofty crossing pass, forcing the student to respond on the other side, which is caught by the teacher's empty hand. That is, we now have a sequence of four passes, involving all hands, teaching the speed of responding with alternating passes from both hands. Continue to pay attention to clean throws and catches and a generally slow rhythm.

If this is working well, a more experienced teacher can take a shortcut to *5-club one-count* without telling the student by always handing the caught pass to the other hand to continue the pattern indefinitely (this is technically the four-handed siteswap 720). This can be done without any

announcement and will often surprise the student about what they can do; adding another club for the final step will not make a difference from the student's perspective.

Finally: 5-club one-count. Adding one more club again, the teacher starts with two clubs in the right hand and one club in the left hand, the student still has one club in each hand. The teacher starts with a lofty crossing pass and the rest is a continuous sequence of responses. This is it. This is *5-club one-count*. The student can also practice starting with three clubs, but should continue to do straight passes, unless they want to get ready to teach somebody else.

Onward to 6-club one-count and 7-club one-count

With an experienced teacher, most students can learn *6-club one-count* on their first day, and some even see first success with *7-club one-count*. Both patterns will likely still be easier than learning *6-club four-count*.

To warm up for *6-club one-count*, first pass three clubs between the teacher's left hand and the student's right hand. All passes are straight and thrown a little from the inside to the outside. Try to keep passes lofty. The responding passes are thrown *underneath* incoming passes, and collisions indicate too short or too low passes. Once this works, switch sides and pass three clubs between the teacher's right hand and the student's left hand. Finally, combine both sides, alternating right-hand and left-hand passes. The most common start is for both passers to have two clubs in their right hand and one club in their left hand and to start at the same time with a right-handed pass – a more experienced teacher might start with four clubs and a left-handed pass, whereas the student starts responding one beat later with a right-hand pass.

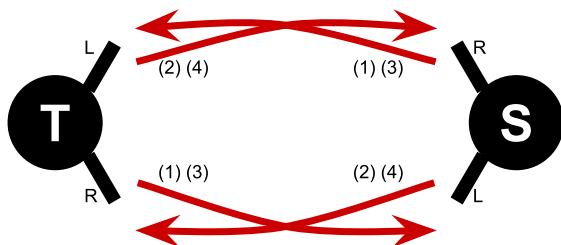


Illustration of the passes between the teacher (T) and the student (S) in *6-club one-count*. Both passers throw at the same time, alternating their right and left hand.

If the teacher is comfortable with *7-club one-count*, transitioning from *6-club one-count* to *7-club one-count* is a fairly small step for the student. The student continues a one-count pattern with lofty straight single passes, now at a marginally faster pace (most students speed up too much going from 6 to 7 clubs; it is really not much faster). The teacher, however, has to carry the pattern with lofty crossing passes, typically starting with four clubs and a lofty crossing pass from the left hand slightly before the student's right-handed start.

What's next?

One-counts are great beginner patterns because the learner can focus entirely on passes, rather than on sepa-

rating passes from self throws. An experienced teacher can carry the pattern, so most incoming clubs for the student will be fairly stable, whereas other patterns often fall apart from bad self throws. One-counts also provide a good foundation for passing slow and lofty and for passing with both hands. From here there are a couple of possible directions, depending on the learner's goals and environment.

First, one-counts provide a good entry point for four-handed siteswaps (actually *5-club one-count* and *7-club one-count* are four-handed siteswaps: 744 and 7). To go this route, learn about the notation (Ch. 9) and start with the beginner patterns (Ch. 10), slowly introducing zips, flips, and selfs. For beginners, zips are easier to introduce than selfs, so good patterns to try next are 777742 (see compatible siteswaps (Ch. 17)) and 77722 (*Parsnip*, see beginner patterns (Ch. 10)).

Second, most passers will have learned *6-club four-count* first and other synchronous patterns (Ch. 3) next. To have a wider range of passing partners at all levels, it is useful to learn those patterns too. They are also the foundation for most group patterns (Ch. 20) and manipulator patterns (Ch. 25). Depending on how stable their cascade is, some beginners might find it easier to learn patterns with more selfs, like *six-count*, while others might prefer starting with patterns with fewer selfs, such as *pass-pass-self*.

Third, there are many less conventional paths with patterns that are fairly easy to teach to beginners. For example, while zaps (Ch. 13) can be challenging for passers who learn them later, beginners sometimes find them very intuitive and even easier than single passes. Four-handed siteswaps with zaps like 522, 552, and 5 are very approachable (and feedable for groups of 3) and 456 and 567 might be ambitious but doable with a strong teacher. Also mini scratch your head patterns (Ch. 6) are very approachable, yet very different.

Synchronous Passing Patterns

2. Introduction to synchronous passing & notation

Most traditional passing patterns, including *6-club four-count*, *three-count*, and *pass-pass-self*, as well as *7-club two-count*, are synchronous patterns in that both passers throw at the same time. This is where a lot of people start passing, though we recommend a different first pattern, as described in *learning to pass* (Ch. 1).

Many passers explore only a small number of traditional synchronous patterns, usually with many selfs and with most or all passes thrown from the right hand, making it harder only by adding more clubs. It is not surprising that many soon find this boring. But there are many synchronous patterns to explore, both one-sided (e.g., *six-count popcorn* (Ch. 5)) and ambidextrous (e.g., *Jim's three-count* (Ch. 4)), and then there is also the whole world of four-handed siteswaps (Ch. 9).

Notation

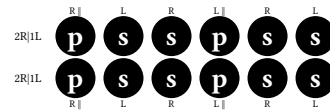
Learning a specialized notation can make reading and understanding different patterns much easier than trying to decipher textual descriptions. There are many different notations and they are not used consistently, since they emphasize different things; some notations are overly complex for simple patterns. Here, we adopt a consistent notation for all synchronous patterns based on solo siteswaps and visualize them in simple diagrams.

We use the following symbols for different throws:

Sym- bol	Description	Solo- siteswap equiva- lent
z	Zip / hand-across: Directly handing a club from one hand to the other without throwing it	1
f	Flip / hold: Holding a club in a hand without throwing it, or flipping it quickly in place	2
s	Self as in a normal cascade	3
p	Single-spin pass, usually straight	3p
h	Heff: A double-spun self to the same hand, as in a four-club solo fountain	4
d	Double-spin pass, usually crossing	4p
t	Trelf: A triple-spun self to the other hand	5
r	Triple-spin pass, usually straight	5p

A pattern where both passers make the same throws at the same time can now be written as a sequence of throws, such as “p s s” or just “pss” for *6-club three-count*, where

both passers pass on every third beat. This can also be visualized as follows:



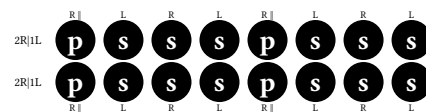
In such a visualization, we show two rows, one row for each passer. Time progresses from left to right. Usually both passers start at the same time with the right hand and then alternate hands, as indicated by the “R” and “L” labels for right- and left-handed throws. The numbers on the left indicate how many clubs each passer has in their right and left hand at the start (“right|left”), and the “|” and “X” next to a pass indicate whether that pass is thrown straight (i.e., right to left or left to right hand) or crossing (i.e., right to right or left to left hand).

3. Basic 6-club synchronous passing patterns

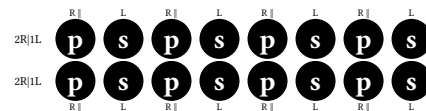
Prerequisite: *Learning to pass* (Ch. 1) | **Next:** *Jim's patterns* (Ch. 4), *synchronous 7-club and 8-club patterns* (Ch. 5), *tedious patterns* (Ch. 7), *four-handed siteswaps* (Ch. 9), or *introduce takeouts* (Ch. 25)

In all these 6-club patterns, both passers start with two clubs in the right and one club in the left hand. Both passers start at the same time with a straight single pass. It is customary to synchronize the start with an *up-down-pass* sequence where both passers lift the club without throwing it.

6-club four-count (pass-self-self-self) and two-count (pass-self). *Four-count* (old name *every others*) and *two-count* (old name *everies*) are probably the most common patterns used as a basis for group patterns, trick throws, and performances, but they are both one-sided, with all passes thrown from the right hand. I consider this as traditional passing, not modern passing. In *four-count*, every other right-hand throw is a pass.



In *two-count*, every right-hand throw is a pass; the left hand only throws selfs.

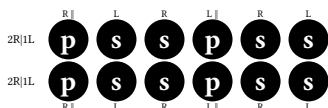


For a more modern version, try *6-club three-count* or *6-club one-count* instead, or the beginner four-handed siteswaps (Ch. 10).

6-club one-count. The *6-club one-count* from learning to pass (Ch. 1), also known as *ultimates*, old name *thunder-shower*, is the easiest synchronous pattern for beginners to learn if they have a stronger passer as a partner, because

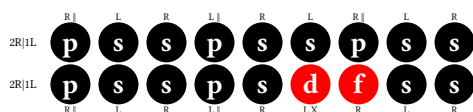
all throws are the same. Both passers pass from their right hand at the same time and then again from the left hand at the same time.

6-club three-count (pass-self-self). A good pattern to introduce selfs after one-count is *three-count* (old name *waltz*), with both passers counting pass-self-self. The pattern is ambidextrous, so it has both right-hand and left-hand passes. Note that two clubs are always passed and the other clubs are always selfed – each club received as a pass gets thrown back as a pass. Using two clubs of a different color to highlight the passes can help beginners remember when to pass.

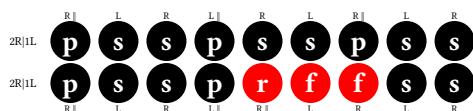


Pass-pass-self, bookends (pass-pass-self-pass-self), and countdowns. Any other sequence of passes and selfs is possible. *Pass-pass-self* (old name *two-thirds-count*), *pass-pass-self-pass-self* (known as *bookends*), and various *countdowns* are common sequences to introduce some challenges. The countdown *pass-self-self-pass-self-pass-pass-self* can be remembered as the sequence three-count, two-count, one-count, two-count. Another common countdown is to start with a four-count and count down to a one-count and back up for the ambidextrous pattern *pass-self-self-pass-self-pass-pass-self-pass-pass-self-pass-self*.

Early doubles and triples. In all patterns (except one-count), instead of a self-pass combination, we can throw a *crossing* double pass followed by a wait (or flip) – that is, replace any 3 *3p* with 4*p* 2. This works because the double is thrown one beat before the single pass would have been, and is thrown to the same hand. For the receiving passer, if the double is thrown well, this should not make a difference – the early double can be thrown to replace any single pass and does not need to be announced. It may, however, require some practice to get the timing and placement right.

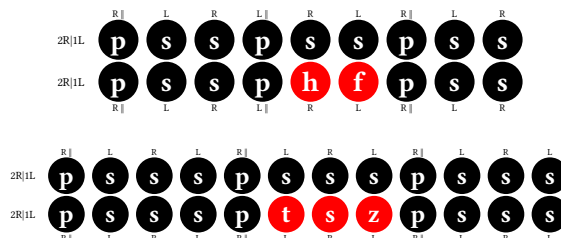


The same idea also works with triple passes. Any self-self-pass combination can be replaced with a straight triple pass and two waiting beats (triple-flip-flip) – that is, replace any 3 3 *3p* with 5*p* 2 2.



When first learning doubles and triples, focus on throwing them high and at the same distance as the singles. Again, avoid spinning clubs from the wrist – if the pass arrives underspun, add height by moving the entire lower arm.

Variations on selfs. As solo jugglers might know, every two selfs can be replaced by heff-flip (as in solo siteswap 342) and every three selfs can be replaced by trelf-self-zip or heff-heff-zip (as in solo siteswaps 531 and 441). These can be easily integrated as tricks in *three-count* and *four-count*.

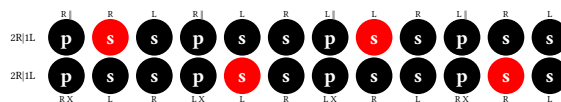


4. Jim's patterns (sync)

Prerequisite: Basic synchronous passing patterns (Ch. 3) | **Next:** Four-handed siteswaps (Ch. 9) or synchronous 7-club and 8-club patterns (Ch. 5)

Jim's patterns are a common variation on basic synchronous patterns that mess with the timing and the hand sequence. They turn one-sided patterns into ambidextrous patterns. The basic idea is that one passer throws crossing passes while the other passer keeps throwing straight passes. As a consequence, passers will sometimes receive an incoming pass to a hand that they do not expect, but they accommodate by quickly making the next throw from that hand instead. This forced, quick action from an unexpected hand is known as a *hurry*.

Jim's three-count. If passer B throws crossing passes, passer A will receive their first pass to the right hand, rather than to the left. Hence, they also throw their first self from the right hand, very quickly after the right-handed pass; their next pass is again from the right hand. Notice how the hands do not always alternate in this diagram – the hurries are highlighted. Overall, each passer throws two right-handed passes and then two left-handed passes before the pattern repeats.

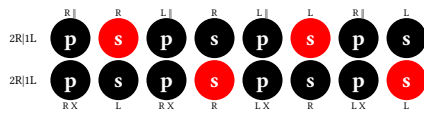


Even with the hurries, both passers should throw passes and selfs at roughly the same time. The pattern is synchronous and simply fudges the timing by rushing two throws from the same hand. It is also possible to throw the pattern as a four-handed siteswap without hurries, but with time for a flip, as shown among the beginner four-handed siteswaps (Ch. 10).

Throwing this asynchronously as a four-handed siteswaps (Ch. 10) eliminates the hurry with time for a flip.

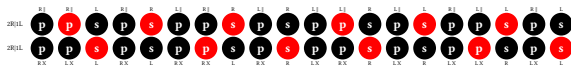
Jim's four-count and two-count. The same idea of crossing passes turns the one-sided *four-count* and *two-count* patterns into ambidextrous patterns with hurries.

Here is the diagram and hand sequence for *Jim's two-count*.



Jim's two-count is compatible with *why not* (see below). It can be used to stabilize the pattern when learning *why not*. There are also 7-club versions of both that change sides with a hurry after every third double pass.

Brainstorming (Jim's pass-pass-self-pass-self). This pattern is a tricky milestone for many passers. It may not be physically hard, but it requires a lot of concentration. It is a long sequence that only repeats after 20 beats. Rather than memorizing the entire sequence, just count the pass-pass-self-pass-self sequence (aloud) and make those throws regardless of which hand is next.



This pattern can be juggled as the four-handed siteswap 7747746677466.

Why not. The pattern *why not* is another popular after-the-basics pattern for many passers. It can be considered a trick throw in *Jim's two-count*: Instead of the hurried self, the passer throws a heff-zip combination with a hurried zip. Rather than fudging the timing in a synchronous pattern, we recommend learning *why not* as a four-handed siteswap (Ch. 12).

Other patterns to try: Every synchronous pattern can be *jimsified* by throwing a club to the wrong hand with the receiver reacting with a hurry. For example, *Jim's one-count* is a fast sequence with many hurries; *Jim's pass-pass-self* turns out to be a one-sided pattern; *Jim's count-down* requires a lot of patience. It is possible to cross only some but not all passes, or even to throw some doubles or selfs to the wrong hand. Both passers can also decide whether and when to throw crossing passes, though this is collision-prone when done without coordination. None of the variations beyond the ones described above are very common, but there is a huge space for experimentation.

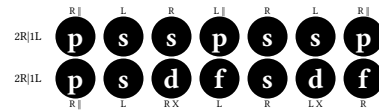
5. Common 7-club and 8-club patterns

Prerequisite: Basic synchronous passing patterns (Ch. 3) | **Next:** Four-handed siteswaps (Ch. 9) or tedious synchronous patterns (Ch. 7)

There are many more variations of synchronous patterns, especially when exploring 7-club and 8-club patterns. They are still all synchronous in that both passers throw at the same time, but they may not both make the same throw, or throw from the same hand.

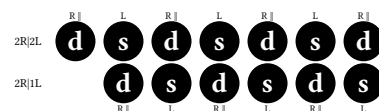
We already introduced *early doubles* as a crossing double pass in basic 6-club synchronous patterns (Ch. 3). Those

are a good way to practice double passes. In fact, continuous early doubles in *6-club three-count* (after a first normal pass) are a good way to practice doubles with both hands:



7-club two-count. Many passers learn *7-club two-count* as a milestone. Because it is one-sided, I consider it traditional passing, not modern passing, and recommend the four-handed siteswap *7-club three-count* (Ch. 11) instead.

The conventional setup is the following: Both passers throw straight double passes from every right hand; passer A starts with four clubs and a double pass as the first throw; passer B starts with three clubs and a double pass on the *second* beat. That is, passer B throws a right-hand pass when passer A throws a left-handed self, and vice versa.



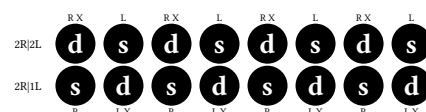
When learning *7-club two-count*, aim for consistent passes. Since both passers cannot easily see their passes land, provide feedback on placement and spin. A good strategy is to remember the spot on the ceiling where the first club peaks, and then try throwing all following passes such that they peak in the same place – consistency is usually more important than the exact placement.

See also the galloped version *7-club two-count on singles* (Ch. 6). Also consider the four-handed siteswaps *7-club one-count* (Ch. 1) and *7-club three-count* (Ch. 11) for a more modern introduction to 7-club patterns.

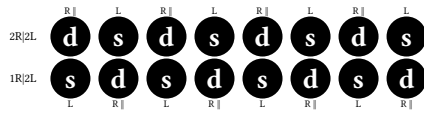
A tiny bit of theory. Why are early doubles crossing when doubles in *7-club two-count* are straight? Why do passers start on different beats in *7-club two-count*?

The patterns are indeed from the same family. By default, passers in synchronous patterns both start with the same hand and throw their singles straight and their doubles crossing. However, it is also possible to throw singles crossing and doubles straight when one passer starts with the opposite hand.

Strictly following the theory, the most obvious approach for *7-club two-count* would be for both passers to cross their doubles and to start at the same time with a right-hand throw, which is a right-handed pass for passer A and a right-handed self for passer B. This is actually a fairly nice pattern to let one passer practice left-handed doubles.

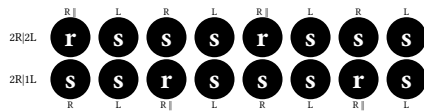


By flipping straight and crossing passes and having passer B start with the left hand, we get a pattern with straight doubles.

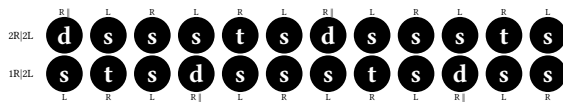


In practice, passer B often leaves out that first left-handed self to start on a right-handed pass one beat later, resulting in the conventional start shown above. However, starting with a left-handed self can help with timing.

7-club four-count. To explore one-sided triple passes, 7-club four-count is a well-known, albeit boring, pattern.

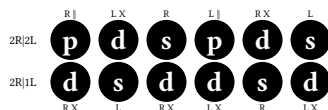


Six-count popcorn. This is one of several one-sided popcorn patterns – named after the trelfs that pop up on alternating sides. It can also be thrown with heff-heff instead of trelf-self, which many find easier to learn. Notice that, conventionally, we again throw the double passes straight and passer B starts with the left hand (but often skips the first self).

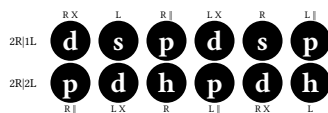


See *five-count popcorn with heffs* (Ch. 12) and *five-count popcorn with trelfs* (Ch. 14) for ambidextrous versions.

7-club pass-pass-self. With odd-length patterns, there are no synchronous patterns where both passers throw the same sequence. The most common 7-club *pass-pass-self* pattern has passer A throw *single-double-self* and passer B throw *double-self-double* (3p 4p 3 vs. 4p 3 4p):



Another common variation is *double-self-single* versus *single-double-heff* (4p 3 3p vs. 3p 4p 4):



As discussed above, all of these can also be passed with crossing single passes and straight double passes if one passer starts left-handed.

Other variations of 7-club *pass-pass-self*, often with one side being substantially harder than the other, are:

- 3p 3 3p vs. 4 4p 4p
- 3p 3p 4 vs. 4p 3 3

- 3p 3p 4 vs. 4p 4 3p
- 3 3p 4p vs. 5 3p 3p
- 3p 3p 4 vs. 5 3p 3p
- 4p 4p 1 vs. 4p 5 3p

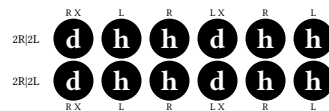
In 8-club versions of *pass-pass-self*, both the synchronous version below and the four-handed siteswap 996 (Ch. 11), both passers have the same sequence.

7-club synchronous three-counts. For three-counts that are not four-handed siteswaps (Ch. 11), there are many possible variations that again combine two different throw sequences; none of them are common patterns:

- 3p 3 4 vs. 4 4 3p
- 3p 4 4 vs. 4p 3 3
- 3 4 4p vs. 4p 3 3
- 3 3p 3 vs. 4p 4 4
- 3 3p 3 vs. 5 3p 4

Try also *techno* (Ch. 6), *7-club three-count* (966; Ch. 11), and *French three-count* (786; Ch. 12) for other three-count patterns with 7 clubs.

8-club patterns (not two-count). For eight clubs, there are obvious sequences of doubles and heffs that mirror standard 6-club patterns: *4p 4 4* (a *three-count*), *4p 4p 4* (a *pass-pass-self* pattern), *4p* (a *one-count*), and *4p 4 4 4* (a *four-count*). These are usually passed with crossing doubles, but can also be passed with straight doubles if one passer starts left-handed. For passers used to 9s in four-handed siteswaps, it may be useful to lower the double passes a bit.



Try also the siteswap 8-club *pass-pass-self* (996; Ch. 11) with only one passer crossing and 8-club one-count on singles versus doubles (97; Ch. 17).

6. Beyond classic synchronous patterns

Prerequisite: 7-club and 8-club patterns (Ch. 5) | **Next:** Four-handed siteswaps (Ch. 9)

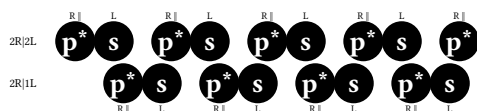
There are a number of patterns that generally fit with the theme of traditional synchronous patterns, but they go beyond the original patterns by modifying the throwing rhythm to squeeze the timing, resulting in throws that are lower than in the initially described notation (Ch. 2). We use an asterisk to note that these throws are lower than they should be if they were juggled as traditional synchronous patterns:

Sym- bol	Description	Solo- siteswap equiva- lent with- out fudg- ing the timing
l*	Heffling: Single-spin self to the same hand, like a single-spun heff or a lofty flip (instead of a heff)	4
s*	Lofty single-spin self	4x
p*	Lofty single-spin pass (instead of a double pass)	4p
h*	Heff: Double-spin self to the same hand	6
d*	Double-spin pass (instead of a triple pass)	5p in gal- lop, 6p in all sync
r*	Triple-spin pass (instead of a quad pass)	6p in gal- lop

Gallops

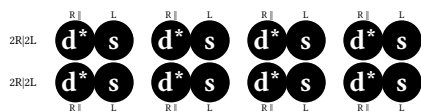
For a number of one-sided patterns, it is common to juggle them lower than standard timing would require, but to fudge the timing by *galloping* the pattern – that is, throwing a fast left-hand self quickly after the right-hand throw.

7-club two-count on singles and 8-club two-count on doubles. The most common galloped patterns are to throw *7-club two-count* with lofty singles instead of doubles, followed quickly by a fast self from the left hand, and to throw *8-club two-count* on doubles (instead of the triple needed for a non-galloped pattern).



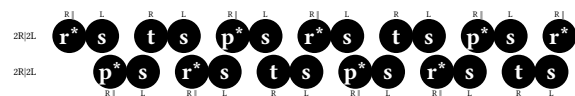
(Technically, we fudge the timing and throw lofty singles instead of doubles. By default, we would expect crossing passes, but just as in *7-club two-count on doubles* (Ch. 5), it is most common to throw all straight passes from the right hand for both passers by swapping straight and crossing and starting hands.)

8-club two-count follows the same idea:



Six-count popcorn on singles. The standard six-count popcorn (Ch. 5) can be juggled on singles and with a double-self instead of trelf if the pattern is galloped.

Long Beach popcorn. This 8-club pattern has the right-hand sequence lofty-triple pass (instead of a quad), double-self (instead of a trelf), lofty single pass (instead of a double), while all left-hand actions are quick, galloped selfs.



See Will Murray's pattern collection for many more galloped patterns and theory of how to create more of them.

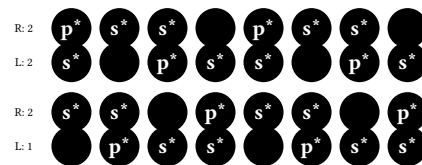


Will Murray's pattern collection (PDF)

Fully synchronized patterns

There are several patterns where a passer's left and right hand always throw at the same time – similar to synchronous throws in solo siteswaps. That is, all four hands always throw at the same time. This effectively doubles the speed, as there are two actions on every beat, rather than one; passers usually compensate with lofty selfs and lofty passes to slow down to a manageable speed.

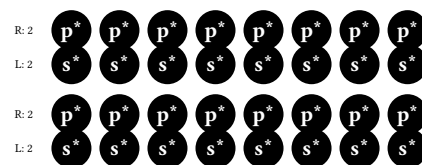
Techno. In this *7-club three-count* variation, a single pass and a self are thrown from both hands at the same time, followed by a single self on the next beat, before it all repeats on the other side. One passer crosses their passes. This pattern is helped by throwing very lofty passes; having passer B start with the self as the same time as passer A starts with a pass helps with timing. Technically, all hands from both passers throw at the same time, though in practice a slight gallop might help to learn the pattern.



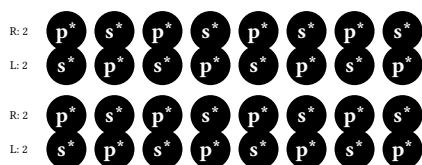
Video

8-club two-count on singles, swing, and variations.

There are many variations on the fully synchronous *8-club two-count on singles*. Again, all four hands throw at the same time, one hand throwing a self and one hand throwing a single pass. This pattern really benefits from lofty passes and lofty selfs. The traditional pattern most people learn first is fully right-handed:



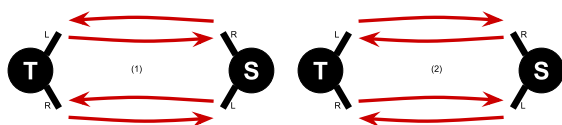
Swing (or *the swinging door*) is a challenging modern ambidextrous variation that alternates passes on the right and the left side of the pattern, while effectively juggling a cascade at the same time. Warm up with left-handed *8-club two-count* and focus on lofty and narrow(!) selfs in the actual pattern.



As a variation, throw a crossing pass and a heffling (a self to the same hand/a single-spin heff) at the same time. This can be done as a trick throw or continuously. For example, alternating between straight and crossing passes provides an ambidextrous pattern that is compatible with right-handed *8-club two-count*.

This is also compatible with various *scratch your head* patterns (see below). As usual, all straight passes can be turned into crossing passes and vice versa (see theory in advanced synchronous patterns (Ch. 5)).

8-club one-count on singles. Similar to two-count, it is possible to juggle *8-club one-count* all synchronously, all four hands throwing at the same time. To avoid collisions, some lane management is needed. A good version to try is with all straight lofty single passes first throwing outside on the right and inside on the left, and then inside on the right and outside on the left for the second throw, but many other variations are possible.

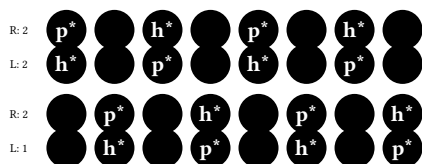


Example of two possible lanes for 8-club one-count synchronously; consider alternating between them.

Also see the many other 8-club one-count variations in the appendix (Ch. 37).

9-club two-count on doubles. A traditional one-sided pattern, which is thrown with a synchronous double pass and self (or slightly galloped). Passer B starts a beat after passer A.

Scratch your head. Throw a single pass and a heff at the same time; one passer is crossing (this can technically be seen as a siteswap transformation in *techno*, replacing self-self with heff-flip, though the flip is usually just held). While technically all synchronous, the actions of both passers alternate since they only hold a club on the off-beat and only throw every other beat.



Video

There are a number of variations found and collected by Will Murray and described on his web page, including a

beginner-friendly 5-club version (single pass and flip at the same time, “*mini-scratch-your head*”), a challenging 9-club version (double pass and heff at the same time). Further variations are *scratch your nose* (7 clubs, pass and crossing double selfs at the same time) and “*mini-scratch-your-nose*” (5 clubs, pass and self at the same time). The *mini-scratch-your-head/nose* patterns are actually good, very approachable, yet interesting early patterns quite doable after learning *5-club one-count*.

7. Tedious synchronous patterns

Prerequisite: Basic synchronous passing patterns (Ch. 3)

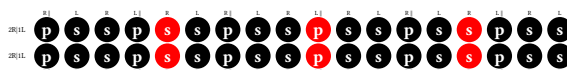
There are various ways to make juggling patterns harder mentally without making them harder physically, typically by requiring nontrivial counting or introducing randomness. They can be an interesting challenge, but few people practice them regularly. I include them more for completeness.

Passing colors. Pick clubs with some distinct colors and assign different counts to different clubs. The number of colors and the assigned counts do not really matter; for example, 2 red clubs = *three-count*, 1 blue club = *four-count*, 3 white clubs = *two-count*. Now focus on passer A’s passes: the club thrown determines the next count. Either return the same clubs to the same starting position each time to learn the sequence, or to simply start with a different sequence each time when clubs are picked up.

Beyond determining the count, colors can also be assigned to determine the spin of passes or any throws (single, double, triples), to indicate whether passer A throws crossing or straight passes (see Jim’s (Ch. 4)), or for combinations of these.

Random passing. Any random sequence of single passes and selfs can be passed synchronously. Double passes and heffs can also be added to the mix, typically pausing the pattern for a beat to continue when they land (doing random valid sequences without pauses is possible by walking a siteswap state chart, but not trivial without paper or a program). The sequence could be called out by one passer, by a third person watching the pattern, or by a computer. Experiment with the timing of calling out the throws; calling them one beat before throwing them typically works quite well.

Patterns from hell. These patterns involve counting. Pass *three-count* and throw a double on every fifth throw (double pass or double self, whichever happens on that beat), waiting for it to land to continue. If that becomes too easy, start walking in one direction (e.g., passer A walks forward, passer B walks backward) one step per throw for 7 beats, and then walk in the other direction for the next 7 beats. This works with any other numbers and other actions on those counts, particularly if actions are always on multiples of prime numbers.



Another hard pattern is modifying *Jim's pass-pass-self-pass-self (brainstorming)* by varying who is passing the crossing passes. The most common variation is for passer A to throw crossing-crossing-straight-crossing-straight (counting only the passes) and for passer B to do the opposite. This pattern has a lot of hurries and only repeats after 120 beats.

For four-handed siteswaps, randomness is very difficult since both passers do different actions, but consider trying very long siteswaps, such as 796827726867726 or 777928892296626.

8. Improve your passing

There are a number of common problems in passing patterns and the community has collected various tips and exercises to improve.

Slow down. Most patterns become easier to juggle if the pattern is slower and passes are lofty. Go back to *5-club one-count* (see learning to pass (Ch. 1)) to practice lofty single passes and experiment with early doubles (see basic synchronous patterns (Ch. 3)) to practice double passes. Similarly, beginners often throw heffs and trelfs fairly low and thus fast, rushing the rest of the pattern.

About 110 to 120 beats per minute is a typical reasonable speed for synchronous 6-club patterns, 90 beats per minute is reachable when deliberately slowing down, and 130–160 beats per minute would be on the fast end. For galloped patterns, these higher speeds are common, and for fully synchronized patterns (Ch. 6), 100–120 beats per minute is normal (i.e., effectively twice the speed of a normal pattern).

Count out loud to synchronize timing. If running into problems where passers go at different speeds, count the passing sequence aloud (“pass-self-pass-self-self”) to synchronize both passers. Some might find it useful to find music with a strong beat at the right pace – some music apps for runners let you select music by speed or have playlists for specific speeds (a 200bpm song works well for 100bpm passing).

Control spin with the arm, not the wrist. A passer can control the motion of a throw at three points: the wrist, the elbow joint, and the shoulder joint. Flicking motions from the wrist can create very fast-spinning clubs, and throwing with a long outstretched arm from the shoulder joint allows very high throws with a single spin – try this solo to get a feel for the different spins.

To throw slow and lofty passes, entirely avoid spinning the club from the wrist, but mostly throw from the elbow – the same holds for heffs, lofty doubles, crossing double selfs, and trelfs. If the pass arrives underspun, correct it by throwing it higher, not by adding spin from the wrist. If the pass is too short, release it earlier or add a little force from the shoulder joint. It is much easier to get consistent throws with the arm than with the wrist. By not throwing from the wrist, the position where the club is held (e.g., near the knob or near the center) matters much less.

In synchronous patterns, with both passers doing the same thing, it is perfectly fine to throw very lofty passes that are slower than selfs, even if the beats may not be perfectly spaced out in time. The main exceptions are patterns where passers do different throws on different beats (see early doubles and synchronous 7-club pass-pass-self patterns (Ch. 5)), where it may be necessary to speed up double passes a bit – here, lowering the doubles with a little spin from the wrist might help keep an even rhythm.

Wide selfs, pass to the outside. Passes should be thrown *under* an incoming self or an incoming pass. Ideally, there should be no collision problem and no need to throw a pass from far inside (in a scooping motion), or from far outside, or far in front. High and wide selfs are helpful to provide the space. Nonetheless, passes are usually thrown slightly to the outside, so that the partner can comfortably pass underneath and slightly inside of them. Collisions are typically a symptom of passes that are too short or too low.

Provide feedback. Even if a poor throw is recoverable – for example, caught underspun or caught upside down but fixed with an extra half spin on the next throw – provide feedback to the other passer, especially if a problem is recurring or consistent. Use consistent terminology, either always describing what is wrong (e.g., “overspun”, “too short”) or, more constructively, describing how to change (e.g., “a little bit more spin”, “longer”). It can be helpful to provide feedback during the pattern, when the problem is occurring, rather than after the pattern has fallen apart. Unfortunately, good passers have a tendency to just correct for problems without saying anything – explicitly and repeatedly ask for feedback.

Watch outgoing passes. Practice seeing “through” the pattern and watching the other passer juggle. In addition to helping with timing, this allows a passer to see how their own passes land and to make corrections without asking for feedback. Start with easier patterns, like *6-club three-count*, and start watching the other passer more and more, until it is possible to constantly look at their pattern. With enough practice it will be possible to watch passes land even in many more difficult patterns like *7-club three-count* (966) and even *holy grail* (975).

Learn to recognize what an underspun and an overspun pass look like when caught. Underspun passes are often caught (if caught) with the palm of the hand pointing up, and overspun passes are often caught with the hand snapping down quickly. Intentionally throw under- and overspun passes to observe this and practice adjusting throws accordingly.

Do not neglect the left hand. Doing only right-hand passes will become limiting very quickly, making it harder to progress beyond *four-count* and *two-count*. Practice ambidextrous patterns, such as *three-count* and *pass-pass-self* or *Jim's two-count*, from the beginning.

Start at the same time. Even on patterns with doubles, like *7-club two-count* and *six-count popcorn*, it can be helpful to start at the same time with the common *up-down-*

pass start, even if it means that passer B has to start with a left-handed self. This can make it easier to get the timing consistent, rather than waiting to start “as late as possible.”

Let the club slide to the knob. This is somewhat controversial, but may be worth trying: Before a pass, in the downward motion, let the club slide down to the knob. That is, still fully grip the handle (i.e., do not swing from the knob), but do this at the far end of the club. This can ensure some consistency in the throws, which is particularly important when spinning clubs from the wrist, but it is less important when using the recommended approach of spinning a club with the arm from the elbow joint.

Four-Handed Siteswaps

9. Introduction to Four-Handed Siteswaps & Notation

Prerequisite: 5-club one-count (Ch. 1) | **Next:** Beginner four-handed siteswaps (Ch. 10)

Four-handed siteswaps describe a large class of two-person passing patterns. All four-handed siteswaps with an odd length are ambidextrous and symmetric, performing the same sequence both on the right and the left side. They are all characterized by an asynchronous beat where both passers juggle the same sequence but offset from each other and by having one passer throw crossing passes.

Four-handed siteswaps come at all difficulty levels and can be learned as the first patterns, before synchronous patterns (Ch. 2). We strongly recommend getting familiar with the notation first and then trying the beginner patterns (Ch. 10). After that, doubles (Ch. 11), heffs (Ch. 12), zaps (Ch. 13), and trelfs (Ch. 14) can be added in any order.

Notation

Here we only describe how to read a pattern; for understanding why the notation works this way and why some passes are crossing, see *four-handed siteswap theory* (Ch. 19).

A four-handed siteswap is written as a sequence of numbers such as 744, 77722 or 8686777. Similarly to the letters used for synchronous patterns (Ch. 2), each number denotes a throw:

Nr	Name	Description
2	Zip	Hand-across without rotation; 1 in solo siteswap
4	Flip	Holding or flipping a club in the same hand; 2 in solo siteswap
5	Zap	Fast, low pass with a half rotation; crossing for passer A, straight for passer B
6	Self	Normal self; 3 in solo siteswap
7	Single	Lofty pass with a single rotation; straight for passer A, crossing for passer B
8	Heff	Double-spin self to the same hand, as in a basic four-club solo pattern; 4 in solo siteswap
9	Double	Double-spin pass; crossing for passer A, straight for passer B
a	Trelf	Triple-spin self

The number sequence describes the infinitely-repeating alternating actions of *two* passers; the first digit is the first action of passer A, the second digit is the first action of passer B, the third digit is the second action of passer A, and so forth. A common and helpful way to think of (and write) siteswaps is to repeat a siteswap twice and alternate the numbers between two rows. Now we can read the actions of each passer in separate rows – for example, seeing

that passer A starts with the sequence 7-8-4-5-6 (single-heff-flip-zap-self) in the siteswap 75864:



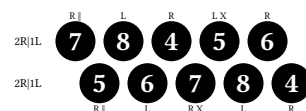
Note how both passers do the same sequence of throws in the same order, but start in different places of the sequence.

What about other numbers? The numbers 1 and 3 are conceptually passes that are not used in popular patterns, because it would be difficult to impossible to pass fast enough. The number 0 for an empty hand can be used, but most people avoid such patterns, simply because having an empty hand for a beat is awkward. Higher numbers are possible – for example, *b* for a triple pass – but less common.

Starting a pattern

Passer A always starts the pattern with a right-hand action (the first digit of the siteswap) and passer B always follows *slightly afterward* with a right-hand action (the second digit of the siteswap). Technically, passer B should start between passer A's first and second action; in practice most patterns are fairly forgiving to fudge the timing a bit.

It is possible to start a siteswap on any beat of the sequence, or conversely to shift siteswaps – for example, 786 is the same pattern as 867 and 678. Here, we write all featured siteswaps as they would usually be started and we indicate how many clubs are in each hand (read “right|left”) – see the theory (Ch. 19) section for how to select a start and figure out clubs or use an online tool like passist.org). We additionally include hints about which hand does the action for the initial throws (R and L for right and left), whether to throw a pass straight (|) or crossing (X), and how many clubs are in each hand at the start:



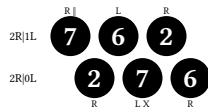
10. Beginner four-handed siteswaps

Prerequisites: 5-club one-count (Ch. 1) and four-handed siteswap notation (Ch. 9) | **Helpful:** 6-club one-count (Ch. 3) and bookends (Ch. 3) | **Next:** Add doubles (Ch. 11), heffs (Ch. 12), or zaps (Ch. 13)

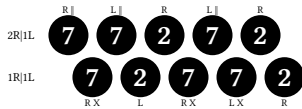
5-club one-count (744 and 726). Note how 5-club one-count (from learn to pass (Ch. 1)) is actually the four-handed siteswap 744



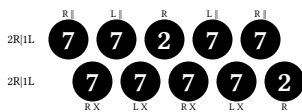
When you get more comfortable with the pattern, try flipping the 4s or throw self-zip instead:



Parsnip (77722). Another good beginner pattern is *parsnip*. Notice that we often automatically do zips without noticing them; it might be easier to focus on the passes, of which there will always be three from the same hand, before changing sides.

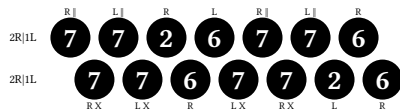


Martin's one-count (77772). If you are comfortable with *parsnip*, add a club, resulting in 4 passes and a (fairly automatic) zip.

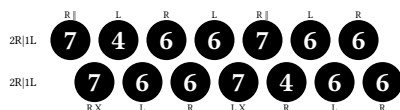


7-club one-count (7). Now add another club and leave out the zips. Especially the crossing singles should be lofty. If you drop a club, continue in 77772 if you drop another one, continue in 77722 or 77272.

Mild madness (7777266). A well-known juggling pattern, often juggled synchronously with fudged timing, makes a nice easy siteswap with selfs.



Jim's three-count, async (7746666). A four-handed siteswap version of *Jim's three-count* (see Jim's patterns (Ch. 4)) without a hurry. Notice the extra time for a flip after every second pass from the asynchronous nature of four-handed siteswaps. There are siteswap versions for all Jim's patterns.

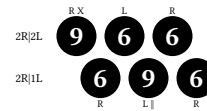


Other similar patterns to try. 77272, 774, *Jim's two-count* (77466), 7742744, 7747746

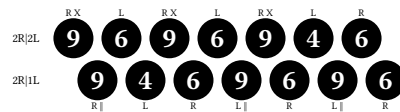
11. Doubles

Prerequisite: Beginner four-handed siteswaps (Ch. 10) | **Helpful:** Synchronous 7-club and 8-club patterns (Ch. 5) | **Next:** Add heffs (Ch. 12) or zaps (Ch. 13)

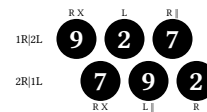
7-club three-count (966). A good pattern to practice doubles. Provide feedback about incoming doubles (e.g., over/under-spun, short/long, high/low, wide/narrow). As the pattern gets more stable, try to look down to see your passes land.



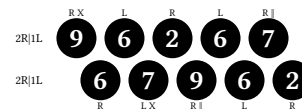
7-club Jim's two-count (9964966).



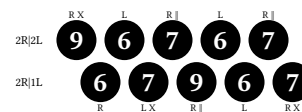
972. A great pattern to combine singles and doubles, one of them crossing, so both thrown to the same hand ("stacks"). Notice the unconventional start with one club in Passer A's right hand.



Not likely (96672). Doubles in period-5 patterns can be tricky and this is a good pattern to practice; make sure they are lofty and use the self-zip-self to stabilize.



Funky bookends friend (96677). Harder version of *not likely*, keep the double high.



8-club pass-pass-self (996). A great introduction to ambidextrous 8 clubs.

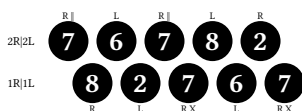


Other similar patterns to try. *Maybe not* (96627), *Odnom* (9647772), *Placebo* (9669667), *Moscow Mule* (9797926)

12. Heffs

Prerequisites: Beginner four-handed siteswaps (Ch. 10) and notation (Ch. 9) | **Next:** Add doubles (Ch. 11), zaps (Ch. 13), trelfs (Ch. 14), or introduce takeouts (Ch. 33)

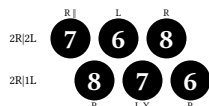
Why not (78627). *Why not* is probably the first pattern with heffs for most passers. It is a widely known 6-club pattern, with lots of videos and good video tutorials. Many passers fudge the timing with a fast zip (like in Jim's patterns (Ch. 4)) and juggle it synchronously. The most common and easiest to learn start is to have passer B start with two clubs and react to the first pass with heff-zip-pass-pass-self.



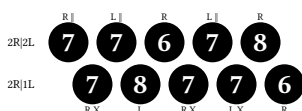
Tutorial video

There is also a 5-club version (78622) and the similar pattern *not why* (72867).

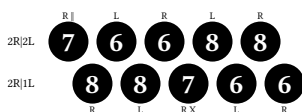
French three-count (786). A very common 7-club pattern and a great foundation for many harder siteswaps.



Funky bookends (77786). Another common, well-known pattern.

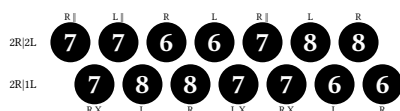


Five-count popcorn with heffs (78686). While the original popcorn patterns arguably have trelfs (Ch. 14) in them, this is a common easier version.



Notice that *French three-count* (786), *five-count popcorn* (78686), and *seven-count popcorn* (7868686) all follow a common idea.

Vitoria (7778686). Essentially a combination of funky bookends and popcorn, named after the city Vitoria-Gasteiz where EJC was held in 2009.



Other similar patterns to try. *maybe* (72786), *Mojito* (8677777), *seven-count popcorn variation* (7888882).

13. Zaps

Prerequisites: Beginner four-handed siteswaps (Ch. 10) and notation (Ch. 9) | **Next:** Add doubles (Ch. 11), heffs (Ch. 12), or trelfs (Ch. 14), or introduce takeouts (Ch. 33)

Zaps are low, fast passes that only spin half a rotation. They open a whole new group of interesting patterns. Look at a video or an animation for examples. They are usually thrown with an extended arm, letting the club slide down to the knob, without any spin from the wrist, aiming quite a bit behind the person catching the zap. Most of these patterns do not have commonly used names and are simply known by their numbers.

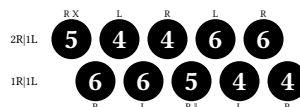


Video

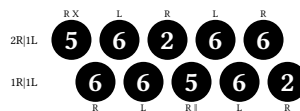


Passist animation

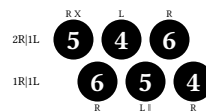
Getting started with zaps (56464). This is a great warmup pattern to learn and practice zaps. Hold the 4s and think of it as *self-self-zap-wait-wait*, starting with the *self-self* when it is necessary to free a hand to catch the zap. The zap is always the same club and there is plenty of time to watch the throw.



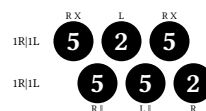
Once this is stable, replace the *wait-wait* with a *self-zip* (56662) to make it feel like an actual juggling pattern. Throw the self from the hand that did *not* just throw the zap.



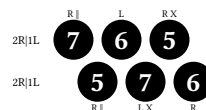
Killer bunny (564). The next good practice pattern is shorter and slightly more challenging – think of it as *self-zap-hold* or *self-zap-flip*. Once the pattern is more stable, flipping rather than holding the club will help with timing.



552, 522, and 5. Nice warm-up patterns to lean into zaps with 4, 3, and 5 clubs. In 522, try doing one of the zips behind the back. 5 is simply a very fast one-count with 5 clubs.



756. This is a well-known 6-club pattern and a great milestone in combining zaps and singles. Each passer throws a zap and then a single (a “stack”) to the *same* hand (crossing one of the passes), and then, after a self, a zap and a single to the other hand. Ensure the zaps are fast and the singles are lofty.



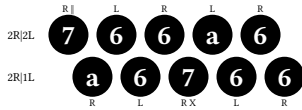
Other patterns to try. 56252, 75666, *Katzi* (75724), *Funky magazine rack* (55564), 75625.

14. Trelfs

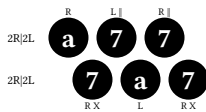
Prerequisites: Beginner four-handed siteswaps (Ch. 10) and notation (Ch. 9) | **Next:** Add doubles (Ch. 11) and heffs (Ch. 12) and look for combinations among common named patterns (Ch. 15)

Trelfs are triple selfs, introducing the artificial term to distinguish them from triple passes. They are common in solo juggling, for example, the solo siteswap 543 with single, double, and triple spins is a good solo practice pattern.

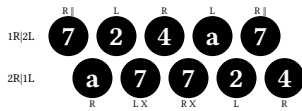
Five-count popcorn (7a666). A well-known, popular 7-club pattern. Some might find it easier to first throw *trelf-self* as a trick instead of *heff-heff* in 78686 (see heffs (Ch. 12)). Note that the trelf is always the same club.



a77. This 8-club pattern is substantially harder since there are two trelfs in the air at any time.



A decent warmup pattern is 7a274:



Other patterns to try. 74a, 7a2a6 (popcorn variation), aa7 (9-club three-count).

15. Advanced patterns

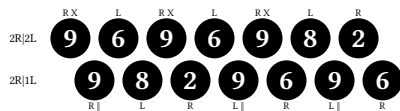
Prerequisites: Beginner four-handed siteswaps (Ch. 10), notation (Ch. 9), doubles (Ch. 11), zaps (Ch. 13), and heffs (Ch. 12) | **Next:** Holy grail sequence (Ch. 16), compatible siteswaps (Ch. 17), and the full siteswap list (Ch. 35)

Once comfortable with basic siteswaps and multiple additional kinds of throws, like zaps, heffs, doubles, and trelfs, there is a whole world of siteswaps that combine these. The following is far from comprehensive but highlights common popular patterns.

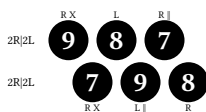
Heffs and Doubles

There are lots and lots of 7 and 8-club patterns that include plenty of heffs and doubles in all kinds of sequences.

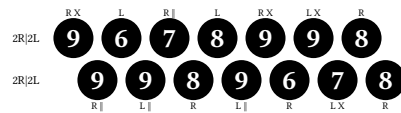
7-club why not (9968926).



978. Warm up with the 6-club pattern 972 (see doubles (Ch. 11)).



Poem (9969788). A challenging, well-known 8-club pattern.

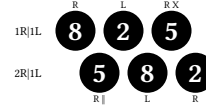
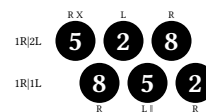


Other patterns to try. *The One to Concentrate* (97428), *Aspirin* (9667867), *Good morning* (9792688), *8-club Vitoria* (9797888)

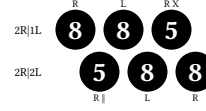
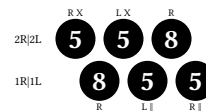
Zaps and Heffs

Many patterns combining zaps and heffs require very stable heffs that can be caught almost blind, which will probably take a bit of practice.

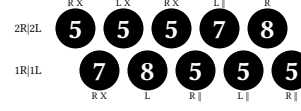
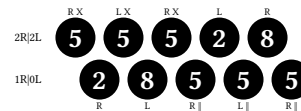
582 and 852. Two nice and beginner-friendly 5-club patterns. 582 feels familiar from *why not* and 852 is substantially more challenging because it requires catching a zap under a heff.



585 and 858. More challenging 6 and 7 club patterns that require precise zaps and stable heffs. Most passers prefer straight zaps wide (to throw heffs inside) and crossing zaps narrow (to throw heffs outside), but check with your partner.

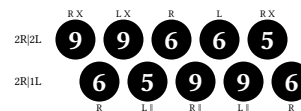


52585 and 57585. A nice introduction to longer sequences and combining zaps, heffs, and also singles.

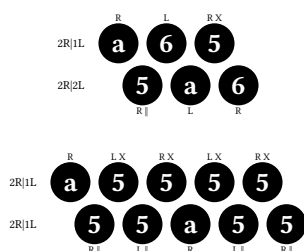


Zaps with Doubles or Trelfs

96956. Combining zaps and doubles usually requires fast zaps and slow doubles.



a56 to a5555. Combining zaps with trelfs makes for rather challenging patterns, requiring very reliable trelfs. Especially *a5555* has very limited time to look up – here, *a555566* is a decent warmup pattern with the self in a strategic location.



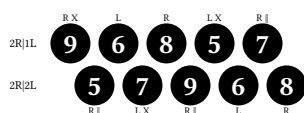
Other patterns to try. *89562* and holy grail patterns (Ch. 16).

Sequences

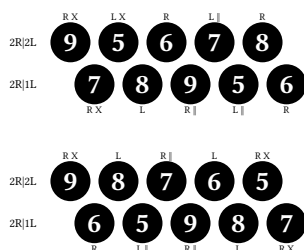
There are a large number of patterns that consist of a sequence of increasing numbers including all kinds of throws: for example, *456*, *567*, *678*, *789*, *45678*, *56789*, *6789a*, *456789a*, and *56789ab*. Those all make valid siteswaps that all tend passes and selfs. They are usually interesting to pass, because they combine so many different throws.

For each siteswap sequence of 5 consecutive numbers, there are actually two additional permutations that make valid siteswaps too: one where each passer passes the sequence counting up (locally) and one where they pass the sequence (locally) counting down; for longer periods there are even more permutations.

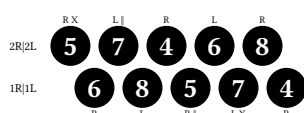
95678. The sequence *56789* is probably the best-known sequence pattern. This 7-club pattern produces a large stack: a sequence of zap, single, and double pass, all to the same hand – as in *holy grail* (Ch. 16).



The permutations are *97586* (each passer counting up) and *96857* (each passer counting down):

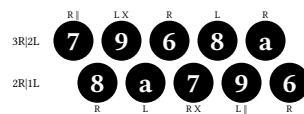


Suicide bunny (56784). This 6-club sequence from 4 to 8 is challenging at first, but usually more for remembering the many different throws than for the actual physical difficulty.



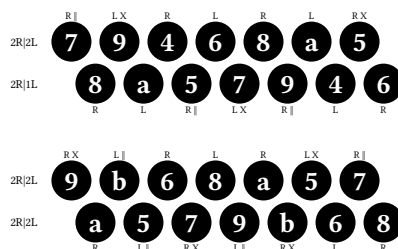
The permutations are *75864* and *57468*.

789a6. This 8-club pattern from 6 to *a* combines a stack with the common solo siteswap *345*.



The permutations are *97a86* and *a7968*.

789a456 and 9ab5678. These long sequences, with 7 clubs from 4 to *a* or with 8 clubs from 5 to *b*, make the stacking really noticeable.

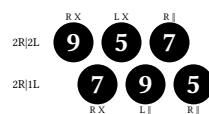


Both have permutations following the same recipe (each passer counting up or down) and several more, too many to list here.

16. Holy grail sequence

Prerequisites: *Beginner four-handed siteswaps* (Ch. 10), *doubles* (Ch. 11), and *zaps* (Ch. 13) | **Next:** *Advanced patterns* (Ch. 15) and *takeouts in 4-handed siteswaps* (Ch. 33)

Holy grail (975). *Holy grail* is a difficult 7-club one-count pattern that combines zaps, singles, and doubles. What makes this pattern particularly challenging to learn is a double-zap combination, known as dragon (“the dragon to slay on the way to the holy grail”), where the double is thrown first, but the zap arrives first – that is, to catch a dragon, you cannot look up for the incoming double until catching the zap. While it was considered nearly impossible until the early 2010s and only few people could run a few cycles, there are now quite a few people who manage long stable runs.

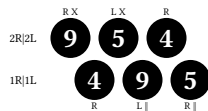


Warm-up. *Holy grail* requires solid zaps, singles, and doubles.

For zaps, it is useful to try the various easier zap patterns (Ch. 13) until zaps feel comfortable, even under stress. Then, the pattern *756* (Ch. 13) is a great warm-up pattern for every holy grail session.

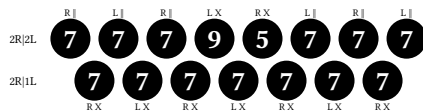
The double is probably the most difficult throw in *holy grail*. *7-club three-count* (966) and *972* (see doubles (Ch. 11)) are good warm-up patterns. Provide detailed feedback on all double passes to your partner (length, spin, height) and practice looking down to see the passes landing in *7-club three-count* to calibrate without feedback.

Finally, the most important warm-up pattern is 945, to dial in the dragons (just hold the 4 without a flip). Again, focus on giving good feedback on the doubles or watching your own double throws land (which is rather difficult). This pattern is hard, nearly as hard as *holy grail*, and not a good pattern to learn dragons. Use it as a warm-up pattern or come back to this if *holy grail* is unstable. From this one to *holy grail*, use the same start but passer B adds a club for the additional single pass.

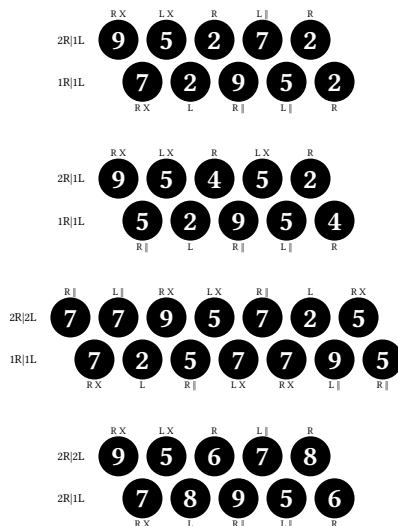


Learning dragons. Practice dragons first with only two clubs: Passer A throws double-zap (both crossing), the other tries to catch it, and then throws it back (both straight). Vary hands occasionally.

A next step is often to throw a dragon as a trick in 7-club *one-count*, something like:



There are several siteswaps that include dragons that are likely easier than 945. Nice examples are the 5-club patterns *Dragonfly* (97522) and *Dragoncat* (95524), the 6-club pattern *Hidden dragon* (7772955), and the 7-club permuted sequence pattern (Ch. 15) 97586.



Tips for learning holy grail. This pattern is hard, but possible. Keep practicing.

- Zaps and singles should be fairly automatic and clean. Practice 756 until it is fully automatic and very stable. Try to intentionally throw bad passes in 756 and try to recover.
- The throw most likely to break the pattern is the double. Focus on clean doubles. Warm up with 966, 972, and 945, and go back to those patterns if doubles are rough in *holy grail*.

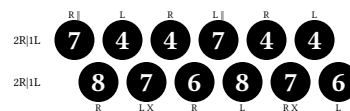
- Practice 945. Every single time. This is the most important practice pattern for *holy grail*. 97522 and other dragon patterns can be good practice to learn dragons initially, but are less useful when actually working on *holy grail* (they introduce their own challenges with doubles in period 5 patterns that are not important for mastering *holy grail* see improve your siteswap passing (Ch. 18)).
- Throw double-zap in quick succession and throw fast zaps to make the dragons easier to catch. It may help to gallop the entire pattern a bit by throwing double-zap-single fast and then waiting a moment before throwing the next double-zap-single round.
- Communicate. It is difficult to see how throws land. Provide feedback about poor throws, especially doubles.
- As passer A, throw the crossing zaps narrow; as passer B, throw the straight zaps wide. This avoids collisions and gives the other passer space to throw good double passes. Other collision problems are often a sign of too short passes.
- Both sides of *holy grail* (passer A and passer B) feel quite different. If you have a stable practice partner, it might be worth learning the pattern on one side first to identify and fix problems.
- Slow down and throw lofty passes (except the zaps). Breathe.

17. Compatible Siteswaps

Prerequisites: Beginner four-handed siteswaps (Ch. 10) and notation (Ch. 9)

In four-handed siteswaps, usually both passers juggle the same sequence, just offset from each other. However, this is not necessary – just like there are many synchronous passing patterns that match different patterns, such as throwing an early double (see basic synchronous patterns (Ch. 3)).

Matching an easier and a harder four-handed siteswap allows passers with different skills to both juggle interesting patterns. A good example is matching the easy 5-club *one-count* (744) with the harder 7-club pattern *French three-count* (786):



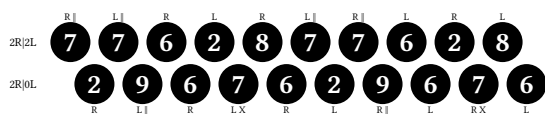
Matching compatible siteswaps also helps to stabilize passes for a passing partner when learning hard patterns. A common example is learning the 8-club pattern 978, where one passer at a time can drop a club to switch to 972, which usually provides them with much more room to recover and still provide good passes.



Theory: What makes two siteswaps compatible?

Two patterns are compatible if they have the same length and the same sequence of *catching* passes and non-passes. The sequence of catching passes and non-passes is the *interface*. For example, 744 and 786 both require catching one pass followed by two non-passes (interface *pxx*), and 972 and 978 require catching two passes followed by one non-pass (interface *ppx*).

Importantly, it does not matter when clubs are thrown, but when they land, since it only matters whether an incoming club comes from another passer or oneself. For example, in *maybe* (72786), the passer throws two consecutive singles, but in *maybe not* (96627), the passer throws a double and a single a pass apart – nevertheless, in both cases the passes arrive on consecutive beats, so they are compatible with the interface *ppxxx*.



Note that *ppxxx*, *xppxx*, *xxppx*, and so forth are all the same interface, simply by shifting where to start each siteswap.

Unfortunately, figuring out the interface of a siteswap is nontrivial and often requires pen and paper (see theory (Ch. 19)) – or simply look it up with a tool like passist.org. Many standard siteswap transformations preserve the interface. Figuring out how to start is also not always obvious and may require some trial and error or scribbling of causal diagrams (see siteswap theory (Ch. 19)).

Compatible Common Patterns

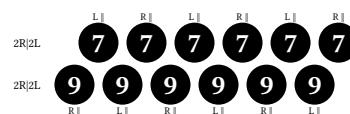
Here is a table with the compatibility of some common period 1, 3, and 5 siteswaps – all patterns in the same row are compatible:

Interface	4 and 5 club patterns	6 and 7 club patterns	8 and 9 club patterns
pxx	5-club one-count (744), 726, 564, 582, 528	French three-count (786), 7-club three-count (966), 588, 56a	a89, a7a
ppx	552	756, 774, 558, 945, 972	996, a77
ppp	555	777, holy grail (975)	999
pxxxx	5-club why not (78622), 56464	five-count (78686, 7a666)	aaa69, aaaa5
ppxxx	72722	maybe (72786), maybe not	969a6

Interface	4 and 5 club patterns	6 and 7 club patterns	8 and 9 club patterns
pxpxx	inverted parsnip (72227)	(79662), 747a2 Jim's two-count (77466), why not (77862), not why (77286), not likely (96672), suicide bunny (56784)	789a6
pppxx	Kaatzi (75724), Dragon cat (95524)	99692, 96956, 96857	
ppxpx	Parsnip (77722), funky mag-azin rack (55564), Dragonfly (97522)	Funky bookends (77786), funky bookends friend (77966), 95678, 97586	999a8
ppppx		Martin's one-count (77772), 75756, 57585, a5555	97978

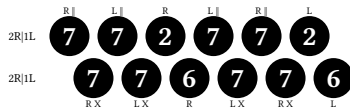
Even-length siteswaps

In siteswaps of an even length, both passers perform their own sequence. The most common example of this is *8-club one-count on singles versus doubles*, which is simply the siteswap 97:

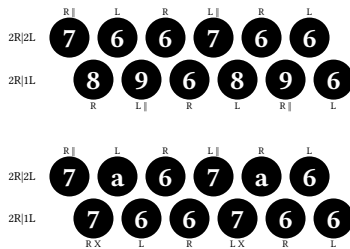


All combinations of two odd-length siteswaps, discussed above, turn into even-length siteswaps. For example, the combination of *maybe* (72786) and *maybe not* (96627) turns into the siteswap 7279662786, as visible in the diagram above. Since it is interleaving the *local* actions of each passer and requires finding the right start, doing this combination manually is nontrivial.

More interestingly, even-length siteswaps open possibilities for combining two sequences that are *not* a valid four-handed siteswap on their own. A typical example is 777726, where the passers throw pass-pass-zip (very good for beginners after one-counts) versus pass-pass-self:



Such patterns are fairly uncommon in the passing community right now, but there is a large space of possible patterns to explore. This includes the possibility of finding patterns that work against pass-self and thus feel like traditional 6-club three-count on one side, such as 786966 and 77a666:



To find more patterns, use any siteswap generator (such as passist.org) to generate patterns with a length of 6, 10, or 14 and exclude any patterns with 1s or 3s.

Hijacking

In siteswaps of length 5, every single pass can be replaced with a zip to get a pattern with one fewer club (the same works for doubles in siteswaps of length 7; this is a standard siteswap transformation (Ch. 19)). It is fairly intuitive to continue a pattern after dropping a club by replacing a pass with a zip if the next hand would be empty otherwise.

A classic sequence is to start in 7-club *one-count* (77777), dropping down to *Martin's one-count* (77772) when dropping a club (by accident or intentionally), dropping further down to *parsnip* (77722) or 77272, and so forth. The inverse direction is possible by adding a club to a pattern (e.g., tugged between the legs), replacing a zip with a pass. It is possible to intentionally go from 77777 down all the way to 72222 and then back up by tucking clubs.

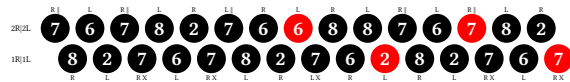
The same automatism of intuitively replacing an action with a zip for a missing incoming pass is also the foundation for hijacking patterns: Hijacking is an idea where one passer changes their pattern into one with one more club, which forces the other passer into a compatible pattern with fewer clubs (introducing a zip for the missing incoming pass). Conversely, they can throw an extra pass to arrive at a time where the other passer would have zipped into the hand, to force them to pass that club and switch into a pattern with one more club – the latter is mostly done to restore from the pattern after hijacking to the original one.

The classic example is hijacking from 6-club *why not* (77862) into the 7-club pattern *five-count popcorn* (78686), forcing the other passer into the compatible 5-club *why not* (78622).

- Hijacking: A passer forces the transition with a *self* instead of a pass, throwing *pass-self-self-heff-heff* instead

of *pass-self-pass-heff-zip*. The skipped pass forces the other passer to compensate with a zip which replaces a pass they would otherwise do – which again is a fairly natural and intuitive transition. From here, the pattern is stable with two different compatible siteswaps.

- Transitioning back: The passer with *five-count popcorn* (78686) throws an extra pass at the time of the forced zip in the other passer's pattern: *pass-self-pass-heff-zip* instead of *pass-self-self-heff-heff*. The other passer has a fairly intuitive transition from 5-club *why not* to regular *why not*.



Another well-known hijacking pattern is from *Martin's one-count* (77772) into *funky bookends* (77786) versus *parsnip* (77722). Here the hijacking passer skips a pass by throwing *pass-heff-pass-pass-self* rather than *pass-pass-pass-pass-zip*, which forces the other passer to transition from *pass-zip-pass-pass-pass* to *pass-zip-pass-zip-pass*. The hijacker can transition back by simply returning from *pass-heff-pass-pass-self* to *pass-pass-pass-pass-zip*.

Using *Martin's one-count* (77772) as a base pattern actually affords a different style of hijacking (or programming). Instead of *pass-pass-pass-pass-zip*, one passer can throw *pass-pass-self* to force *pass-pass-zip*, *pass-heff* to force *pass-zip*, a *trelf* to force a *zip* and *pass-pass-pass-flip* to force *pass-pass-pass-zip*. Any of these sequences can be chained, so funky bookends vs *parsnip* follows simply as the combination of *pass-pass-self* and *pass-heff*.

Aidan Burns' Highgate Collection describes a couple of these patterns and their transitions (page 36ff) and Ed Clark explains the mechanics more generally with many additional patterns on passing.zone/hijacking.



Highgate Collection



Hijacking article on passing.zone

18. Improve your siteswaps

Prerequisites: Beginner four-handed siteswaps (Ch. 10), notation (Ch. 9), and doubles (Ch. 11) | **Helpful:** Improve your passing (Ch. 8)

This is a collection of advice for common problems in four-handed siteswaps.

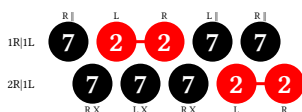
Slow down. The single pass in four-handed siteswaps should be slow and lofty. In particular, the crossing single should be high enough that the partner can comfortably pass below the incoming passes. Return to 5-club *one-count* (744 or 726) to calibrate singles or practice with increasingly fewer zips from *Parsnip* (77722) to *Martin's one-count* (77772) to 7-club *one-count* (7).

Request feedback. Most passers are not good about giving feedback, and it often gets worse as they get better and can catch more poor passes. Explicitly request feedback, possibly direct feedback on every pass while juggling the pattern.

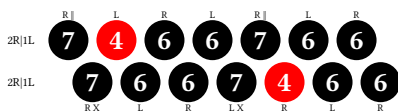
Watch your passes land. Conversely, aim to rely less on feedback by watching your passes land where possible. This will not work for all patterns, but for many. For example, set it as a goal to watch doubles land in siteswaps of length 3 (e.g., 966, 972) – this is challenging but eventually possible when the incoming passes are decent.

When learning a siteswap, switch starts. When it is difficult to get a full round of a pattern, it often helps to have both passers start with the same throws but start left-handed. This allows them to practice the second side of the pattern and come afterward to the already-practiced first side. In contrast, switching who is throwing crossing passes adds complexity but does not help learning a new pattern – keep the roles stable for each session.

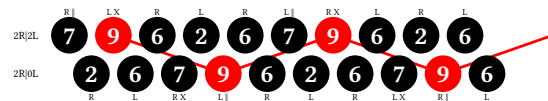
Make zips and flips a full beat. Zips often happen very fast and automatically. Many passers may not even notice that they are doing them, which can make a pattern like *Parsnip* (77722) tricky to learn. Passers who have learned *why not* (78627) and *Jim's two-count* (74667) as synchronous patterns are used to very quick zips. Since zips are so fast, they are often used to fudge the timing, which on the one hand can help make patterns like 972 much more forgiving, but on the other hand can also screw up the timing of a pattern. Try to make zips a full beat; to force this, try to hand the zip behind the back. In particular, patterns with two consecutive zips, like 77272 and 522, can be fun by handing one zip in the back and the other in the front.



Similarly, patterns with 4s are easier to juggle in a consistent rhythm if the club is flipped rather than just held. For example, actually flip the club in the pause of *Jim's three-count* (7746666) to juggle the pattern as a fully asynchronous siteswap rather than a (nearly) synchronous pattern with hurries.



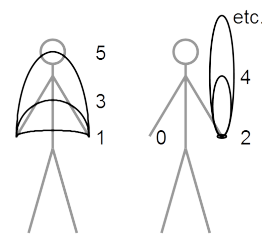
Focus on doubles in siteswaps of length 5. Double passes in siteswaps with 5 beats can be challenging. Those double passes force each other – that is, each double pass gets thrown under an incoming double pass to free the hand for that incoming pass. If a double pass is too low or too fast, the pattern can quickly degrade, because the receiving passer has little time to throw a good double pass. The best strategy to rescue the pattern from falling apart is to respond to a low double pass with an extra-high one. *Not likely* (72966, see doubles (Ch. 11)) is a good pattern to practice recovery (it is extra forgiving with the zip) – intentionally throw low doubles occasionally and try to recover.



Separate passes in stacks. Many patterns throw multiple consecutive passes to the same hand, such as zap and single in 756, single and double in 972, and zap, single, and double in 95678 (and other sequences (Ch. 15)). Separate those passes clearly in height, which means fast zaps, lofty singles (substantially higher than in synchronous patterns (Ch. 3)), and lofty doubles. At the same time, make sure that all passes of a stack land in roughly the same location and can be caught at the same height.



19. A bit of siteswap theory and lore



Visualization of traditional solo siteswap throws by Hyacinth (Wikipedia)

Siteswap basics

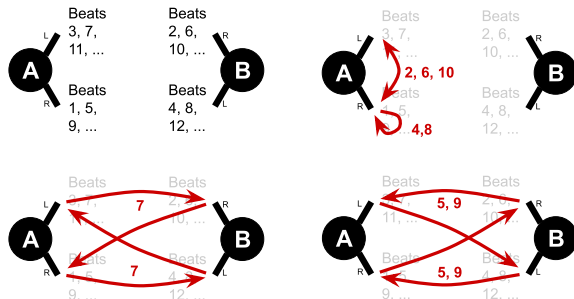
Siteswap notation dates back to the 1980s. It describes a sequence of throws with numbers, where each number represents how many beats later a thrown object will be thrown again. For example, a 4 describes that the object thrown now will be thrown again four beats later after three other throws. Traditional siteswaps assume a single juggler with two hands who alternates throws from both hands, so a siteswap 441 would be read as a right-handed 4 throw, followed by a left-handed 4 throw, followed by a right-handed 1 throw, then repeating on the other side. As a consequence, any odd-numbered throw crosses from one hand to the other (i.e., it gets rethrown an odd number of beats later when it is the other hand's turn) and all even-numbered throws return to the same hand.

N-handed siteswaps

Nothing in the siteswap notation or theory requires juggling with two hands. Siteswaps merely describe after how many beats an object is thrown again, and we simply assume by default that two hands alternate in solo siteswaps. Patterns can be juggled with 1 hand, 3 hands, or 16 hands, and hands do not even need to alternate in a regular way (irregular hand orders such as right-left-left are known as *handswaps* and very confusing).

Four-handed siteswaps are one way to interpret siteswaps for two passers with four hands total: We assume two passers facing each other with passer A throwing with the

right hand on beat 1, passer B throwing with the right hand on beat 2, passer A throwing with the left hand on beat 3, and passer B throwing with the left hand on beat 4, before it all repeats on beats 5, 6, 7, and 8 – as shown in the diagram below. That is, all odd beats are thrown by passer A and all even beats by passer B.



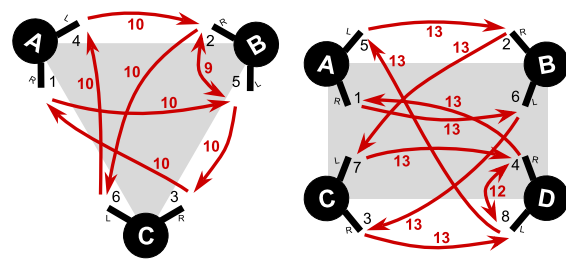
From this, all the standard throws in four-handed siteswaps can be derived:

- A 4 (flip) gets rethrown four beats later from the same hand, but there is only a single beat from the same passer before then. An 8 (heff) gets rethrown eight beats later from the same hand, while that same hand has another throw before then, four beats later.
- A 6 (self) gets rethrown six beats later from the passer's other hand, a 2 (zip) two beats later with the passer's next throw, and an *a* (trelf) gets rethrown 10 beats later.
- A 7 (single pass) gets rethrown seven beats later by the other passer. The straight/crossing passes approach where passer A throws straight single passes and passer B throws crossing single passes follows directly from the hand sequence: A right-hand single pass from passer A on beat one gets rethrown on beat 8, which is a left-hand throw from passer B, whereas a right-hand single pass from passer B on beat 2 is rethrown on beat 9 which is a right-hand throw from passer A.
- A 5 (zap) and 9 (double pass) are crossing for passer A and straight for passer B, following the same mechanism.
- A 1 would be a very, very fast pass (faster than a zip) that gets immediately rethrown on the next beat by the other passer; there is no plausible way of juggling this. A 3 is a very fast pass, which is technically feasible if slowing everything down a lot, but not commonly juggled. Hence, lists of four-handed siteswaps generally exclude patterns with 1s and 3s.

Assuming that both passers juggle at a normal speed, all numbers are twice as high as in solo (two-handed) siteswaps, as we have twice the number of beats in the same time.

The same way we define a four-hand sequence for two passers, we can define a six-hand sequence for three passers, an eight-hand sequence for four passers, and so forth. We now have much higher numbers, as there are even more beats in the same amount of time. In the following, we illustrate the hand sequence and the throws that represent selfs and single passes. For example, as a

start, try the 6-handed siteswaps *a899* and *aa79* or the 8-handed siteswap *fcc* ("three-count friction").



Passist animation
for *a899*



Passist animation
for *fcc*

Transforming siteswaps

There are a number of common transformations that can be used to transform a pattern into other patterns.

Adding/removing clubs. It is possible to add the length of the siteswap to any individual throw to get a pattern with one more object. For example, the 6-club pattern 972 of length 3 can be transformed into the 7-club pattern 975 (*holy grail*) by adding 3 to the last throw, and then be transformed into the 8-club pattern 978 by adding 3 to that throw again, which can then be transformed into the 9-club pattern 9a8 by adding 3 to the second throw. Conversely, removing the length of the pattern from any throw yields a pattern with one club less, such as transforming the 6-club pattern 972 into the 5-club patterns 672 (*5-club one-count*) or 942.

This transformation is useful in many passing patterns to make them incrementally harder (or easier) without changing the pattern otherwise. In siteswaps of length 3, all zips can be turned into zaps, all zaps can be turned into heffs, all flips into singles, all singles into trelfs, and all selfs into doubles – and vice versa. In siteswaps of length 5, all zips can be turned into singles (e.g., 77722 to 77772 and 52585 to 87585), and, in siteswaps of length 7, all zips can be turned into doubles.

It is also possible to add 1 to every throw to add a club to the pattern, for example, turning the 6-club pattern 45678 into the 7-club pattern 56789 and turning 77786 (*funky bookends*) into 88897. However, this usually changes the character of the pattern substantially.

Swapping throws. Siteswaps get their name from a manipulation that *swaps* the landing places of two throw *sites*. Any two throws in a pattern can be changed such that the first throw lands where the second would have landed and the second lands where the first would have landed. This is the logic behind *early doubles*: Throw a higher pass earlier to where the normal pass would have landed and then make up for it with a lower throw later instead of the original pass – the two throws have swapped their landing sites. Generally, two throws x and y that are n beats apart can swap into $y+n$ and $x-n$ – for example, transforming solo siteswap 441 into 531 and 531 into 333.

This transformation is commonly useful in four-handed siteswaps to think of compatible variations of a pattern, such as early doubles or extra trells, either as a one-time trick throw or as a different pattern. In practice, we are usually interested in transformations from the perspective of one passer, thus transforming two consecutive throws of one passer, which are two beats apart in the siteswap. For example, we can turn the local sequence single-single into double-zap (e.g., 77722 to 97522) or heff-pass into double-self (e.g., 77867 to 77966).

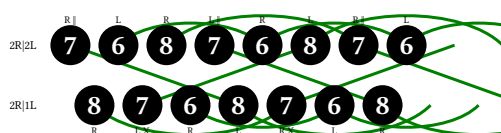
Repeating and shifting the pattern. It is probably obvious at this point, but 7, 77, and 777 are effectively the same pattern, as are 786 and 786786. Also, 786, 867, and 678 are the same pattern, just shifting the start. In lists, siteswaps are usually normalized – without repetitions and starting with the highest throw – rather than selected for a convenient start.

To create compatible siteswaps, it is useful to repeat an odd-length siteswap twice and then manipulate the resulting even-length siteswap with another transformation. For example, 786786 can be transformed by swapping the landings of beats 4 and 6, resulting in 786885, that is, creating the compatible siteswaps 786 and 858.

Diagrams

Several diagrams are common to depict siteswaps, usually developed for solo siteswaps. For example, just like we illustrate passer A and passer B on separate lines, in a solo siteswap, a diagram may show the alternating actions of the right and left hand in two lines.

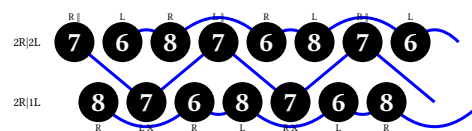
Moreover, there are two common ways of showing the throws in a pattern as lines: ladder diagrams and causal diagrams. In a *ladder diagram*, a line illustrates the path of an object from where it is thrown to where it is thrown again next. This is a ladder diagram for *French three-count* (786):



In such a diagram, we can observe the path that a club takes, for example, that the self in 786 is always the same club and that all heffs turn into passes.

Note that a throw lands quite a bit before it gets thrown again. It lands somewhere between the beat it is thrown again and the previous action of the same hand happening 4 beats earlier in a four-handed siteswap. This previous action is necessary to empty the hand to catch the incoming throw – we say that that action was *caused* by the incoming throw.

A *causal diagram* illustrates how throws cause the passer to do other actions to empty their hands, that is, they illustrate which throw triggers which other throw rather than illustrating the path of individual objects. This is the causal diagram for the same pattern *French three-count* (786):



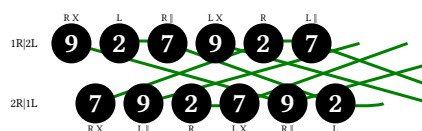
We can see that we always throw a single pass to catch an incoming single pass (i.e., 7 causes 7), and we always throw a self to catch a heff (8 causes 6) and vice versa. The fact that singles cause singles in patterns of length 3 (and doubles cause doubles in patterns of length 5) is why these patterns easily fall apart when those passes are too low and fast (see Improve your siteswap passing (Ch. 18)).

In the passing community, ladder diagrams are rarely used other than for determining starts and color coding (see below), but causal diagrams are more common, especially for reasoning about takeouts.

How to start a pattern

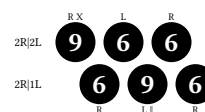
Determining starting hands. In a ladder diagram, it is very easy to see which hand starts with how many clubs, simply by counting the beats in the beginning without incoming lines. In the ladder diagram for *French three-count* diagram above, we can see that passer A throws four throws (two right and two left handed) before throwing the first caught club (a self) and passer B throws three throws before rethrowing a caught club.

This also works for less intuitive starts like the start of 972, where we can see that passer A has only one right-handed throw without an incoming club but two left-handed throws:



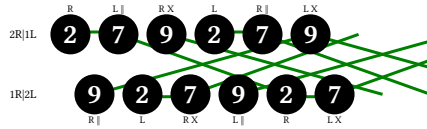
Similarly, we can count the hand without incoming lines in a causal diagram and add one club to each hand (one less if the very first action is a zip).

Avoid skipping initial beats. Some common patterns are often taught with starts that skip the first beat for the second passer. For example, it is common to start *7-club three-count* with a right-handed straight double, and for the other passer to start “as late as possible” with a right-handed crossing double, which should be *three beats later*. This works but requires practicing a new timing. We argue it is better to start all four-handed siteswaps one beat apart, that is, passer A should start with a crossing double from the right hand and passer B should start just afterward with a self from the right hand, followed by a straight double from the left hand as clearly indicated by the notation:



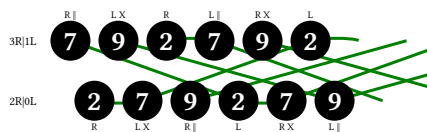
Selecting a beat to start. Since siteswaps can be shifted, it is possible to start on every beat. There is no single right way to start a siteswap, but some starts are usually better than others.

We usually do not consider starts where a club would need to be caught with a non-empty hand, such as the first throw of starting 972 on the 2:



Beyond that, we usually prefer starts where (1) the first throw of passer A is a pass, (2) the first throw of passer B is a pass, (3) the number of starting clubs is the same in both hands or the right hand has one more club, and (4) the number of starting clubs is relatively balanced between the passers.

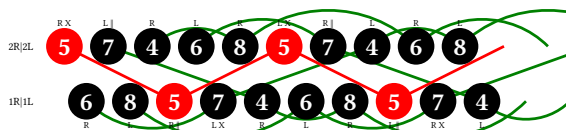
It is not always possible to satisfy all four preferences. For example, among the two remaining starts of 972, both violate at least one preference: Starting with the double requires passer A to start with two clubs in the left hand (violating preference 3). Starting with the single requires passer B to start with a non-pass, with two clubs in the right and an empty left hand (violating preferences 2 and 3). Despite not satisfying all preferences, the start with the double seems overall the better start.



With a siteswap animator like passist.org it is easy to cycle through the various starts and pick a nice one.

Orbits and color coding

Following a pass in a ladder diagram identifies its orbit, that is, the sequence of throws until the club repeats the same path through the pattern. Clubs that always repeat only a single action are called magic and can be highlighted by using a club of a different color. Throws a multiple of the length of the pattern are always magic: Zaps and trelfs in siteswaps of length 5 are always magic, and so are selfs and doubles in siteswaps of length 3 and singles in siteswaps of length 7.



Terminology

The passing community has now adopted a couple of terms that may not be broadly known among beginners or people who learned passing a long time ago. Some terms simply became popular and spread through the community.

A *heff* is not an abbreviation but was simply a random short term or a misheard version of the letter *f* for fountain, depending on who you ask. It has spread because “double self to the same hand” really needs a shorter alternative.

A *trelf* is a more recent attempt to disambiguate triple selfs from triple passes with a short term. It is not as broadly used, but I adopt it to have a distinct short word for all throws.

The *zap* was originally discovered when playing with the early passing animator JoePass!¹ Based on the software’s name, they were sometimes called *joe passes*, but now the name zap is much more common.

In this book, I use *passer A* and *passer B* and assume that passer A starts and throws straight single passes and crossing zaps and doubles. This is arbitrary. When agreeing on a side, it is common to negotiate who is throwing straight and crossing passes. As a running gag, some in the community have adopted “*James*” as the name for the passer with straight singles and “*Not James*” as the name for the passer with crossing singles. Alternatively, some have suggested “*James*” and “*Jim’s*,” because the latter throws crossing singles as in *Jim’s three-count*.

¹http://koelnvention.de/w/?page_id=151

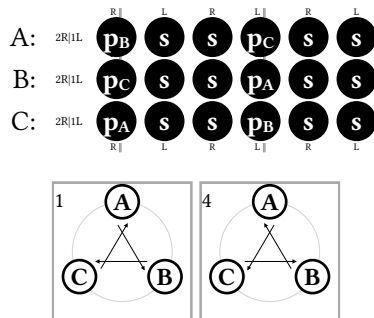
Group Patterns

20. Passing with 3+ People

There are many different ways to include more than two passers in a pattern. In this part, we will discuss both **static patterns**, in which multiple passers stand in specific locations such as in a triangle to exchange passes, and **moving patterns**, in which some or all passers change their positions during the pattern, usually while they continue to juggle and pass. In addition to static and moving patterns, in the next part (Ch. 25), we will discuss another popular class of group patterns, **manipulator patterns** (also known as takeout patterns), in which one or more additional jugglers steal and replace clubs out of a static or moving pattern, often swapping places with those passers in the process. These group patterns can be learned in many orders, but static patterns are usually a good starting point before adding movement, manipulators, or both.

Notation. To describe a group pattern, we need two parts: (a) the actions of each passer over time and (b) the positions where the passers stand or move. The actions of each passer are usually described using the notation of synchronous patterns (Ch. 2) or four-handed siteswaps (Ch. 9) for two passers. Although it is not always needed, we add an index to the notation of all passes indicating which passer to pass to. The positions are usually shown with diagrams showing locations as seen with a bird's-eye view from above; for moving patterns, often multiple diagrams are used to show changing positions throughout the pattern.

Here is an example of three passers passing *three-count* in a triangle:



Keep group patterns small. Most group patterns are best with 3 or 4 passers, and there are some interesting patterns with 5 passers. Larger groups are usually better off by splitting into smaller separate groups. While it can be fun to pass with many people at the same time, and there are some patterns that scale to very large numbers of passers, it can be very difficult to keep even simple patterns going with large groups. In patterns with 10 or more passers, even with very good passers, somebody will drop fairly early, resulting in frequent stops and resets. Because it is so challenging to keep large group patterns going, large groups usually pick patterns that are not particularly challenging or interesting for each passer individually.

21. Feeds

Prerequisite: Basic synchronous passing patterns (Ch. 3) or compatible four-handed siteswaps (Ch. 17) | **Next:** Static group patterns (Ch. 22), moving patterns (Ch. 23), or takeouts (Ch. 25)

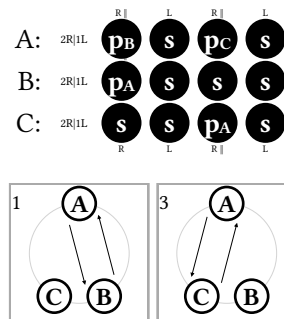
Feeds are a common and simple way to involve three or more passers. A passer acting as the *feeder* (A) will pass with multiple *feedees* (B, C, ...). Each feedee will only pass with the feeder, but not with other feedees.

Feeders and feedees generally juggle different patterns that are compatible when merged together. Feeders usually have the more difficult job as they receive (possibly inconsistently thrown and inconsistently timed) passes from multiple feedees and need to aim their passes at multiple different positions. Unless the intention is to integrate weaker passers in easier positions, it is common to try a feed and then rotate positions clockwise until everybody has tried every position.

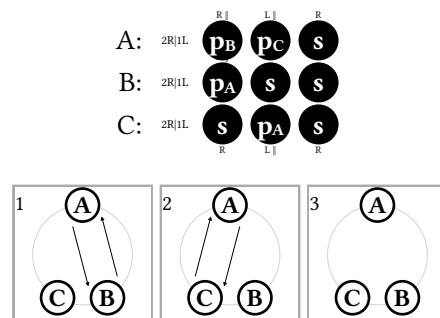
Synchronous feeds

The basic idea of a feed based on synchronous 6-club patterns is simple: The feeder juggles a repeating sequence of selfs and passes where different passes in the sequence may go to different feedees; the feedees each juggle selfs and passes so that they pass to the feeder on exactly those beats that the feeder passes to them.

Basic feeds. The traditional standard pattern is to feed two feedees on *6-club four-count* (Ch. 3) (starting two beats offset) with *6-club two-count* (Ch. 3) alternating between the two feedees:



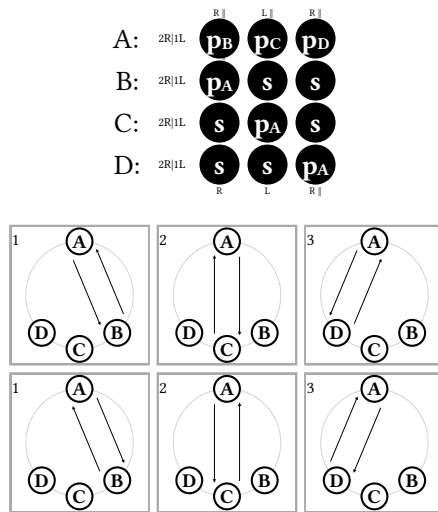
As usual, we instead recommend an ambidextrous pattern as a modern starting point: *6-club three-count* (Ch. 3) vs *6-club pass-pass-self* (Ch. 3):



(From the feeder's perspective, it can be helpful to think *inside-inside-self-outside-outside-self* for the fact that the

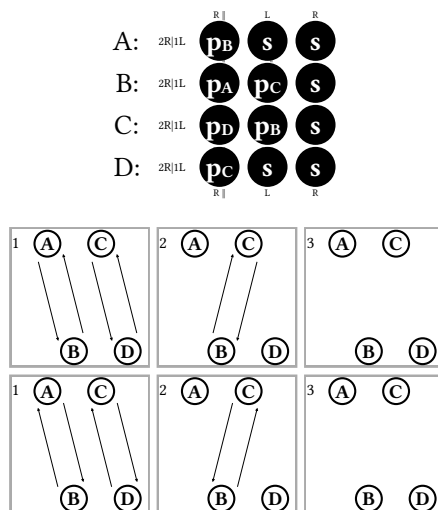
first pair of passes goes in between the two feedees and the second pair goes to the outside hands.)

For four passers, this can be easily extended to a feeder juggling *6-club one-count* (Ch. 1) and alternating passes to three feedees each juggling *6-club three-count* (Ch. 3):

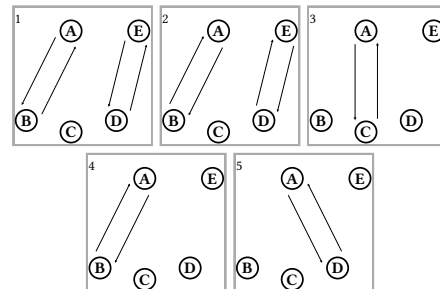
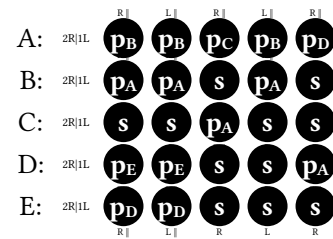


As another beginner-friendly feed, a feeder juggling *6-club one-count* (Ch. 1) can alternate passes to two feedees in *6-club two-count* (Ch. 3) – with one of them juggling left-handed two-count.

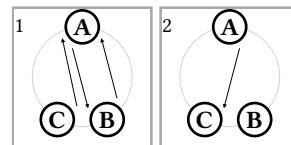
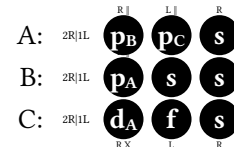
Chaining multiple feeds. To integrate more passers, it is possible to have more than one feeder in a pattern, producing N-shaped or W-shaped layouts. For example, here is a pattern with two feeders (B, C):



Getting creative. It is easily possible to come up with various different variations by deciding whether and to whom the feeders should pass on each beat. For example, a feeder juggling *6-club one-count* (Ch. 1) could pass to one feedee in *bookends* (*pass-pass-self-pass-self*; Ch. 3) and to two more feedees in *five-count*. To further extend this, one of those feedees could act as a feeder themselves, feeding the first feeder in *five-count* and a fifth passer in *pass-pass-self-self-self*:

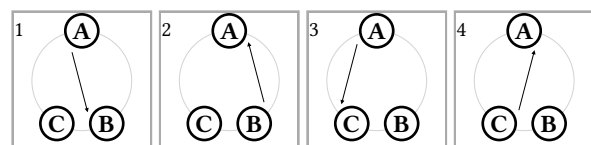
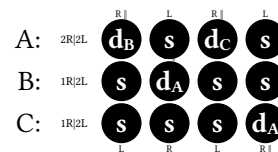


It is similarly possible to introduce (crossing) double passes as early doubles (Ch. 3), either as a trick throw or continuously. For example:



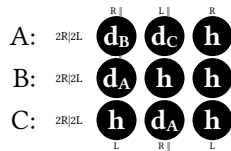
It is also possible to feed Jim's patterns (Ch. 4), but we recommend treating them as four-handed siteswaps, see below.

Adding clubs to synchronous feeds. It is possible to add extra clubs to a feed. The most common traditional pattern is a feeder passing *7-club two-count* (Ch. 5) to two feedees passing *7-club four-count* on doubles:



(Note that, as for *7-club two-count* (Ch. 5), rather than crossing all doubles, the feedees conventionally start left-handed or a beat late. The two feedees also each juggle a pattern that would not work with two passers, since they split the extra club between them.)

8-club pass-pass-self (Ch. 5) can also straightforwardly feed two feedees juggling *8-club three-count* (Ch. 5):



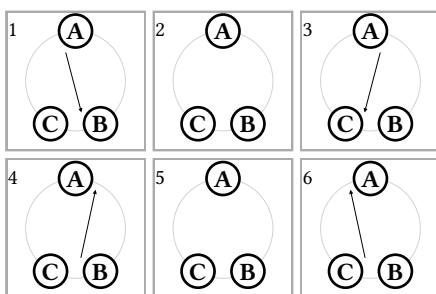
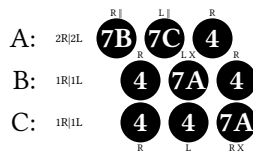
(As with 6-club patterns above, any sequence of double passes to feedees and heffs can be combined to create more patterns.)

Beyond this, extra-club synchronous feeds become a bit obscure. Any 6-club or 8-club *pass-pass-self* pattern can feed any pair of two compatible 7-club three-count (Ch. 5) patterns, and many additional strategies can be found to distribute one or two extra clubs across feeds with three or more passers. None of these are common, and we recommend exploring feeds with four-handed siteswaps instead.

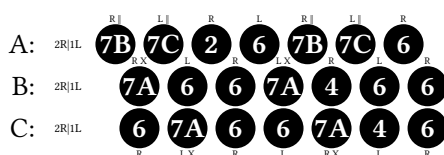
Feeding four-handed siteswaps

There are many common feeds of four-handed siteswaps and it is easy to create more. N-shaped and W-shaped patterns with more than one feeder are possible, but not common. Who throws straight passes and who throws crossing passes can be negotiated – usually the feeder gets to throw the (easier) straight passes and the feedees throw crossing passes (which can be harder as they may require extra wide angles to go all the way across the pattern).

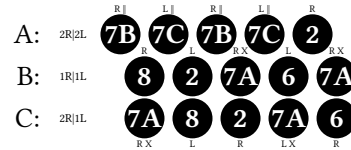
774 vs. 5-club one-count. To integrate beginners into a feed, it is possible for a more experienced passer to feed two passers in *5-club one-count* (Ch. 1) with 774 (Ch. 10) or three passers in *5-club one-count* with *7-club one-count* (Ch. 10).



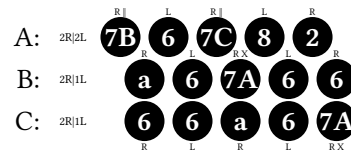
Mild madness vs. Jim's three-count. Many passers learning *Jim's three-count* (Ch. 4) then learn that it can be fed with *Mild madness* (Ch. 10) (pass-pass-self-pass-pass-zip-self). This works well when considering both of them as the four-handed siteswaps 7767746 and 7777266:



Martin's one-count vs. why not. For more experienced feedees, *Martin's one-count* (pass-pass-pass-pass-zip) feeding two passers passing why not (Ch. 12) (or the asynchronous Jim's two-count (Ch. 10)) is a good introduction to feeding with four-handed siteswaps.

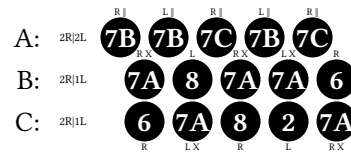


Why not vs. five-count popcorn. This feed is roughly of similar difficulty for all passers; as usual, *five-count popcorn* can be juggled with either heffs (Ch. 12) or trelfs (Ch. 14).

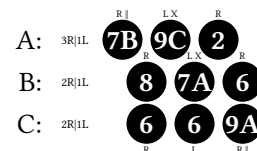


7-club one-count vs. funky bookends and why not.

Combining three different patterns, the feeder needs to remember the passing sequence B-B-C-B-C independent of whether throwing with the left or right hand.

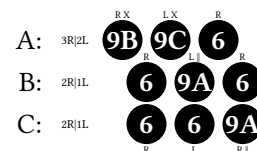


972 vs. 7-club three-count and French three-count. In this pattern, the feeder passes double passes with one feedee and single passes with the other.



(It is possible for the feeder to throw both singles and doubles as straight passes if both feedees cross their passes.)

8-club pass-pass-self vs. 7-club three-count. The siteswap 996 can naturally feed two feedees passing 966 for a total of 11 clubs.



For a challenge, add a club and have the feeder juggle *9-club one-count* (on doubles) against one feedee passing 996 and another passing 966. Or pass *9-club one-count* against three feedees each passing 966.

Creating custom siteswap feeds. With the theory of compatible siteswaps (Ch. 17) it is easy to create many more feeds. The key point is to arrange three or more pat-

terns so that the combined interface of the feedees' patterns matches the interface of the feeder's pattern.

Generally the two feedees always throw at the same time, but they must not pass such that their passes arrive on the same beat. For example, two feedees can pass *why not* with the interface *pxpx*, but they must be offset from each other by one beat so that their combined interface toward the feeder is *ppppx* – that is, either one of them will pass on every beat except the last. The feeder can pass any pattern that is compatible with the combined interface of the feedees; in the example, any pattern with interface *ppppx*, such as *Martin's one-count*, can feed two *why not* feedees. As another example from above, *funky bookends* (Ch. 12) has the interface *ppxpx* and can be combined with *why not's* interface *pxpxx* when started two beats later for a combined interface of *ppppp*, which is compatible with *7-club one-count* by the feeder. It is possible to combine patterns with throws of different heights and of very different difficulty levels as long as their interfaces can be combined. Following this principle, we can find many unusual feeds of common four-handed siteswaps, such as:

- *7-club one-count* (Ch. 10) (*ppp*) vs. *765* (Ch. 13) (*ppx*) and *582* (Ch. 15) (*pxx*)
- *parsnip* (Ch. 10) or *funky bookends* (Ch. 12) (*ppxpx*) vs. *Jim's two-count* (*async*, 77466; Ch. 10) (*pxpxx*) and *five-count popcorn* (Ch. 14) (*pxxxx*)
- *945* (Ch. 16) (*ppx*) vs. *French three-count* (Ch. 12) (*pxx*) and *5-club one-count* (Ch. 10) (*pxx*)
- *7-club one-count* (Ch. 10) (*ppp*) vs. *74a* (Ch. 12) (*pxx*) and *77a* (Ch. 14) (*ppx*)

As with all compatible siteswaps, identifying starts can be a bit tricky and may require pen and paper as described in the theory section (Ch. 19). The total number of clubs needed for the feed is the sum of the clubs for each pattern divided by two, since each passer passes half of each siteswap. The following heuristic to figure out the start often works: Let the feeder start with their pattern with a convenient start and identify when each feedee will receive their first pass. Usually each feedee can identify how they usually would start their pattern in reaction to an incoming pass. For example, it is common to start *French three-count* (Ch. 12) with a heff on the beat after the first incoming single pass is thrown. If the first incoming pass is at a different height than usually expected in the feedee's pattern (e.g., an incoming zap instead of a single pass for a feedee's *French three-count*), this start would be adjusted correspondingly to start a beat earlier or later. In many cases, the second feedee may need to wait a beat or two for their first incoming pass; they can either wait for their usual start or backtrack and identify the throws before; the throw before might include a pass to the feeder. In many cases, it is possible to identify the start this way with only a few attempts to figure out what works; if it does not work, go back to the pen and paper method. See the patterns above for some examples of starts.

22. Static Group Patterns

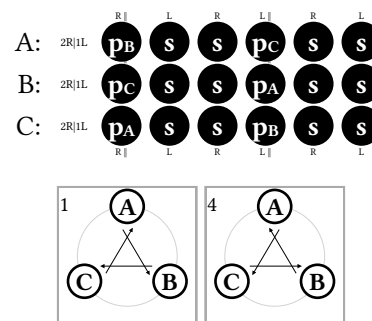
Prerequisite: Basic synchronous passing patterns (Ch. 3) | **Next:** Feeds (Ch. 21), moving patterns (Ch. 23), and takeouts (Ch. 25)

Beyond feeds, there are many static group patterns for different sizes of groups and different difficulty levels. We group them roughly by the number of passers and shape of the positions. Almost all of these patterns are based on the basic synchronous 6-club passing patterns (Ch. 3). Most of these patterns are easy to medium difficulty.

Triangles (3 passers)

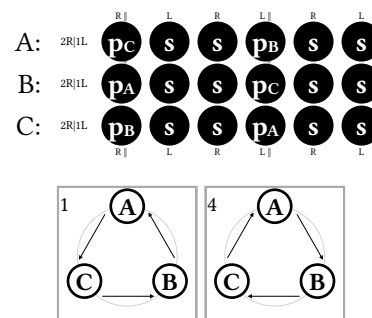
Triangle patterns are conceptually simple and versatile. In contrast to feeds, they are usually symmetric in that all passers juggle the same pattern.

Three-count, insides. A good first pattern is to juggle *three-count* with *inside* throws, that is, right-handed passes go to the left hand of the passer on the left and left-handed passes to the right hand of the passer on the right. Everybody passes at the same time; count out loud if necessary to synchronize timing and avoid collisions.



Once this works, there are many more variations to explore that are interestingly different without drastically increasing difficulty.

Three-count, outsides. Stay on the same *three-count* rhythm, but throw the passes *outside*, that is, right-handed passes go to the left hand of the passer on the right and left-handed passes to the right hand of the passer on the left. Outside throws tend to be less collision-prone but harder to watch due to a much wider angle – do not watch the outgoing club but look for the incoming one. Actively provide feedback about incoming passes and where you would like to receive them (usually slightly behind you), as other passers also will not see their passes land.

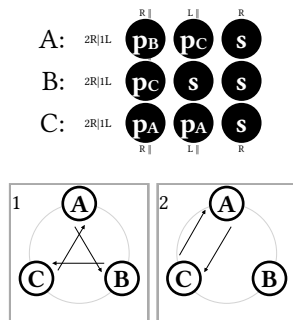


Three-count, outside-inside-inside-outside. Several further good variations come from exploring different se-

quences of inside and outside throws. For example, alternating outside and inside results in all clubs being thrown to the same person. The sequence *outside-inside-inside-outside* is interesting in that it passes to all four hands of the other two passers, from right to left.

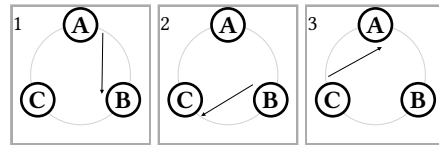
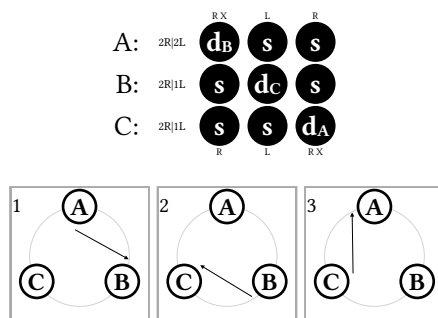
Pass-pass-self and one-count. The same triangle idea also works for all other base patterns (including *four-count* if somebody insists). *Pass-pass-self* and *one-count* can be interesting challenges with different combinations of *inside* and *outside* throws. *Pass-pass-self* with *inside-inside-self-outside-outside-self* throws feels similar to pass-pass-self feeds (Ch. 21). *One-count* with all-*outside* passes is particularly challenging as it requires constant head movement to see incoming passes.

Getting creative. Similar to variations in a feed, it is possible to design many different passing sequences in a triangle. Essentially, the group needs to decide for each beat whether (a) everybody passes in a circle to the left or the right, (b) two passers exchange passes while the other does a self, or (c) everybody does a self. Here is a typical pattern where on beat one each passer passes to the right, on beat two passers A and C pass with each other, and on beat three everybody does a self, resulting in a different sequence for each passer (pass-pass-self feed, pass-pass-self to the right, three-count):



To extend this sequence for a more challenging pattern, we can swap roles after every n iterations. For example, a passer starts in role A (*pass-pass-self* feed) for two iterations, followed by two iterations in role B (*three-count*), followed by two iterations in role C (*pass-pass-self* to the right); the others similarly shift through the roles but start with a different role.

Extra club three-count. With all passes thrown as crossing doubles, it is easy to add a 10th club to a triangle *three-count* pattern, with double passes all going in a circle in one direction:



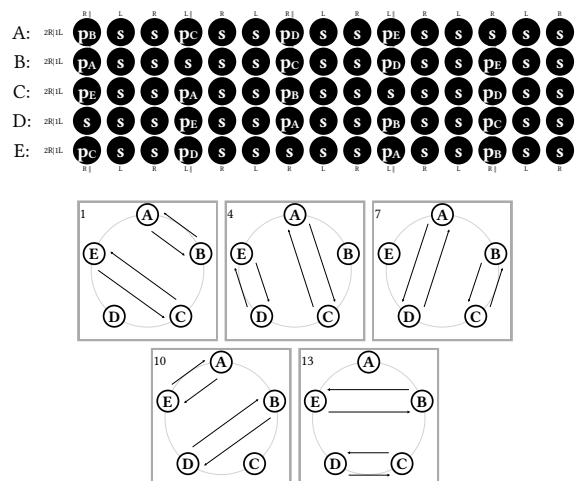
(All passers start at the same time with the same hand. Crossing passes can be awkward to throw in a triangle with left-hand passes being much longer than right-hand passes; provide feedback.)

Six-handed siteswap triangles. Six-handed siteswaps are naturally juggled in triangle positions, as described in the context of four-handed siteswap theory (Ch. 19), but they are not commonly passed in the community. Use a siteswap generator like passist.org to find interesting patterns with “a” as single passes or “7” as zaps, such as aaa69 or a37979999 (Mayday Zap).

Feast (3+ passers)

The *feast* is an elegant and scalable pattern that theoretically works with any number of passers and on any base pattern and avoids the collisions of star formations: The passers stand in a circle. Each passer has a starting partner such that no passing lanes cross (with odd numbers of passers, one passer has no partner). On the first passing beat, each passer passes with their starting partner (or a self if they have no starting partner). On every next passing beat, they pass to the passer on the right (in the circle) of their previous pass. If the previous pass was to the last passer on the right, they do a self on the next passing beat, and continue with the passer on their left on the passing beat after. That is, everybody passes with everybody in the circle in order (including themselves).

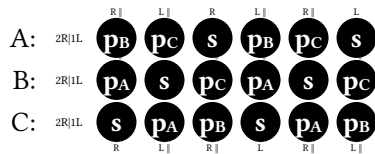
The feast is commonly juggled on *four-count* or *two-count*, but we strongly recommend *three-count* or another ambidextrous pattern. Here is the pattern for five passers on *three-count*:



(Notice the starting partners A+B and C+E resulting in parallel passes and passer D starting with a self. Notice that everybody passes with every other passer in order, including themselves.)

One-count feast. Three passers juggling the *feast* in a *one-count* results in an interesting triangle variation: All

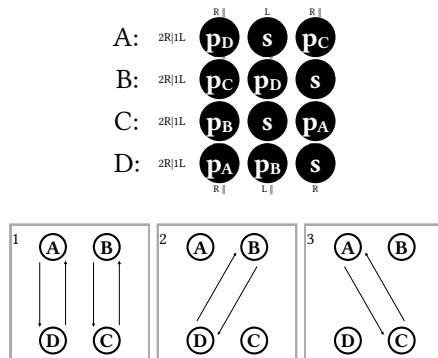
passers juggle *pass-pass-self* in the typical *inside-inside-self-outside-outside-self* sequence, but on offset beats, so that two passers always exchange passes while the third passer has a self:



Scaling the feast. For more than 6 or 7 passers, the length of different passes starts to differ a lot, making it hard to throw long passes and hard to keep the time consistent. Have one passer (or everybody) count *pass-self* (or whatever the base pattern is) to keep the pattern in sync. One trick to scale the feast for very large groups is to turn it into a moving pattern that keeps the shape of an oval or two roughly parallel lines (instead of a circle), so that all passes are always roughly at the same distance.

Double feeds (4 passers)

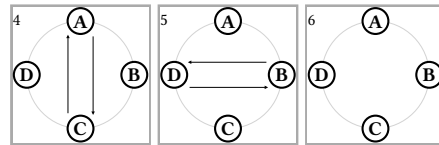
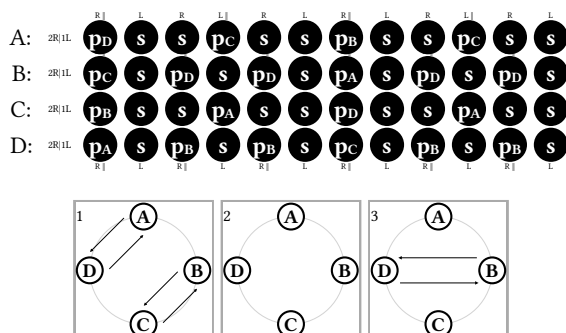
By arranging four passers in a rectangle with two facing the other two, each passer can feed two other passers. The challenge is to find patterns that do not collide in the middle, sometimes involving selective double passes. The most elegant of these patterns is a *double pass-pass-self feed*:



Eight-handed siteswaps. Eight-handed siteswaps (Ch. 19), such as fcc (three-count friction), are also generally arranged in this double-feed position, but not commonly juggled.

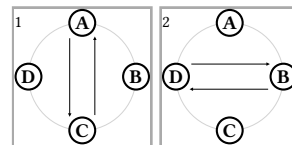
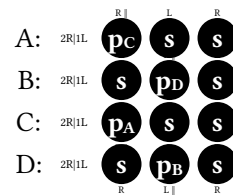
Square (4 passers)

In a square arrangement, everybody can pass with everybody. Aside from feasts (see above), the following pattern combines *two-count* and *three-count* in a somewhat interesting arrangement:



Again, it is easy to be creative and create many more patterns by deciding who passes to whom on each beat (pairs, triangles, and a full circular exchange are all possible), usually avoiding having everybody pass through the middle at the same time.

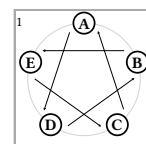
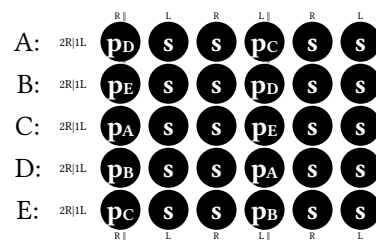
This also includes trivial patterns where just two (or more) pairs of passers pass through the same space but do not otherwise interact:



Star (5 passers)

A common pattern for a group of five passers is in a circle where each passer juggles with the two people opposite in the circle, resulting in a five-pointed star formation. Like in standard triangle patterns, all passers pass to a different person than from whom they receive the incoming pass; like in triangle patterns, many variations are possible by deciding the sequence of “inside” and “outside” passes. Since all passes go through the middle on the same beat, it is important to be consistent on timing and length of all passes, especially *inside* passes.

Here is a standard 5-passer star pattern on three-count with all outside throws:



Adding clubs. The easiest way to add a 16th club is to pass *five-count* on doubles all in one direction (i.e., left- and right-hand passes go to the same person), either with all passes crossing or with every other passer starting left-handed. To add another club (17 total), *pass-self-pass-pass-*

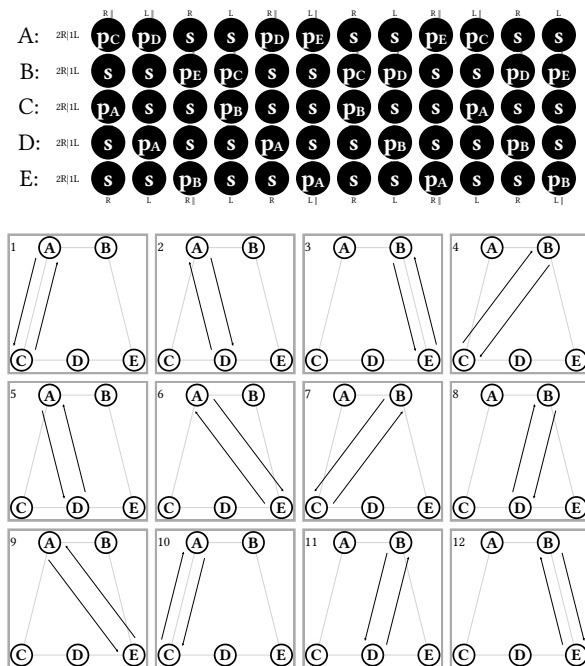
self on doubles is a good sequence to try, and in theory every other self can be replaced by a double pass if adding one more club. A simpler 20-club version is simply *two-count* on doubles, where everybody starts with 4 clubs and passes the gallop 8-club two-count on doubles (Ch. 6).

Ten-handed siteswaps. Ten-handed siteswaps can be naturally juggled in a star pattern. Actually, by throwing slightly lower or higher passes, many four-handed siteswaps have equivalent ten-handed versions, such as *French three-count* with very lofty singles (j k f) and *seven-count popcorn* with either lofty zaps or doubles (e f k f k f k or l f k f k f k), but none of these are common or intuitive to figure out.

Seven-pointed star The star formation works conceptually for any odd number of passers, but, already with seven passers, this becomes very collision-prone if passes are short or not exactly synchronized.

Trapezoid (5 passers)

Chocolate box. Another common setup is two passers A and B facing three passers C, D, and E in a trapeze shape. A common pattern of intermediate difficulty is *chocolate box* where the two passers A and B each juggle *pass-pass-self-self* (which is a synchronous pattern called *chocolate bar*) and the three other passers juggle *three-count*, in the following sequence:



Rotate through all positions and let the passer who previously held a position explain the sequence to the new passer in that position.

Other Shapes for Static Patterns

There are endless variations to arrange passers in different shapes, letting them pass on different lanes, either in pairs or in longer loops. This includes formations in a Y shape, in a T shape, and in a line – some patterns include drop-back and drop-forward passes (not discussed here) – others add double passes and extra clubs. There are several

pattern collections that feature many of these, including the Madison Area Jugglers Pattern Book and the Passing Patterns Compendium. The patterns in this chapter are our suggestions for beginner to intermediate patterns in a modern passing style; beyond those, we rather suggest adding movement (Ch. 23) and manipulators (Ch. 25) for variety and challenges.



Madison Area Jugglers Pattern Book



Passing Patterns Compendium

23. Moving Group Patterns

Prerequisite: Basic synchronous passing patterns (Ch. 3) | **Helpful:** Static group patterns (Ch. 22) | **Next:** Takeouts (Ch. 25)

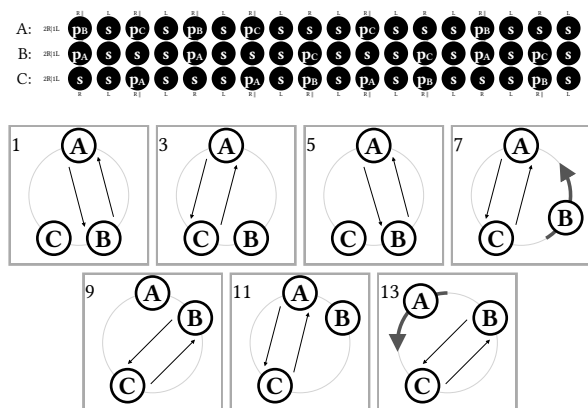
Movement adds interesting variations and challenges to group passing patterns. We mostly discuss patterns that are symmetric in that all passers cycle through all positions during the pattern. The following patterns are roughly sorted by increasing difficulty.

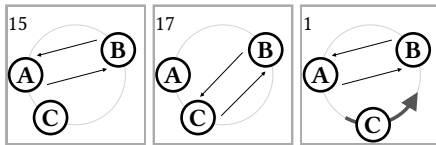
Notation and Relabeling

To notate the pattern, we usually rely on a sequence of diagrams of passer positions from above that illustrate the positions and movement. There is no established standard notation for indicating who moves when and where.

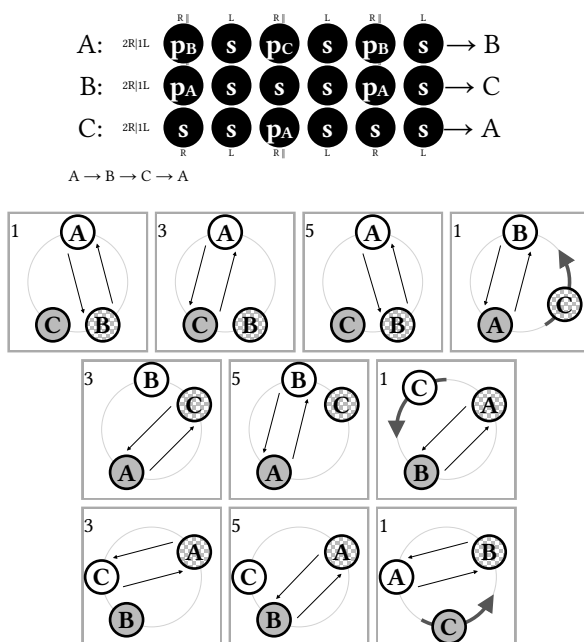
In most patterns, it takes a while until all passers cycle through all positions, to get back to the original start. However, conceptually, the pattern is usually composed of smaller repeating steps, similarly to how siteswaps repeat over and over again even if we write the most compact version showing only the first half of the pattern. With walking and takeout patterns, it is common to write down only one transition of the pattern and then describe how it repeats.

For illustration, here is the full notation for the *rotating feed* in *two-count* vs *four-count* (described in more detail below). It is 18 beats long to get back to the start where passer A feeds (though the orientation in the room will have changed). However, the first six beats already describe all that is happening in the pattern. After those six beats, a different passer (who started as C before) will now feed; after another six beats the third passer will be the feeder.





Relabeling. The standard approach to notate those patterns compactly is to describe only one transition, but then explain how the roles change. That is, the same passer (identified by a specific circle with a shaded background in the diagram) will go through all three roles – in this pattern, first A, then B, then C. In the diagrams, the same circle has different labels over time. The role changes (how passers are relabeled) are indicated as arrows at the end of each line in the notation. While the relabeling approach makes patterns much more compact to notate, it can require some practice to read the notation and follow how roles change for each passer during the pattern.



Changing starts: Turning back. While learning longer patterns, it is a good idea to change the start when the first beats of the pattern work well, but the group rarely gets to later beats to practice them. The best way to change the start is to go *backward* in the pattern by one segment. This way, everybody can learn the new segment and then gets to a point that they already know (whereas turning forward, everybody gets to more unknown parts of the pattern and never practices previous parts again until getting around).

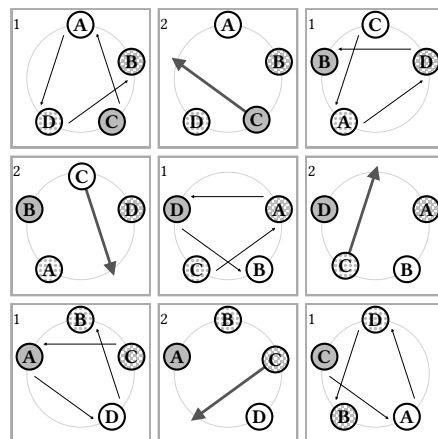
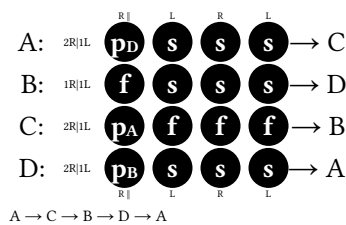
For most walking patterns, it is obvious how to turn back. However, when not obvious, this step-by-step process always works: Look at role changes in the notation. Identify which role gets relabeled to your current role; that's the role in the previous start – for example, in the rotating feed above, the passer with role A has role C in the previous start (because C turns into A). When everybody has identified their role, simply move to the starting positions for each role. For teaching more complicated patterns, after turning back, the passer who previously held a role can

typically explain well what to do to the new passer in that role.

Shooting Star (4 passers)

The shooting star describes a family of patterns in which one passer is missing from a standard 5-person star pattern (Ch. 22). These moving patterns are particularly approachable because the movement happens without juggling while moving.

Since one passer is missing, one passer (role C) will not receive clubs and one passer (role B) would pass into a hole. In the standard four-count version, passer B, who would pass into the hole, starts with two clubs and skips the first pass, whereas passer C, who does not receive clubs, walks immediately after their first pass through the middle of the pattern to the hole while holding two clubs; they receive the next pass there when they arrive. On the next beat, another passer does not receive a club and walks to the hole, and so forth.



Variations: It is possible to remove clubs and walk with one club or no clubs to slow down the pattern.

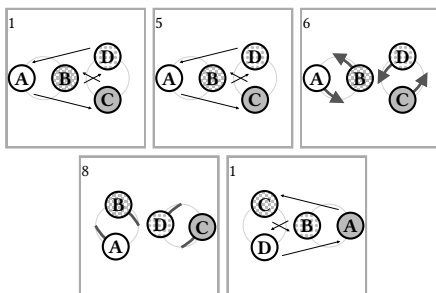
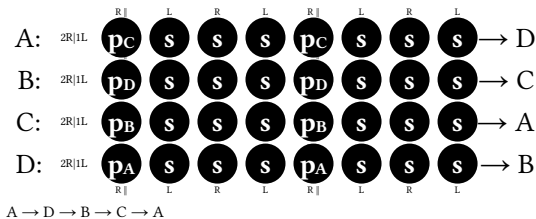
- Walking with one club: Removing one more club, passer B (facing the hole) starts with *one* club and passer C (not receiving clubs) passes until they are down to a single club for walking.
- Walking the last pass: As before, passer B starts with one club. After their first pass, passer C is down to two clubs and walks their last pass to passer A, to then walk (run) around behind A with their last club to their target position in the hole.
- Walking without clubs: Passer B (facing the hole) starts without clubs and passer C (not receiving clubs) walks without any clubs after passing their last club. This slows down the pattern and results in walking only every other or every third pass.

Two-count shooting star. In the two-count version of the shooting star, the person moving stops in the middle to let passes go by before making it to the hole. Typically they walk when they have one club, but they can also walk to the middle with two and pass a last one from the middle.

Rotating Y (4 passers)

An good beginner pattern with easy movement is the *Rotating Y*. The Y is a formation of two passers next to each other facing two passers behind each other (a feed with an extra passer behind the feeder). The rightmost passer throws a long pass to the passer in the back, who throws a long pass to the passer on the left, who throws a much shorter pass to the feeder in the middle, who then throws another short pass to the rightmost passer. For movement, consider that the two passers standing next to each other are on the left and right of a circle, whereas the other two passers are in the front and back of another circle; for each movement, each passer moves a quarter position counter-clockwise on their circle (all walking at the same time), yielding another Y. Note that after movement, everybody still passes to the same passer (now in a different location, possibly with a different distance) and receives from the same passer.

The rotating Y is commonly juggled in four-count (Ch. 3) with movement after every other pass or after every pass. To learn the pattern, it is common to try every position without moving during the pattern, and move to the new positions between attempts when resetting. When moving during the pattern, only fairly little movement is needed, typically only a step or two without turning, making this a good beginner pattern.



Rotating Feeds (3 passers)

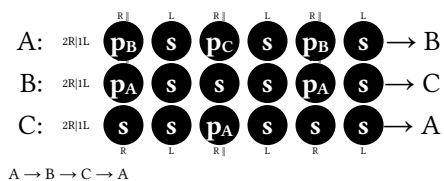
The rotating feed is a good introduction to walking and turning on a four-count (usually), which is an important foundation for many other walking and takeout patterns. So even though the rotating feed on two-count versus four-count can be rather boring, it is an important milestone.

In all these patterns, one feedee (usually the left one) is walking across the pattern while turning to a position beside the previous feeder. The other feedee becomes the new feeder, feeding the passer who just walked and the previous feeder.

Two-count vs. four-count. The standard pattern, shown already in the notation section above, is a *two-count* feed with feedees on *four-count*. This pattern is the foundation for many four-person manipulator patterns (Ch. 30).

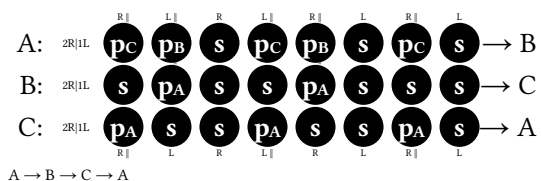
To begin, the left feedee can walk across the pattern after any pass with or without announcing it. There is enough time for both the previous feeder and the new feeder to adjust patterns; the previous feeder will simply do a self where they would have passed to the feedee who just walked, resulting in a switch to four-count; the third passer will throw a pass to the passer who just walked instead of a self, thus switching to a two-count feed.

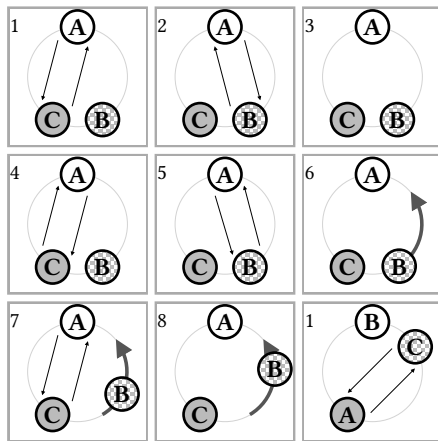
The most common pattern is for the left feedee to walk every six beats; which passer is currently in the left feedee position will change. The feeder typically counts the two-count passes as 1 - 2 - 3 and the left feeder would start walking after the pass on 3. After this, the right feedee takes over counting (and feeding) 1 - 2 - 3 after that, which is when the next passer (the first feeder) will start walking, and so forth.



Walking and turning while juggling can initially be somewhat challenging. Usually the passer walking will walk immediately after their pass and catch the incoming pass somewhat along the way (ask the feeder to throw it shorter if necessary). It is possible to practice walking and turning while juggling alone, simply walking around while maintaining a 3-club cascade. Less confident passers can also collect all clubs and walk across the pattern holding all three clubs to then restart with a pass on the other side.

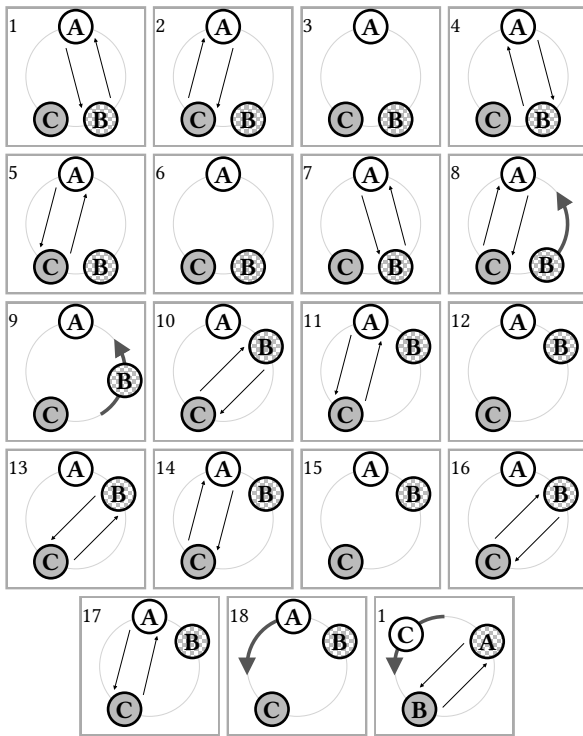
Pass-pass-self feeds. The following pattern is a nice approximation of a pass-pass-self feed (technically pass-pass-self-pass-pass-self-pass-self), which still allows walking on a right-handed four-count. That is, the pattern is ambidextrous and slightly more challenging, but the walking is the same as in the two-count vs. four-count version.





A pure pass-pass-self feed is also possible, but substantially harder. It requires walking on a three-count and alternates between walking on a right-handed three-count and a left-handed three-count. Walking after a left-handed pass is harder for most people, because it is easier to turn with the angle of the incoming pass.

A: 2R(1L) 7B 6 7C 8 2 7C → B
 B: 2R(1L) a 6 7A 6 7 → C
 C: 1R(2L) 6 6 a 6 7A → A
 A → C → B → A

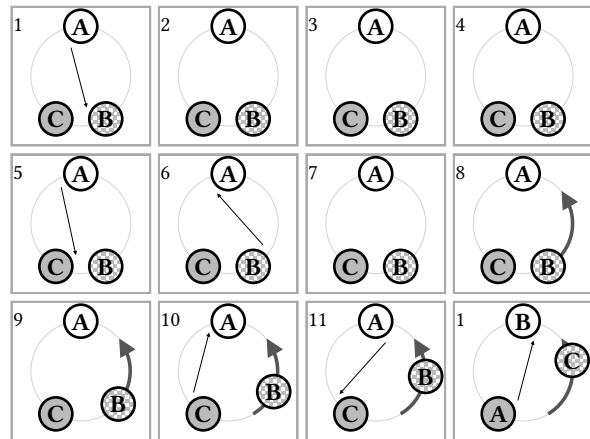


Four-handed siteswap feeds. Rotating feeds on four-handed siteswaps are not common and usually very challenging since they require changing between straight and crossing passes and accounting for the half-beat timing difference between the two sides. To make this work, the common trick is that the feeder throws straight single passes to feedee B and crossing single passes to feedee C, and feedee B responds with crossing single passes and feedee C with straight single passes. When walking, passer B juggles slightly slower (to lose half a beat; written

as 7x in the notation) and maintains the crossing passes with the previous feeder, but starts throwing straight passes to the other feedee.

Here is an example of this based on a why-not vs five-count popcorn feed (Ch. 21).

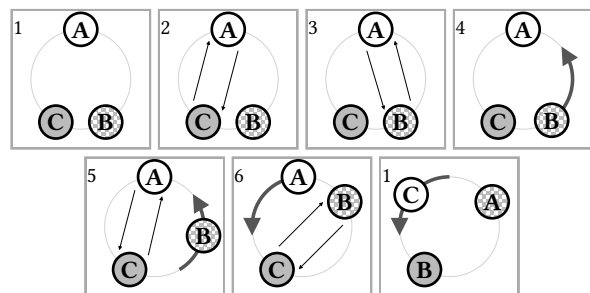
A: 2R(2L) 7B 6 7C 8 2 7C → B
 B: 2R(1L) a 6 7A 6 7 → C
 C: 1R(2L) 6 6 a 6 7A → A
 A → B → C → A



Extra club Bruno's (see below) uses the same idea. The appendix has a few more patterns to explore.

Other feeds. Generally any feed can be turned into a rotating feed if there are enough selfs to walk across. It is also possible that multiple passers walk before the pattern repeats (as in the rotating pure pass-pass-self feed above). Here is an example of a very short pattern (the base pattern for MiniEd (Ch. 32)), with a lot of walking on right-handed three-counts:

A: 2R(1L) s pc pb s pc s → C
 B: 2R(1L) s s pA s s pc → A
 C: 2R(1L) s pA s s pA pb → B
 A → C → B → A

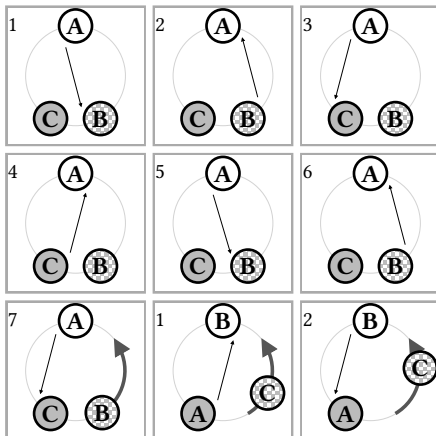
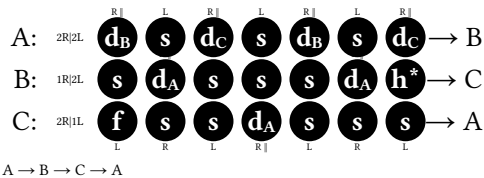


Extra Club Rotating Feed (3 passers)

The two-count vs. four-count feed with 10 clubs (see Feeds (Ch. 21)) can also be turned into a walking rotating pattern, similar to other feeds. In this pattern, on all double

passes, the feeder throws one more pass to their right feedee before switching to four-count and the walk happens on a five-count (resulting locally in the sequence pass left, pass right, pass left, pass right, pass right, pass right).

To maintain the usual approach to throw all double passes straight instead of crossing, the feedees start left-handed or one beat late (see *7-club two-count* (Ch. 5) and adding clubs to synchronous feeds (Ch. 21)). Since the walking technically changes from the left-handed to the right-handed side of the pattern, there can only be three selfs in the five-count and the passer walking needs to take one of these options: (a) juggle a four-count very slowly to match the speed of a five-count, (b) throw one of the three selfs of a four-count as a double self followed by a wait to gain an extra beat of time, or (c) walk on a normal four-count and throw an early triple pass followed by a wait. In either case, the timing is right if, after walking, the first pass responds to an incoming pass with the offset timing common for *7-club two-count*.



With a bit of galloping, this pattern can also be juggled on single passes (see *7-club two-count* on singles (Ch. 6)).

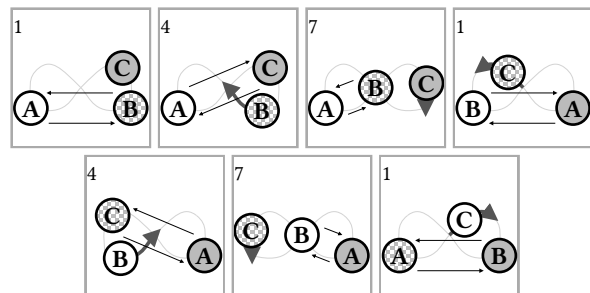
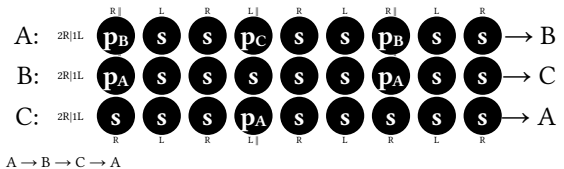
Bruno's Nightmare (3 passers)

The conceptual idea behind all “Bruno’s” patterns is that the passers move as if they were balls thrown by a giant. In the basic Bruno’s nightmare pattern, the passers move in a simple cascade pattern, being “thrown” to one side of the room and then “falling” back down to the other (see the diagram below). While the passers are moving in the shape of the giant’s juggling pattern, they pass clubs.

In the basic Bruno’s nightmare pattern, the passers start in a V shape and one feedee walks *through* the middle of the pattern to arrive at the opposite side of the former feeder to where they would have walked in a rotating feed; during that time the other feedee “falls down” to take the place of the feedee who just walked from where they will feed next. The initial feeder first throws to the feedee

walking, then to the other feedee, and then once more to the feedee walking while they are in the middle of the pattern. From here the pattern repeats with the previous feeder now walking through the pattern, the previous “falling” feedee now feeding, and the passer who previously walked falling down.

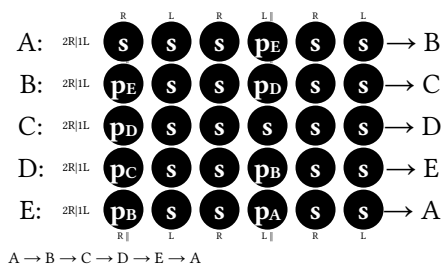
The standard way to juggle this pattern is on *three-count* vs. *six-count*, which gives passers a lot of time to walk and turn.

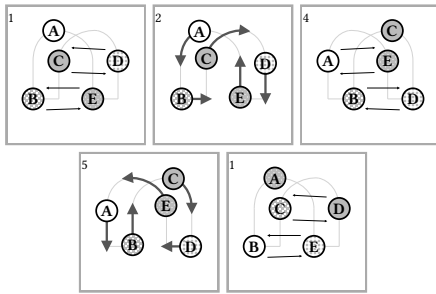


The pattern can also be juggled on many other baseline beats. Feeding two-count vs. four-count is fairly common too, but since the pattern requires turning both clockwise and counter-clockwise, one of those turns is usually more challenging. A much slower version has five instead of three passes before it repeats, where the walking passer passes twice while walking through the middle of the pattern. Less conventional base patterns are pass-pass-self or pass-pass-self-pass-self feeds. See the appendix (Ch. 36) for illustrations of these.

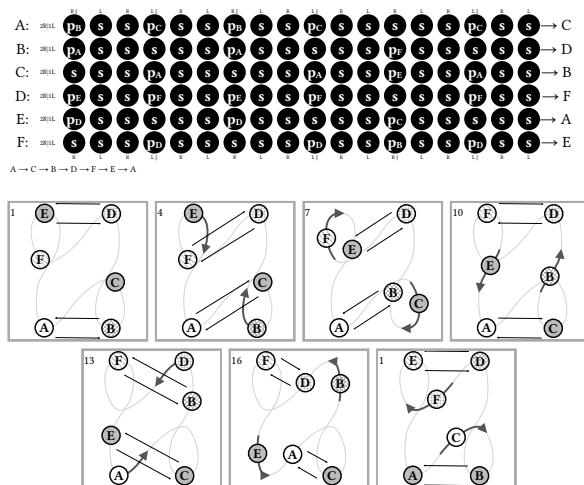
Beyond the cascade. The idea of a giant juggling the passers can be conceptually extended to other base patterns. Walking can follow any solo pattern as a base pattern, such as 423, 441, 33441, and the box for three passers, or 534 and 531 for four passers (see the appendix (Ch. 36) for an example). There is no principled way to decide when to pass and to whom to pass (that I am aware of), so it is easy to create lots of different patterns by first picking a pattern for the walking and then fitting passes in there.

This is an easy pattern based on the five-ball cascade:

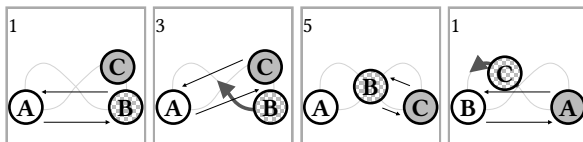
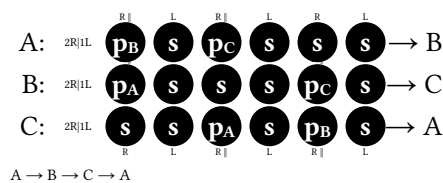




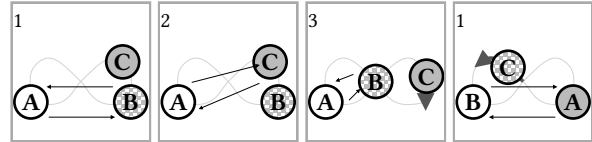
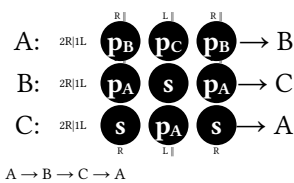
Beyond solo patterns, Bruno's patterns can also be extended to passing patterns, when imagining two giants facing each other passing with each other. The most common of these (known as *Magermix* when juggled in one-count, see below) is a six-person pattern where the passers move as if they were passed in two-count:



Turbo. *Turbo* is a Bruno's variation (same walking paths) where the walking passer turns around to pass back to the passer who started next to them when walking through the pattern, after which they back up to their target position. While it looks like a feed setup at the start, the passer "in the air" (in the Bruno's analogy of juggling people) starts as feeder one pass into the pattern. Again, *Turbo* can be juggled on different baseline patterns, but *two-count* vs. *four-count* is the most common.



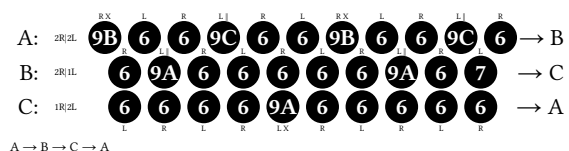
Bruno's one-count. A particularly challenging variation of Bruno's nightmare is Bruno's nightmare on one-count vs. two-count, usually known as *Bruno's one-count*. This pattern usually requires very lofty passes and lofty selfs, fast turns under a single self, and fairly precise passes.

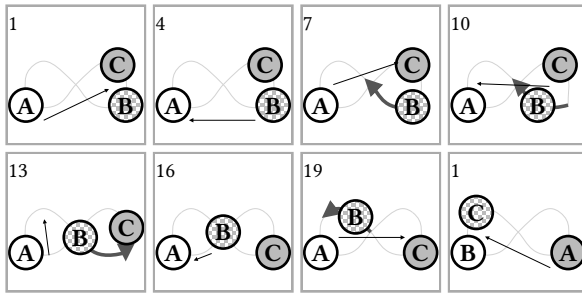


This pattern is very difficult to learn from scratch. By far the best way to learn this pattern is with two passers who can run it. Here are a couple of hints: Juggle very lofty and slow; count out loud to synchronize. After the first pass of the feed, the walking passer should take a step forward to give the "falling" passer space, but should not yet move sideways. The second pass of the feed needs to be long to avoid collisions with the short pass after; for the passer walking through the pattern, this is the first pass on the other side after turning (likely the most difficult pass of the pattern); collisions are most commonly caused by the walking passer's pass being too short here. The third pass of the feed needs to be lofty but very short; usually the feeder is leading the walking passer quite a bit; the outgoing and incoming passes usually cross, and the walking passer should aim to the nose or even the wrong hand of the feeder. For the feeder, the second and third pass are usually roughly in the same direction; the third pass is just much shorter. The walking passer has a single self to turn all the way around; usually they already turn a lot after throwing their short pass *before* catching the incoming short pass, so that they need to turn much less under the self.

Bruno's one-count is possible on all the other variations, like *Magermix* for six passers moving as if they were thrown in *two-count* (see above) and various three-ball siteswaps like 441 and 33441 (known as *Babymix*). See the appendix (Ch. 36) for illustrations of these.

Extra club Bruno's. Similar to the rotating feed, it is possible to add a club and juggle the entire pattern on doubles. However, since this is juggled on a four-handed siteswap feed, the walking and notation is somewhat unusual: The feeder always throws crossing passes to the feedee walking and straight passes to the other one; the first pass after walking is always crossing, and the passes while walking are always straight. Feedee B walks on 7.5 beats, but the half beat is barely noticeable and it can be juggled as a normal seven-count (in the notation, the extra half beat is visible in the 7 on the last beat of B, which is a slow self (!) to make up for switching the half beat between sides).

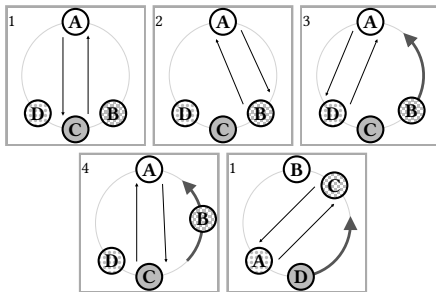
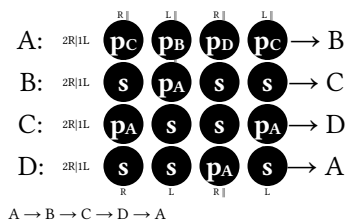




(Technically the approach also works for 10-club *Bruno's one-count* by leaving out the extra selfs.)

El Niño (4 passers)

El Niño is a version of a rotating feed for 4 passers, based on the feeder passing *one-count* to three feedees in *three-count*. The feeder feeds the feedees in the following order: middle feedee, left feedee, right feedee, and middle feedee. First the left feedee walks in three-count after their pass, and then the middle feedee after their second pass, turning the right feedee into the new feeder. The pattern is usually started left-handed so that all walking happens after right-hand passes.



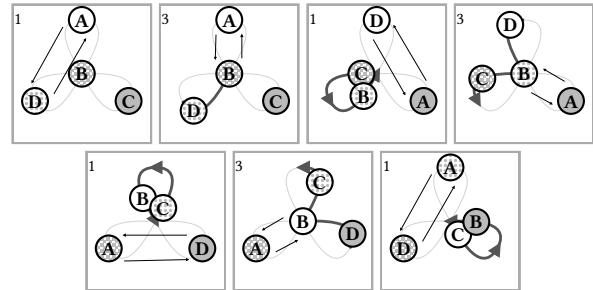
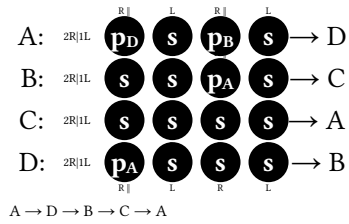
Other Classic Patterns (4 passers)

The Madison Area Jugglers Pattern Book has a huge number of walking patterns, including *Turbo* and *El Niño* discussed above. Here are two more common patterns from that collection that are also the basis for many other variations.

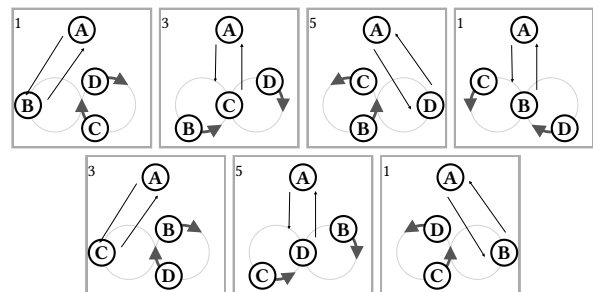
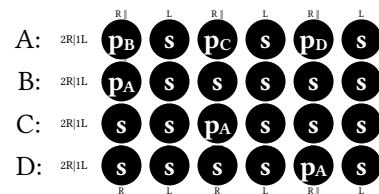


Madison Area Jugglers Pattern Book

3-leaf clover. In this pattern, all passers continuously walk in and out of the middle of the pattern, through three loops (see diagram below). Essentially, a feeder throws two-count to three feedees in six-count. The Madison book has many more variations, including ambidextrous ones.



The weave. In the weave, three passers walk in a figure of 8 on six-count all while facing a feeder outside the pattern who feeds them in two-count. This pattern does not cycle through all positions, since the feeder stays fixed, but it is intuitive and easy to learn and there are many variations (including ambidextrous ones) in the Madison book.



24. Large Patterns

For large groups of passers, it is almost always better to break up into smaller groups. However, here are some ideas to include many passers.

Speed Passing

Speed passing is speed dating for passers. This is commonly run as a workshop early in a juggling festival so that passers find who else attending the festival is interested in passing.

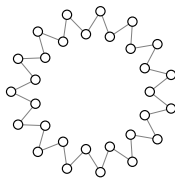
In a long line through the gym, passers meet in pairs. The passers in each pair introduce themselves and decide on a pattern to try. An organizer keeps the time and signals to change partners every 60 to 120 seconds (a whistle and a tabata workout timer work well for this). On each partner change, each passer moves a step to the right to pass with the next passer in line. At the end of the line, passers have

a break for one round and then continue on the other side on the next partner change. This continues until everybody has passed with everybody else, or time runs out.

Encourage passers to try ambitious patterns and to switch patterns when they switch partners. If passers want to drop out early, they ideally do so only at the ends or together with their current partner.

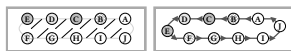
Very Long Feeds

As shown earlier, it is possible to chain multiple feeds (Ch. 21). The simplest way to scale this with similar-length passes is to extend the feed in a zig-zag line, where everybody feeds two other feeders, except for the two feedees at the very end. With very large numbers of passers, this zig-zag line can even be bent into a large circle to connect the ends, so that everybody feeds. This can be juggled on any base pattern.



Skinny Loopy Feast

The Feast (Ch. 22) pattern conceptually works for any number of passers, but with enough passers the circle will be very large and some passes will be exceedingly far while others are very short. One way to solve the problem is to turn the feast pattern into a walking pattern with two lines that maintains all passes at a similar length:



Beyond these, the Madison Area Jugglers Pattern Book and the Passing Patterns Compendium have many more patterns for large groups of passers.



Madison Area Jugglers Pattern Book



Passing Patterns Compendium

Manipulator Patterns

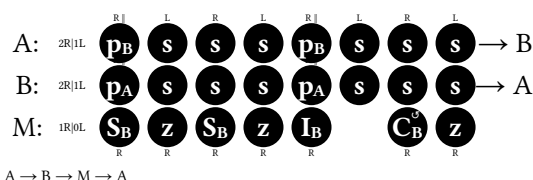
25. Starting Manipulator Patterns: Concepts and Nicki's 3-Count Roundabout

Prerequisite: 6-club three-count (Ch. 3) | **Next:** Roundabout (Ch. 27), Scrambled V (Ch. 30), or takeouts in 4-handed siteswaps (Ch. 33)

Manipulator patterns, also known as *walking and takeout patterns*, are passing patterns where one or more jugglers *steal* and *place* clubs in a passing pattern, usually also swapping roles with one of the regular passers – similar to the role changes in moving patterns (Ch. 23). This is easier to see in a video than to explain with words, here with the popular Roundabout (Ch. 27) pattern on a four-count base pattern:



Video



The new actions in manipulator patterns are *stealing* and *placing* clubs. A sequence of first stealing a club and then placing a different club where the original club would have landed is called a *takeout* or (now more commonly) a *substitution*.

Takeouts

The most basic version of a takeout, that most jugglers learn first, is a manipulator standing in front of a juggler juggling a 3-club solo cascade with a single club held upside down on the body in their right hand. The manipulator then steals a right-handed throw from the juggler's cascade with the left hand (usually when it is moving up through the pattern) and places the held club into the juggler's left hand at the time that the stolen club would have landed. Afterward the manipulator usually hands the stolen club over to their right hand (a zip (Ch. 2)), flipping it over in the motion, so that they are ready to steal another club. Conversely, left-hand throws are stolen with the manipulator's right hand.

The same idea also works in passing patterns, where the manipulator can steal and replace a club thrown as a pass just as well as steal and replace a club thrown as a self.



passing.zone article with good video illustrations

Before diving into manipulator patterns, it is useful to practice takeouts with a partner or with two partners doing a simple passing pattern, such as 6-club two-count. It can be useful to have two clubs of a different color, one for the manipulator and one for the pattern, to then substitute

every right-handed throw of that club. When the manipulator is getting better, they usually can take out every second throw, such as every right-handed self or every pass in *two-count*. The very old takeout pattern *Wally Walk*² does this continuously on a *four-count*. There is no role switching for these takeout practice patterns, so the passers should take turns practicing the takeouts.

Common Manipulator Actions

From the perspective of a manipulator, there are three actions that form the building blocks of all manipulator patterns:

- **Substitution:** The manipulator performs a takeout by stealing a club and placing another club where the original club would have landed. Typically, the manipulator has one club before and one different club after the substitution, which they then zip to the other hand to reset.
- **Intercept:** The manipulator steals a club and does not replace it. That is, they have just gained a club whereas the passer to whom that club was originally thrown is now down a club. An intercepted throw triggers a role switch where the manipulator has gained a club and replaces the passer who would have received that club; that passer now becomes the new manipulator, typically starting with two clubs since one was stolen.
- **Carry:** The manipulator places a club in the pattern, without stealing one first. A carry is typically the first action of a new manipulator after a club was stolen from them with an intercept from the previous manipulator. In many patterns, the manipulator flips both their initial clubs, places one, zips the other, and then continues the rest of the manipulation sequence with one club.

In the standard manipulator pattern, the manipulator always starts with two clubs, first does a carry action to go down to one club, then does any number of substitution actions, and finally intercepts a club to trigger a switch with another passer who will then be the next manipulator.

The First Manipulator Pattern: Nicki's 3-Count Roundabout

While other patterns are more popular, *Nicki's 3-Count Roundabout* is a good first manipulator pattern. It is easier to learn than most others because it does not require zips. Zips are not necessarily hard, but the extra actions can be overwhelming to beginners, and most experienced passers are bad at explaining where they are needed.



Video: <https://youtu.be/OB3mwD08Hck>

In the pattern, two passers with roles A and B pass 6-club three-count (Ch. 3). A manipulator M stands in the middle of the pattern (between the passing lanes) with a single club in the right hand (upside down).

1. On the first beat, the manipulator M *substitutes* a right-handed pass from passer A to passer B, stealing it with

²<https://www.youtube.com/watch?v=6IsHw9nd8m4>

their left hand in the air, catching it on the handle (late steal, see below) and placing the held club with their right hand from below into passer B's left hand where the pass would have landed.

2. On the third beat, the manipulator now stands in front of passer B and *intercepts* B's right-hand self with their right hand, catching the club on the handle (late steal). Passer B will usually help by throwing a nice self with less spin than usual (a pelf, see below).
3. The manipulator has two clubs and takes passer B's position, moving to the left to give passer B some space to get out of the way. Passer B is now down a club, because their self was stolen; they now become the new manipulator.
4. At the same time, the new manipulator (previously passer B) flips both clubs to hold them both upside down on the body. They walk across the pattern to passer A, placing the clubs in their left hand into passer A's right hand from below, just after passer A throws a right-handed self on beat four.
5. Remaining in the middle, the new manipulator turns back to substitute the next pass to passer A with their left hand, which is a right handed pass. This is step 1 on the first beat of the next iteration: The manipulator's substitution. From here, the pattern repeats, just with the roles switched.

Role switching works similarly to moving patterns (Ch. 23): The pattern repeats, but with different roles, until everybody is back in their starting role. Here, at the end of six beats, the passer who originally started in role B is now in the role of the manipulator M, the passer who started as manipulator is now in role A, and the passer who started in role A is now in role B.

Variations on how to steal and place a club

There are many variations of how to steal and place a club, whether as part of substitutions or other manipulator actions. While they are largely interchangeable, most manipulator patterns have a canonical form that uses a specific variation.

Stealing a club. The three common ways to steal a club are early steals, late steals, and very late steals.

For an *early steal*, the manipulator steals the club when the juggler moves their arm to throw it, but before it is actually thrown. The manipulator receives the club upside-down, that is, catching it on the body. Early steals are fairly common for passes and less common for self throws. If a juggler knows that a club they throw will be stolen early, they will usually just gently place the club into the manipulator's hand.

For a *late steal*, as in *Nicki's 3-Count Roundabout* above, the manipulator steals the club in the air, usually when it is fairly vertical (body pointing up, handle pointing down), which is about one-third through the throw. The manipulator catches the stolen club on the handle. If a juggler knows that a club they throw will be stolen late, they usually throw a nice half-spin throw that is easy to catch for

the manipulator – this hybrid of *pass and self* is known as a *pelf*.

For a *very late steal*, the manipulator steals the club where it would have landed. Some patterns use this for intercepts, where the manipulator catches the club instead of the juggler to whom the club was thrown. The manipulator then catches the club like a normal throw, that is, on the handle. If a juggler knows that a club they throw will be stolen very late, they usually throw a lofty throw to the position where the manipulator wants to catch it, which may be slightly different from where it would have gone otherwise (often more to the right or longer).

In some patterns, the difference between early and late steals is important, as it determines whether the club is caught on the body or the handle. In many patterns it does not matter much, as the stolen club is zipped immediately after, which provides an easy opportunity to flip it over if needed.

Placing a club. For placing a club, the main question is usually whether a club is placed *from above* or *from below*. By convention, the manipulator places a *substituted self from above* into the hand of the receiving juggler, places a *substituted pass from below*, and places a *carry from below*. The receiving juggler should simply hold out their hand (without moving around) and it is the manipulator's responsibility to place the club into the hand. Generally, unless the pattern explicitly demands it, avoid throwing the club when placing it, and only let go when the club has arrived in the target hand.

Manipulator position. Where the manipulator stands when stealing or placing clubs is different in many patterns. Some patterns have a canonical form that is described, others let the passers figure out what works. When substituting a pass, the manipulator often stands in the middle of the pattern between the two passing lanes, facing the passing lane where they plan to steal the pass. However, they can also stand outside the pattern facing inside. In another variation, the manipulator stands in the middle facing the passer they steal from and places the club behind their back (see *Chopabout* (Ch. 28)). For substituting selfs, the manipulator typically stands in front of the other juggler, but they can also move and turn between stealing and placing (canonical in *Roundabout* (Ch. 27)). For intercepts, all kinds of positions are common, including intercepting a pass when standing behind the juggler that would originally receive it.

Handedness. It is common convention to steal right-handed throws with the left hand and to steal left-handed throws with the right hand, but this is not required. Stealing a club with the "wrong" hand (usually to avoid a zip on the beat before) is called *rhondaing* a manipulation.

26. Manipulator Pattern Notation

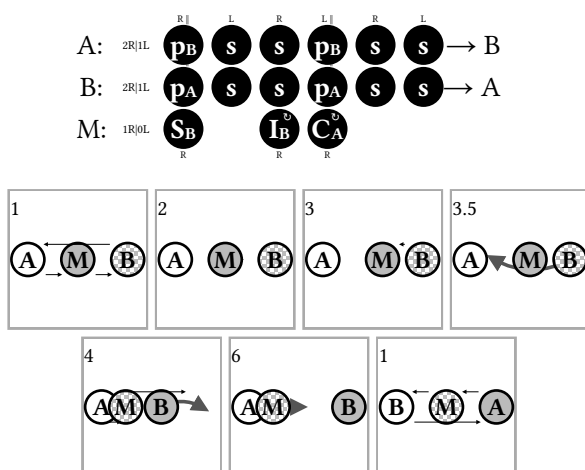
The first manipulator patterns were written down as lengthy wordy descriptions, similar to the description of *Nicki's three-count roundabout* in the previous chapter (Ch. 25). Since then, a common notation has emerged that

allows us to capture the essence of these patterns compactly. This notation was originally suggested by Aidan Burns, and while it has evolved quite a bit with contributions from many in the community, it is generally called the *Aidan notation*.

The Aidan Notation

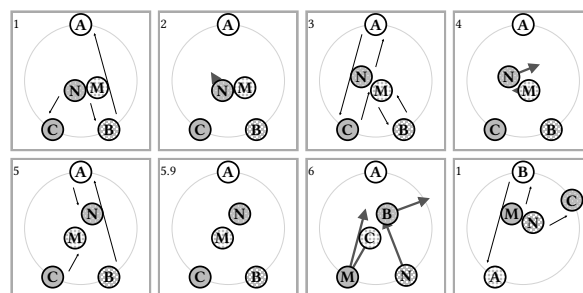
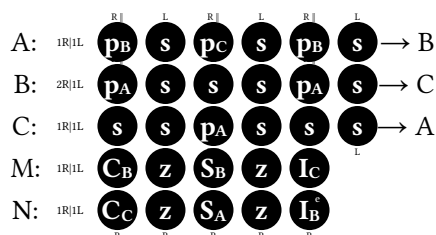
The basic idea of the Aidan notation is as follows: A base pattern is described with a conventional passing notation, such as basic synchronous throws (Ch. 3) or moving group patterns (Ch. 23). In addition, the action of each manipulator is described on a separate line below the base pattern. A manipulator's actions are described in terms of the three concepts *carry* (C), *substitution* (S), and *intercept* (I). To identify which throw is carried, substituted, or intercepted, we usually need two pieces of information: the time when it is thrown and the passer who will receive it. We notate this with the letters C, S, and I on the throw beats and use a subscript to identify the role of the passer who would receive it (sometimes additionally a superscript is added indicating the role where the pass is coming from).

In this notation, *Nicki's three-count roundabout* can be written as:



That is, on the first beat, the manipulator substitutes the throw to B, which is A's right-handed pass to B. On the third beat, a throw to B is intercepted, which is B's self. On the fourth beat, the manipulator carries the throw to A, which would have been a left-handed pass from B.

The scheme generalizes to patterns with more passers and more manipulators. For example, this is the notation for the five-person pattern Scrambled 3-V (Ch. 30), with two manipulators M and N based on a rotating two-count vs. four-count feed (Ch. 23):



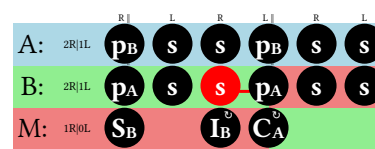
For common base patterns, especially for the rotating two-count vs. four-count feed (Ch. 23), it is also common to describe a manipulator pattern just in terms of the manipulator's actions – for example, describing Scrambled V (Ch. 30) as $C_B S_B I_C$.

Changing Roles

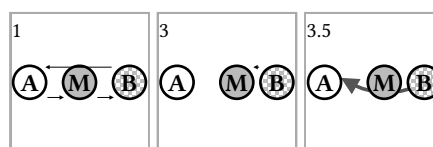
One thing that makes the Aidan notation somewhat challenging to read is *relabeling*, where passers switch roles. There are now two places where relabeling happens: (1) The relabeling of the base pattern after the last beat, as described for moving patterns (Ch. 23), and (2) relabeling when the manipulator switches with a passer in the base pattern. Only the former is explicitly written down in the Aidan notation, with arrows at the end of a row.

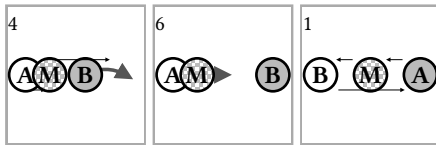
The relabeling for switching manipulators is less obvious to recognize in the notation. It happens when the manipulator takes over the role of another passer *triggered by intercepting* a throw to that passer, often in the middle of the pattern. At the time the throw is intercepted, the passer who would otherwise have caught that throw becomes the new manipulator and continues with the manipulator's actions.

In *Nicki's three-count roundabout*, the switch between M and B is triggered when M intercepts B's self (highlighted below). The intercepted self is thrown on beat 3 and intercepted on beat 4, so beat 4 is where M and B switch (also highlighted with background colors and changes during the animation). On beat 4, the previous manipulator now has two clubs and takes over the remainder of B's sequence, in this case by also catching the pass that A throws on beat 4 to B. At the same time, the previous passer in the role of B becomes the new manipulator M and starts with a carry on beat 4. At the end of the iteration, the passers in role B (originally M at the start of the iteration) and A swap roles, and the pattern repeats.



A → B → M → A





Turntable and turning back. Having both explicit relabeling at the end of the pattern and implicit relabeling at intercepts in the middle is not intuitive to read and can make it tedious to identify how roles change in the previous or next iteration of the pattern. Hence, it is now common to write a *turntable* about how roles change at the end of the pattern, like the “ $A \rightarrow B \rightarrow M \rightarrow A$ ” for Nicki’s *three-count roundabout*. This shows that the passer with the role A will start the next iteration in role B, the passer in role B will start as M, and the passer in role M will start as A.

When turning back to learn the previous iteration – which is usually a great strategy to learn new patterns, see the corresponding explanation in moving patterns (Ch. 23) – we simply follow those arrows backward.

When the turntable is not available for a pattern and deriving this from the notation is inconvenient, here is another practical approach for turning back after having learned one or two iterations of a pattern: Juggle the pattern as a group for one iteration and stop. Everybody should now recognize which role they have (e.g., in *Nicki's three-count roundabout* B would recognize that they now do M's actions). Everybody now points to the person who previously had that role. The pointing should form a circle – the equivalent of the turntable above. To move back one iteration, everybody goes to the starting position of the person who points *at them*.

Movement

As for moving patterns (Ch. 23), the Aidan notation does not describe how passers move, only when things happen.

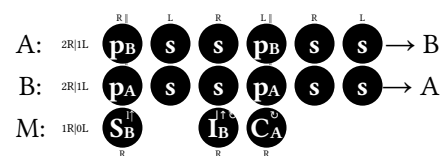
Manipulator patterns usually inherit some movements from a base pattern. The base pattern of *Nicki's three-count roundabout* is a stationary three-count between two passers, so it has no movement beyond the manipulator. Walking feeds (Ch. 23) are common as a base pattern for manipulator patterns with four or more passers. Movement is usually described outside the notation.

There is also no common notation for describing the location of the manipulator or *how* they steal and place clubs, that is, whether to steal early or late and whether to place from below or above as described in our introduction to manipulator patterns (Ch. 25). Some patterns have canonical forms that are passed verbally or through videos, but it is equally common that passers will just experiment and figure out what works. For example, for *Nicki's three-count roundabout*, I would recommend *late* steals for both substitution and intercept, placement from below for carry and substitution, and the manipulator moving to the left of the pattern when intercepting the self, but there are also videos of the pattern with other movements.³

For this book, since we need the information for computing animations anyway, we experiment with optional superscript symbols for intercepts and passes to indicate common conventions. We use:

- e for early steals
- l for late steals
- v for very late steals
- † for placement from below
- ‡ for placement from above
- c for a steal caught as a chop, as in Chopabout (Ch. 28)
- o for an action standing on the outside of the passing lane
- x for an action standing on the outside of the *opposite* passing lane
- b for an action standing behind the original receiver of a throw
- ↻ and ↺ for moving clockwise or counter-clockwise around a passer
- f for flipping a club on a zip

With this, *Nicki's three-count roundabout* indicates late steals, placement from below, and clockwise movement when B and M swap can be written as follows:



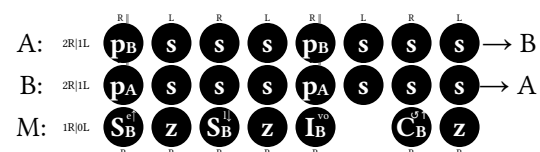
Local Notation (experimental)

The web version of this book includes a description and an alternative rendering of each manipulator pattern in an experimental *local* notation. To not render each pattern in two different notations, we omit this from the pdf.

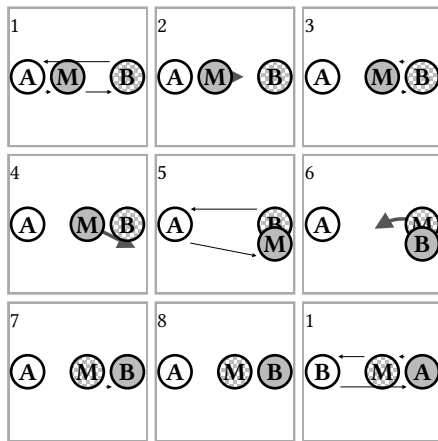
27. Roundabout

Prerequisite: 6-club four-count (Ch. 3) | **Helpful:** Nicki's three-count roundabout (Ch. 25) | **Next:** Roundabout variations (Ch. 28), north-wall patterns (Ch. 29), or Scrambled V (Ch. 30)

The *Roundabout* is the first manipulator pattern many passers learn. It is the *6-club four-count* of manipulator patterns: (1) it is universally known and relatively easy to find passing partners who can do it, (2) it is easy to juggle and visually appealing for performances, (3) it is the first manipulator pattern that many passers learn, but not a great intro pattern (Nicki's three-count roundabout (Ch. 25) is a better starting point), (4) it has many variations (Ch. 28) and tricks to explore, and (5) it is entirely right-handed with many more interesting patterns to move on to afterward. It is now so common that it has recently made it into juggling games at the IJA and EJC festivals.


$$A \rightarrow B \rightarrow M \rightarrow A$$

³<https://passing.zone/pattern/nickis-3-count-roundabout/>



The *Roundabout* is based on 6-club four-count and the manipulator has the following actions on right-handed beats:

- Beat 1: Starting in the middle of the pattern between the passing lanes, M substitutes a pass from A to B. The canonical version is to steal the pass early with the left hand and place the other club with M's right hand into B's left hand from below. After the substitution M zips the stolen club to the right hand, holding it on the body, to get ready for the next step.
- Beat 3: Now standing in front of B, M substitutes B's right-hand self. The canonical version is for M to steal the self late catching the handle, and then to spin out clockwise to the right side of B (the rotation following the hand movement that steals the self), placing the other club in M's right hand into B's left hand after the turn when standing next to B (this is commonly known as the *German turn*). B usually helps by throwing an underspun, easy-to-catch self – a *pelf* (Ch. 25). Again, after the substitution, M zips their remaining club from their left to the right hand, holding it on the handle, to get ready for the next step.
- Beat 5: On this beat both A and B pass, but M intercepts the pass that would have gone to B, catching it with their left hand. Usually A helps by throwing the pass wider as M stands next to B. After this, the passer previously in the B role becomes the new manipulator.
- Beat 7: The new manipulator carries B's self by stepping forward and flipping both clubs to hold them on the body, turning 180 degrees counter-clockwise to face the new B, and placing the club from their right hand into B's left hand. The previous manipulator, now B, simply holds both clubs and steps to the right to take B's position; optionally they can flip the right club. Their first action is a self from the left hand to receive the carry. After the carry, the new manipulator zips the club from their left to their right hand, holding the club on the body, and continues turning counter-clockwise by 90 degrees to get ready for the substitution on beat 1.

From here the pattern repeats and all passers go through all roles. The passer initially in role A starts the next cycle in role B, the passer initially in role B now starts in role M, and the passer initially in role M now starts in role A.

Hints. Beginners find the zips and club rotations of the manipulator challenging, and teachers should focus their attention on explaining this clearly. As a general rule, all clubs are stolen with the left hand and are placed with the right hand. After each carry and substitution action, the manipulator resets by zipping their remaining club to the right hand. If the pattern is juggled the canonical way (flipping both clubs before the carry, early steal on the first substitution, and late steal on the second), all clubs should have the right orientation and do not need to be flipped during a zip.

As usual, slowing down the pattern and throwing lofty passes helps a lot. Especially the intercepted pass should be thrown late and lofty in the beginning when the manipulator is still figuring out where to look after a stressful sequence of substitutions and turning. The passers can help the manipulator a lot by slowing down the throws that are stolen and throwing a nice *pelf*. The sequence carry, zip, and steal (for the substitution) can feel very fast and can be practiced separately.

There are lots of small differences in how the pattern can be juggled that are not canonical but common: On the first substitution, the pass can be stolen late, which requires turning the club to hold the body on the zip. The second substitution is often done without the German turn by stealing and placing the club in front of B and only turning (counterclockwise) after the placement. The manipulator may throw a self to their empty hand instead of the zip as the last action before the intercept, or alternatively flip the club they just zipped.

28. Roundabout Variations

Prerequisite: *Roundabout* (Ch. 27) | **Helpful:** *Synchronous 7-club and 8-club patterns* (Ch. 5) and *moving patterns* (Ch. 23)

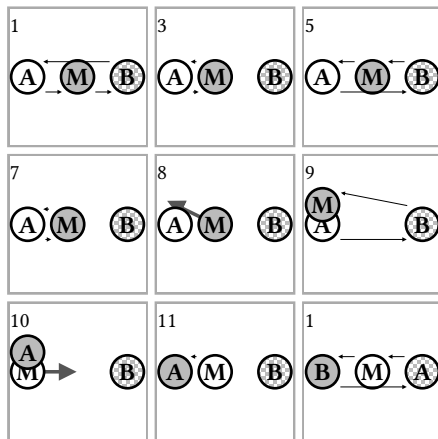
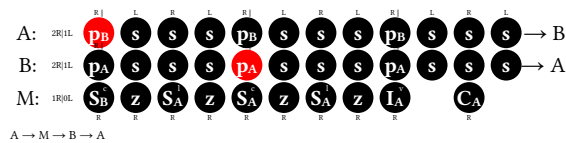
There are many variations of *Roundabout*, patterns that incorporate *Roundabout* in larger group patterns, and patterns that are conceptually similar to the traditional *Roundabout*.

Conceptually Related Patterns

After the standard *Roundabout*, there are a number of other 3-person patterns that are one-sided with all right-handed manipulations, each followed by a zip, that are good next patterns with only gently increased difficulty.

Chopabout. The *Chopabout* is a longer, more challenging pattern that introduces a new kind of takeout: the chop substitution. When substituting a pass from A to B on the first beat (highlighted), the manipulator faces A and steals the pass thrown as a chop and places the other club behind their back to B. The same happens in the opposite direction on the fifth beat. The passer throwing the chop usually needs to prepare a beat early with a narrow self, but in a pinch, a reverse spin zap or even a pelf or normal zap will do instead of a chop. The chop is caught with the left hand, upside down, catching the body (or the middle) of the club. The manipulator places the club behind them with the right hand, raising the hand high to make it easy for B to grab; B needs to actively look for the club. The

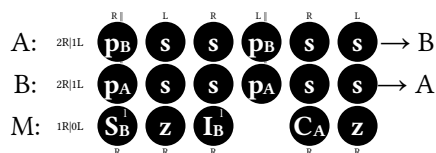
placement is often done blind without looking, but with some practice, the manipulator has enough time to look back to check and improve their placement.



Chopabout Video

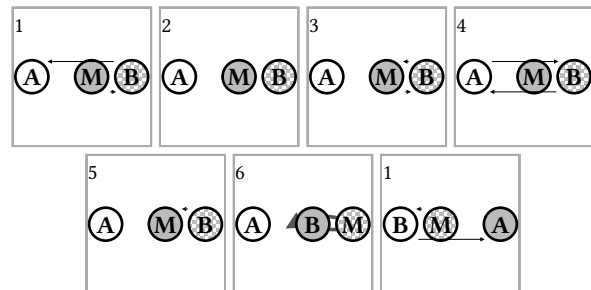
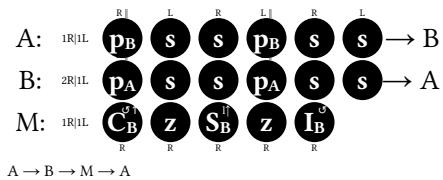
All spinning in *Chopabout* is clockwise, including the German turn at the end (as in *Roundabout*) and on the carry (opposite to *Roundabout*). The manipulator spins continuously except for the substituted self after the first chop. Usually the carry is placed with the left hand, so that no zip is needed to catch the chop just afterward.

Three-count roundabouts. Beyond Nicki's three-count roundabout (Ch. 25), there are two classic one-sided, right-handed *Roundabout* versions based on *6-club three-count*.



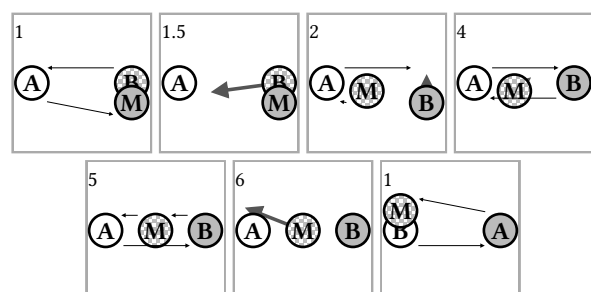
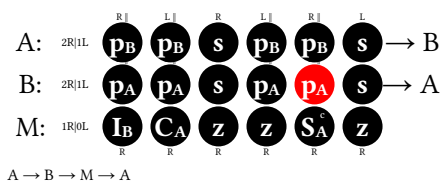
In this one, the manipulator intercepts a self, turns around, and passes that intercepted club immediately on the next beat as B with their left hand – this is very fast for the manipulator.

```
<div class="warning">
This pattern breaks common assumptions about
how carries work, hence I cannot render it
correctly. The actual manipulator sequence is
SB IB CB (not CA).
</div>
```



This one is fairly straightforward, except that there is little space to place the club for the substitution, because B throws a left-handed pass at that point. Therefore, the manipulator typically places the substitution from below, even though it is a self.

Champi. *Champi* is a short, one-sided takeout pattern based on *6-club pass-pass-self* that includes a chop on the fifth beat (see *Chopabout* above).



Messing with Roundabout

As many passers know the classic *Roundabout* so well, there are several more or less silly variations to challenge the pattern.

Long-distance Roundabout. Sometimes used for games, the idea is to start *Roundabout* at a normal distance but continuously have to move the passers further apart, making the passes longer and longer and requiring the manipulator to cover increasingly long distances.

Tess-about. The idea is to isolate one passer in place and have the pattern move around them. This can accommodate passers who cannot or do not want to walk, and can be an interesting challenge in itself. Usually the isolated passer stands (or sits) in one location but can turn. When the isolated passer would walk across the pattern, instead the other two passers walk the opposite direction to move

the entire pattern relative to the isolated passer. The sequence is fairly easy to learn and repeats quickly. The general idea can be used to *tessify* any moving and manipulator pattern.

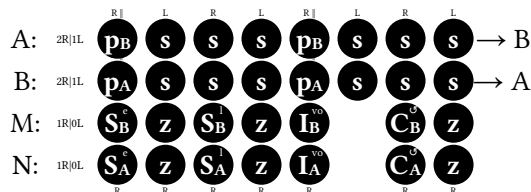


Video

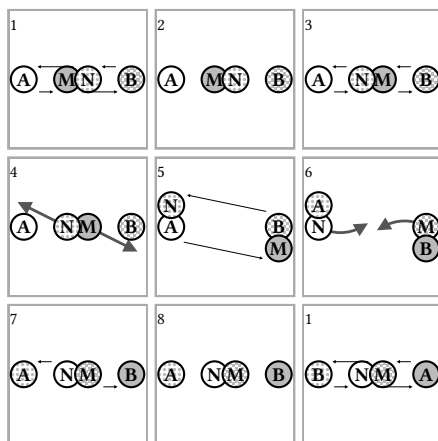
Clubabout. Instead of isolating a passer, here a club is isolated and the pattern moves around the club. That is, if the club would be passed, it is just thrown straight up, and all passers move relative to the club. Typically the club is isolated only in the direction between the passers, allowing some wiggle room for movement between the left and the right hand; a line on the floor is usually used to indicate the position. The pattern is exceedingly long (168 beats, since each club goes through all positions in *Roundabout* in a single orbit), but it is a fun and silly exercise to try any segment of it.

4 and 5 Person Patterns based on Roundabout

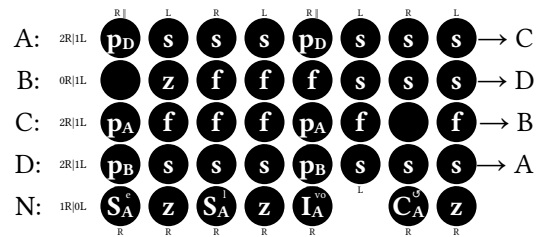
Two manipulators (4 passers). A simple way to include a fourth passer is to have two manipulators doing the roundabout sequence but in opposite directions.



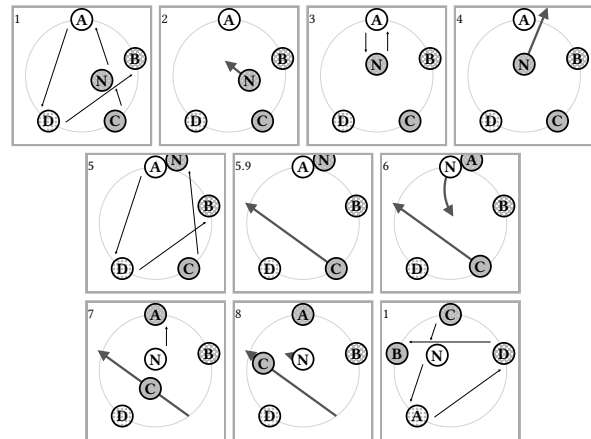
A → N → B → M → A



Shooting star with Roundabout (5 to 7 passers). A manipulator doing the *Roundabout* manipulation can be integrated into the moving pattern Shooting star (Ch. 23) in the variation where a passer walks after every other pass with *one* club. The manipulator simply does the roundabout sequence between C and A, swapping out the target passer who then does the roundabout sequence on the next segment of the star.



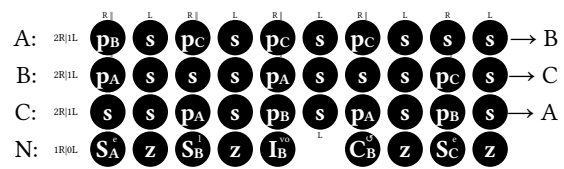
A → N → C → B → D → A



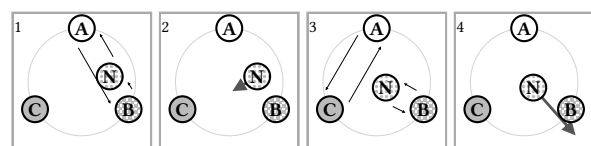
Variations:

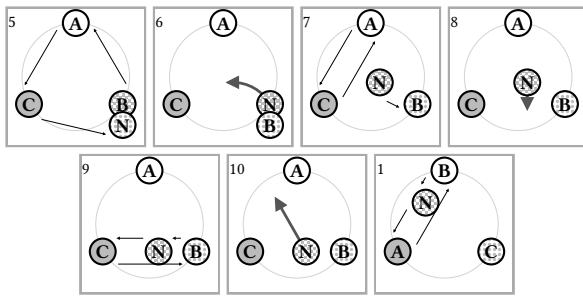
- Additionally or alternatively, additional manipulators can do the roundabout sequence between D and B and between A and D, supporting up to three Roundabout manipulators in the pattern at the same time.
- Furthermore, in what's called *Shooting star with manipulator and chaser* (or just *Chaseabout*) when manipulating between C and A, rather than waiting with two clubs for their last pass, C can follow the manipulator M across the pattern when M substitutes the pass to A and bring the manipulator the intercepted pass, to then run to their position behind A (on the outside of the circle).

Bounceabout (4 passers). *Bounceabout* is a fairly easy *Roundabout*-style pattern for four passers doing a kind of *two-count* vs. *four-count* feed in a triangle formation (Ch. 22). The takeout sequence is Roundabout-like but two beats longer, substituting a second pass (i.e., bouncing off of one corner to the next) before substituting the self and swapping roles.



A → B → N → C → A

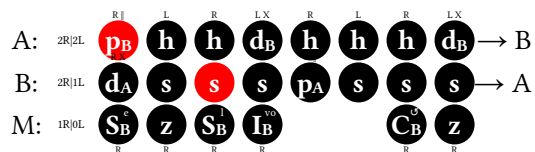




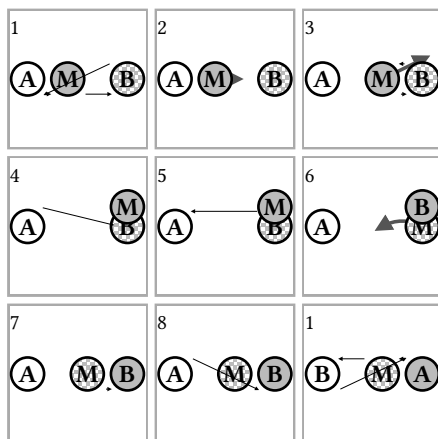
Adding Extra Clubs

There have been several attempts to create *Roundabout*-style patterns that use more clubs and higher passes. Most commonly, the goal is to keep the manipulator sequences as in the base pattern, but have the two passers juggle a harder sequence with an extra club.

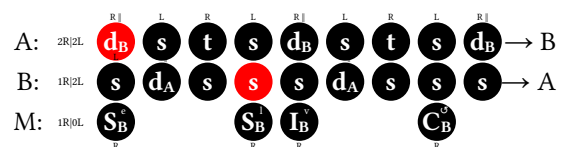
Extra-club roundabout. The original *extra-club roundabout* is a good example of this strategy. Notice that the manipulator actions are the same as in *Roundabout* and all throws that are stolen remain unchanged from the base pattern (highlighted), but a lot of other throws are changed to crossing double passes and heffs. Due to quirks of the notation, the intercept is notated one beat earlier, since it is intercepting a double pass thrown one beat earlier, but caught at the same time as in regular roundabout. The base pattern itself is a challenging, long synchronous 7-club pattern, specifically designed to keep the manipulator actions unchanged.



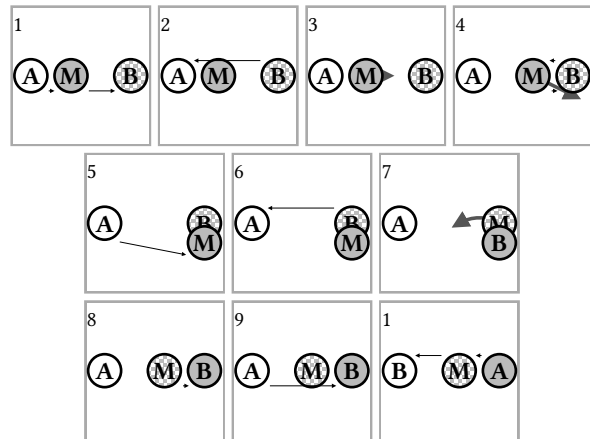
$A \rightarrow B \rightarrow M \rightarrow A$



Ronjabout. *Ronjabout* is a newer and more elegant solution to the problem, making the pattern one beat longer but maintaining a simpler base pattern with all straight double passes (with the usual trick (Ch. 5) of having one passer start left-handed). Here the manipulator is technically substituting a double pass and has more time for the substitution, though it may be barely noticeable as they wait for an empty hand anyway.



$A \rightarrow B \rightarrow M \rightarrow A$



Beyond. While not common, there are challenging extra-club versions of many common patterns and also patterns that add two clubs (e.g., *9-club Roundabout*), with triple passes and trelfs. Cameron Ford created an excellent video explaining concepts and showing examples. For other takeout patterns on more challenging base patterns of seven and more clubs explore takeouts in four-handed siteswaps (Ch. 33).



9-club Roundabout
on passing.zone



Cameron's explainer video:
<https://vimeo.com/1046051913>

29. North-Wall Patterns

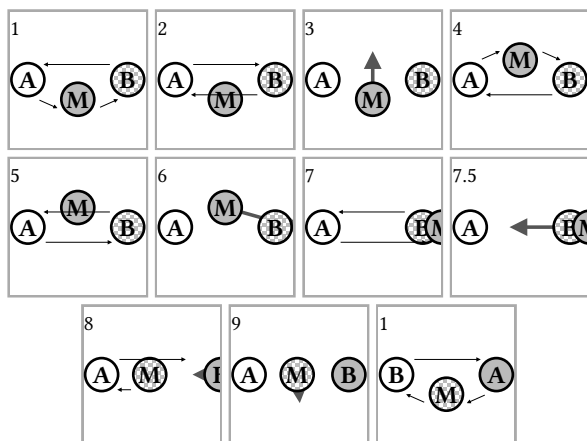
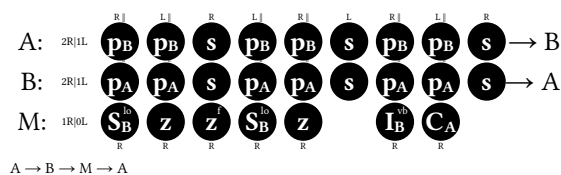
Prerequisite: Nicki's three-count roundabout (Ch. 25) | **Helpful:** Roundabout (Ch. 27) and Roundabout variations (Ch. 28) | **Next:** Four-handed siteswap abouts (Ch. 33)

All 3-person *Roundabout*-style patterns on base patterns with an *odd period* are symmetric in that they have a left side and a right side; every passer goes through all passing and manipulator positions both left-handed and right-handed before the pattern repeats after six segments.

These patterns are often called *north-wall patterns* because actions relate to fixed directions in a room: Assume that passers A and B stand in the east and west position of the room; specific actions always happen on the north or south side of the room. For example, a carry would always happen at the north side – the left-handed club when carrying west to east and the right-handed club when carrying east to west. It is often easier to remember whether an action happens on the north or the south side, rather than whether it is left- or right-handed in each direction. That is, after each iteration, the pattern repeats after *flipping* it, rather than *rotating* it by 180 degrees as even-period *Roundabout*-style patterns do.

Phoenician Waltz

Phoenician Waltz is a good first challenge for learning north-wall patterns. It is based on *pass-pass-self* and widely known.



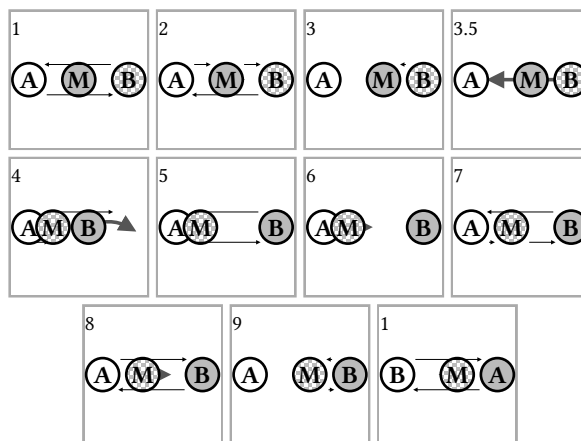
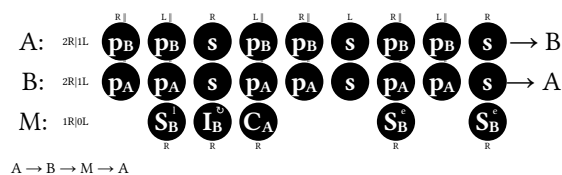
Phoenician Waltz Video on passing.zone

The substitutions happen from outside the pattern, the first on the south side facing north, and the second after walking through the pattern on the north side facing south. The intercept is caught on the south side from behind B, and the new manipulator carries the next club on the south side and steps out of the pattern to start the next segment by substituting a pass on the south side in the same direction as the carry (catching with the same hand that just placed the carry, which is the opposite hand and in the opposite direction compared to the previous cycle). Notice that the manipulator needs to flip their club between the two substitutions while walking through the pattern.

Turning back. North-wall patterns tend to be long – for example, *Phoenician Waltz* repeats after 54 beats compared to *Roundabout*'s 24 beats – because they repeat after six segments rather than three. As usual, it is a good idea to learn a segment and then turn backward to learn the previous segment, which then connects to the previously practiced start. In north-wall patterns, we can turn back as usual using the turntable (see notation (Ch. 26)), but the previous segment starts with the opposite hand (i.e., left-handed start rather than right-handed and vice versa) and the manipulator faces the *same* direction in the room as the manipulator in the previous segment (e.g., standing south of the pattern, facing north, in *Phoenician Waltz*). To turn back three segments at once, that is, half the pattern, all passers keep their positions and simply switch which hand they start with.

MinuEd

MinuEd is another popular pattern based on *pass-pass-self*, which is substantially more challenging than most *Roundabout*-style patterns.



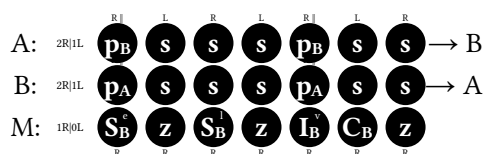
Ed's juggling.tv video of *MinuEd*

There are two somewhat unusual parts. First, the fast substitute-intercept sequence is known as a *pop*: The receiving passer throws ("pops") a pelf almost as a flat and the manipulator hands in the substitution from below and catches the pop in the same upward motion. Second, the pattern does not use zips for the first two substitutions, but instead catches the second substitution early with the "wrong" hand (catching the self on the north side with the hand on the south side); this results in two consecutive placements into the south hand from different hands for what is known as the "shuffle" or the "macarena".

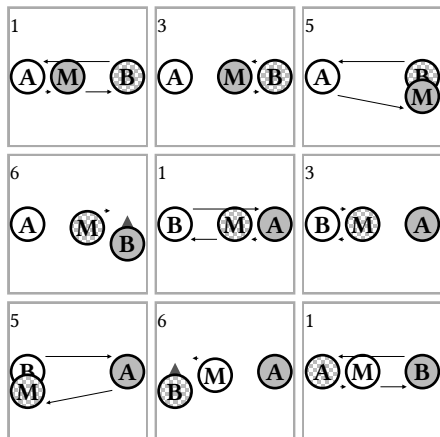
Hints: Slow and lofty passes will help a lot, especially for the challenging turn after catching the pop, but also for the rest of the pattern. The manipulator should stay in the middle of the pattern, walking between the two passing lanes. The manipulator starts facing north, the pop is always on the north side, and the carry is always on the south side. The canonical form of the pattern has no zips.

Dolby Surround

This pattern leaves out the last self of the *Roundabout* sequence to turn *Roundabout* into a 7-beat-long north-wall pattern. The pattern essentially consists of juggling the *Roundabout* right-handed in one direction (e.g., going east) and left-handed the other direction. In theory, it is very easy to learn, because it is so similar to *Roundabout*, but at the same time it can be very challenging to do the *Roundabout* parts left-handed. It can be a fun challenge for passers who know *Roundabout* well but rarely do takeouts that are not fully right-handed.



$A \rightarrow B \rightarrow M \rightarrow A$



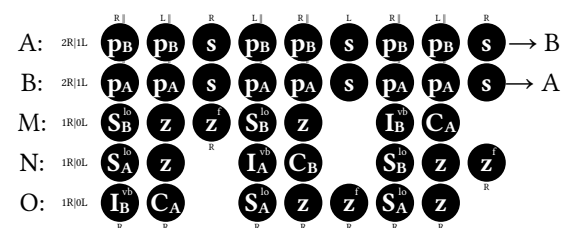
Aside from having to juggle the *Roundabout* left-handed, the main difference is the transition: The first step of the new manipulator is to quickly hand in their club from their south hand into the new B's north hand (the near hand), from where the normal *Roundabout* sequence resumes. The substituted pass is always on the south side and the substituted self always from the north hand, spinning out to the south side. It is important that the last action of the manipulator before catching the intercept is to do a zip, rather than a self – this is canonical in *Roundabout*, but many passers are used to throwing a self to the empty hand instead, which will not work here since that self is carried.

It can be helpful to simply practice left-handed *Roundabout* first to learn takeouts with the other hand and get used to spinning the other direction.

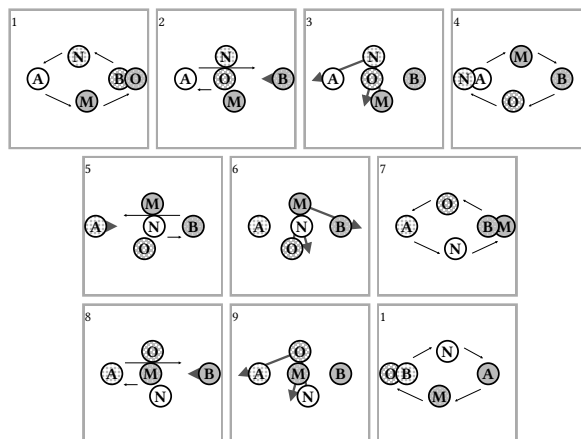
The same idea to switch directions by leaving out the last self and carrying to the opposite hand also works for other *Roundabout*-style patterns, such as *Chopabout*.

Opennball (5 Person)

Opennball is a five-person version of the *Phoenixian Waltz* with 3 manipulators all going through the *Phoenixian Waltz* sequence, but with offset starting points. This results in a pattern that feels like *Phoenixian Waltz* locally, but without ever pausing in a *pass-pass-self* sequence for long. Also, all but a single pass that is going back and forth across the pattern are manipulated.



$A \rightarrow N \rightarrow B \rightarrow O \rightarrow M \rightarrow A$



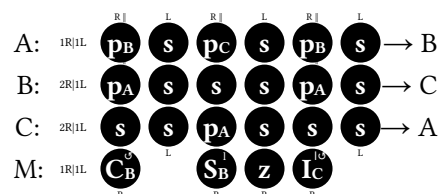
There are many more north-wall patterns to explore, but they are less common. Examples include, *Vashon Roundabout*, *Chopsticks*, *ChopDolby*, and *Dolby 5.1*. Passing.zone is a great source collecting most of them with notation and videos.

30. Scrambled V and other Scrambled Patterns

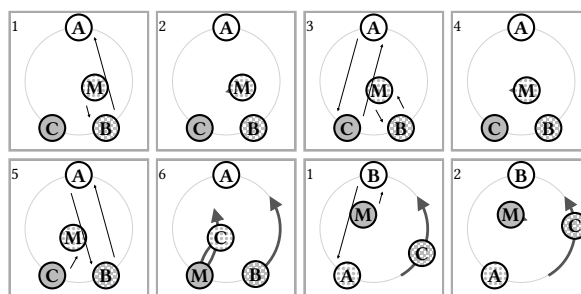
Prerequisite: *Roundabout* (Ch. 27) | **Next:** *Ambled patterns* (Ch. 31) or *Zippy* (Ch. 32)

Scrambled V is a standard 4-person manipulator pattern that is widely known and the first that most people learn, just like *Roundabout* for 3 passers. It is based on a rotating two-count vs four-count feed (Ch. 23) where passers stand in a V formation. Beyond *Scrambled V*, there are 26 more 4-person patterns based on the same rotating feed with similar takeout actions.

Scrambled V



$A \rightarrow B \rightarrow C \rightarrow M \rightarrow A$



The pattern starts with the feeder and the manipulator each having two clubs. The manipulator responds to B's pass on beat 1 and carries what would have been a pass from A to B, placing from below and then zipping the other club to get ready for the substitution. Standing in front of B, the manipulator substitutes B's self on beat 3, stealing late by grabbing the handle and placing from

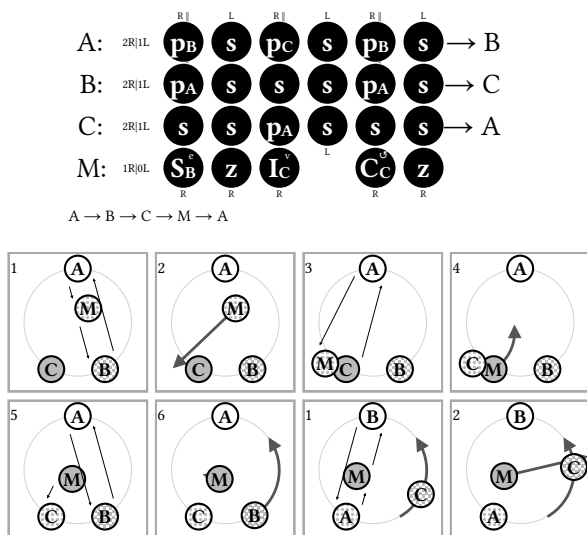
above. As the final step, the manipulator then intercepts (late, catching the handle) a self from C while passing in front of C to the outside of the pattern; the passer previously in role C now becomes the manipulator, flips both remaining clubs, and walks forward toward the previous feeder to repeat the cycle. The passer in role B walks across the pattern in a four-count, just as in the standard rotating feed (Ch. 23). The previous manipulator starts the next cycle by receiving a pass to start their feed.

Hints: It is common for the feeder to count right-handed beats, 1-2-3, to keep the timing. The feedees can help the manipulator a lot by throwing nice pelfs (Ch. 25) (B on beat 3 and C on beat 5). It also used to be common (and recorded in many videos) for the group to start the pattern by skipping the manipulator's first beat; this way both A and B can start with three clubs and a pass on beat 1 and the manipulator comes in from the side with one club to substitute the self on beat 3.

Turning back: As in moving patterns (Ch. 23) and other manipulator patterns (Ch. 26), when a segment or two works, it is useful to turn *back* to learn the segment before the current start. To move backward, switch positions as follows: The passer in role C walks backward across the pattern and the manipulator switches positions with A; the previous A now starts as M, B as A, C as B, and M as C.

Toast

Toast is another common pattern worth learning and remembering, where the manipulator substitutes a pass to B on beat 1, then jumps across the pattern in front of C to intercept the pass to C, from where the old C now starts with a carry to the old manipulator, as in *Roundabout*.



Hints: The feeder's first and second pass both go to the manipulator; it is really helpful to throw the second one lofty. The manipulator does not usually need to jump for the intercept, but it can be fun to exaggerate this part of the pattern.

The 27 Scrambles

There are a total of 27 manipulator patterns in the style of *Scrambled V* and *Toast* that each have the manipulator sequence carry-substitute-intercept on subsequent right-handed beats. Many passers know *Scrambled V* and maybe a few more like *Toast*, *B*, and *3* but, these days, it is more common to just pick a pattern from a list and try it from the notation. While some of them are a bit more difficult than others, they are all accessible when familiar with *Scrambled V* and *Roundabout*. In fact, learning the notation and trying to juggle a randomly assigned pattern is a common workshop format.

By convention, these patterns are simply notated with 6 letters describing the manipulator actions, such as "C_BS_BI_C" for *Scrambled V*, whereas everything else is implied, including the actions and movement of the other passers in a two-count vs four-count rotating feed. To learn a pattern, it is usually useful to first track what the manipulator does in each step and where the manipulator switches with one of the other passers (at the intercept). The notation does not describe where the manipulator should stand, or how they should steal or place a club, or where the passers can help with pelfs – many passers enjoy the challenge of identifying what works and finding solutions for how to navigate a tight spot, for example, performing a substitution with a chop (as in *Chopabout* (Ch. 28)) to avoid extra spinning or throwing a zap instead of properly placing a manipulated club to reduce the manipulator's walking. Alternatively, feel free to look up videos of these patterns online.

Here is the full list:

- C_AS_AI_A Pirouettes go crazy
- C_AS_BI_A Casbia
- C_AS_CI_A Cascia
- C_CS_AI_B 3
- C_CS_BI_B Wrong one
- C_CS_CI_B Zig Zag
- C_BS_AI_C chopped up V
- C_BS_BI_C Scrambled V
- C_BS_CI_C Postmen
- I_AC_CS_A Around the World
- I_AC_CS_B Unscrambled LB
- I_AC_CS_C Ivy
- I_BC_BS_A Unscrambled B
- I_BC_BS_B Chopped up B
- I_BC_BS_C Gentle Romble
- I_CC_AS_A Moonwalk
- I_CC_AS_B 3 variation
- I_CC_AS_C Wankle Engine
- S_BI_AC_B Anna-Maria
- S_CI_AC_B Panto
- S_AI_AC_B Buddy Check
- S_BI_BC_A Last one
- S_CI_BC_A WUST
- S_AI_BC_A Saibca
- S_BI_CC_C Toast
- S_CI_CC_C Right One
- S_AI_CC_C Vegemite Toast

Most patterns were originally recorded and named as part of the aidanburnsproject. Clean and consistent recordings of all these 27 patterns can be found at passing.zone.



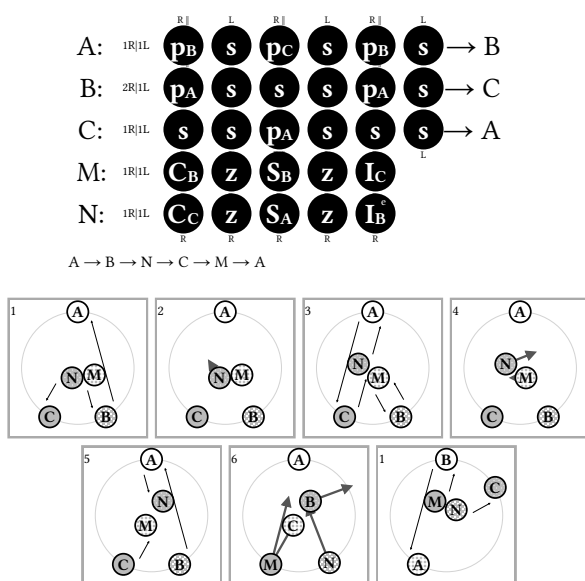
Original recordings
from aidanburns-
project



passing.zone
recordings of all 27
patterns

Combining Scrambles (5+ Persons)

It is possible to have two or even more manipulators in a scrambled pattern that each do different manipulator sequences. The best known among these is *Scrambled 3-V* that has both a *Scrambled V* manipulator ($C_B S_B I_C$) and a 3 manipulator ($C_C S_A I_B$):



Other combinations of common patterns are *B on Toast*, *3 on Toast*, and *Scrambled V-B*.

When adding even more manipulators, there is very little juggling remaining as many throws get manipulated and the number of objects equals or exceeds the number of hands in the pattern, such as in the 6-person pattern *Scrambled 3-B on Toast* combining $C_C S_A I_B$, $I_B C_B S_A$, and $S_B I_C C_C$.

Many, but not all patterns can be combined. An obvious conflict occurs when two manipulators would manipulate the same club on the same beat – for example *Scrambled V* ($C_B S_B I_C$) and *Postman* ($C_B S_C I_C$) both try to intercept the same pass. Having two manipulators interact, for example because one intercepts the carry from the other, as in *Scrambled V on Toast*, is possible but unintuitive. Without those there are still 162 combinations of two and 190 combinations of three Aidan patterns, most of which have probably never been juggled. Lukas Bonauer created a spreadsheet with all combinations. As a simple conservative heuristic, any two manipulators can be combined if their manipulator actions target distinct roles on each beat.



Spreadsheet of scrambles combinations

History and lore

Scrambled V (like *Roundabout*) predates any notation for manipulator patterns and predates the terminology of carry, substitute, and intercept. As far as I know, *Scrambled V* was the first of these patterns, named for the V formation. The patterns *B*, *3*, and *IV* were also very early and named for being the second, third, and fourth pattern in different numbering styles. *Toast* was named for the jump, like toast jumping in a toaster.

Aidan Burns' key insight was that all these patterns share the elements of what became known as carry, substitution, and intercept, and that these manipulator actions happen on every other beat. Around 2012, he suggested (a slightly earlier version) of the now common Aidan notation (Ch. 26) and identified that there are 27 different *scrambled* patterns that do the carry, substitute, and intercept actions on right-handed beats: 3 beats when the intercept can happen (first, third, or fifth beat), 3 throws that can be intercepted on that beat (A, B, and C), and three passers that receive the substitution 4 beats after the intercept (A, B, and C), resulting in $3 * 3 * 3 = 27$ combinations. Note, the recipient of the carry two beats after the intercept is decided by the intercept already: it replaces the action that the intercepted passer would have done next with their right hand.

By the time of Aidan's untimely death⁴ in 2014, most of these 27 patterns had not been juggled or named. The community decided to embark on a distributed project to name and film two rounds of each pattern, which resulted in one video with all of them: aidanburnsproject and the names listed above. Since then, several groups have juggled all of them.

Aidan, when he introduced the notation, made many assumptions that were true for *Roundabout* and *Scrambled V* but that are not necessary, such as that all manipulator actions happen on right-handed beats and that they are always two beats apart. The next chapters introduce some of the more recent developments that break with these assumptions.

31. Ambled Patterns

Prerequisite: *Scrambled V* (Ch. 30) | **Helpful:** *Extra club rotating feed* (Ch. 23) | **Next:** *Zippy* (Ch. 32) or *takeouts in four-handed siteswaps* (Ch. 33)

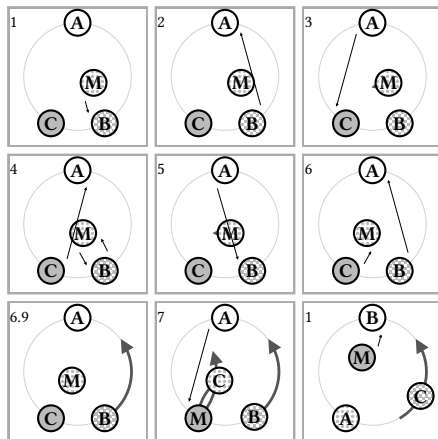
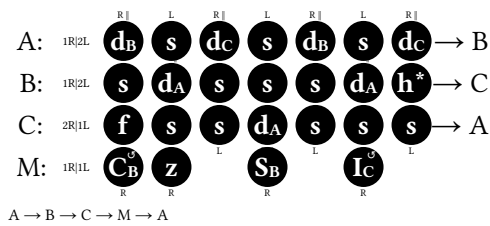
Ambled patterns are extra-club versions of scrambled patterns, juggled on double passes. They are all based on the extra-club rotating feed (Ch. 23) in *two-count* vs *four-count*. Since the extra club is distributed across three, not two passers, ambled patterns are more approachable than extra-club roundabout (Ch. 28) patterns.

Ambled V

Ambled V is the extra-club version of *Scrambled V*. As described when introducing its base pattern, the *extra-club rotating feed* (Ch. 23), all passes are doubles and the feedees start left-handed. With the extra club, the pattern

⁴<http://ezine.juggle.org/2014/10/15/an-obituary-to-aidan-burns/>

is one beat longer and the feeder has one extra pass to C in their feed, and B needs to fill one extra beat when walking across the pattern (e.g., double self, juggling slow, or triple pass).



Hints: The carry has an extra beat to walk (“amble”) across the pattern. The manipulator should look up immediately after the intercept to look for their next incoming pass. More than aiming for a specific placement, the feeder should try to throw the last two passes (caught by the previous manipulator) to the *same* place.

Several other scrambled patterns work with the same base pattern; for example, *Ambled Toast* and *Ambled B* are straightforward adaptations of *Toast* and *B*.

Ambled 3

The double passes, timing differences, and the extra beat create some challenges, so that not all patterns can be translated into ambled patterns easily, and some not at all. *Ambled 3* is one of those patterns that needs a new solution.

```
<TODO-manipulator-sync >
A: 4pBx3 4pCx3 4pBx3 4pCx -- B
B: !34pAx 3 3 34pAx 4x -- C
C: !2 33 4pAx 3 3 3 -- A
M: !. C z ! (SCAd 3) IABe --M
positions: V(A,B,C)
move: Vmove(B,5.9,3)
</TODO-manipulator-sync>
```

Since the substitution of the pass on beat 4 is for a double pass, it takes an extra beat and would be placed just after beat 6, but the manipulator also needs to intercept the pass to B on beat 5, before they place the substitution! The common solution here is for the manipulator to first steal

the substituted pass (late, on the handle) and then turn to face A and throw a self with that hand to catch the intercept (also late, on the handle), and only then hand in the substitution as a zap. That is, the manipulator briefly has three clubs. Ideally the manipulator has both clubs on the handle to do the self-zap combination, rather than flipped. This trick is commonly referred to as *time travel*.

This can be difficult to read in the Aidan notation. The problem is that it is not only relevant when clubs are thrown, but also how long they are in the air and when they land. Causal arrows can be helpful approximations for how long clubs are in the air (they land a little after the end of the arrow). So if a club is stolen while a substituted club has not landed yet, the manipulator will have more than two clubs. The local notation makes it clearer what actually happens.

Unicorn Charge (5 Persons)

Just as multiple scrambled manipulators can be combined in the same pattern, the same can be done for ambled patterns. The most common one is *Unicorn Charge*, which is the extra-club version of *Scrambled 3-V* (Ch. 30), combining the manipulators of *Ambled V* and *Ambled 3*.

```
<TODO-manipulator-sync video="https://
juggling.tv/16543">
A: 4pBx3 4pCx3 4pBx3 4pCx -- B
B: !34pAx 3 3 34pAx 4x -- C
C: !2 33 4pAx 3 3 3 -- A
M: CB 1 !lx SB . IC 2 .. -- M
N: . C z (SCAd 3) IABe
positions: V(A,B,C)
move: Vmove(B,5.9,3)
</TODO-manipulator-sync>
```

Other Ambled Patterns and Combinations

Assuming always a sequence of carry-substitution-intercept on right-handed beats (but not necessarily every other beat), there are 45 ambled patterns, where many but not all roughly correspond to a scrambled pattern. For many of them, videos can be found on passing.zone. Here is a spreadsheet with all possible combinations: <https://passing.zone/lukas-ambled-sheet/> – however, note the nonstandard notation with the manipulator action written on the beat the causal arrow arrives.

Many combinations of these work, including *Ambled B on Toast*.

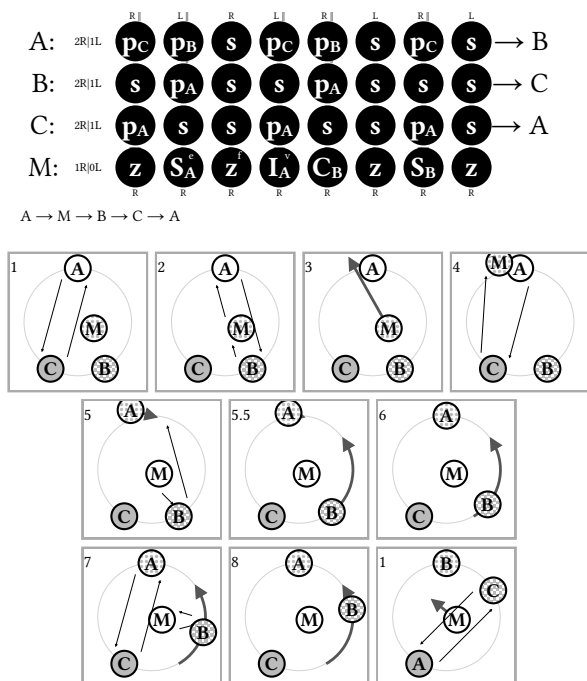
32. Zippy and other advanced 4-5 person patterns

Prerequisite: *Scrambled V* (Ch. 30) | **Next:** *North-wall patterns* (Ch. 29) or *takeouts in four-handed siteswaps* (Ch. 33)

All standard scrambled and ambled patterns are right-handed and use *four-count* or *two-count* as the base pattern. *Zippy*, based on a rotating pass-pass-self feed (Ch. 23), is a good starting point to explore patterns with

more interesting base patterns and even a left-handed takeout.

Zippy



Hints: Some find counting aloud 1 to 8 useful to keep the time and coordinate what to do. The first manipulation is left-handed. The manipulator should turn quickly out to the left of A after placing that substitution to make place for A's pass on beat 4. Then, the manipulator catches two clubs in a row, and B and C can make it easy by throwing them lofty. B starts walking after their pass on beat 5 (or even slightly earlier). The previous A is now the new manipulator, carries the pass, and then substitutes a pass, *while B is walking*, stepping quickly out to the left at the end to open B's passing lane. At the end, the manipulator has two zips (beat 8 and 1) that usually come naturally – the first zip is often automatic and the second happens when realizing that the next substitution is left-handed. Canonically, one of those two zips should be behind the back.

When *Zippy* became popular, some in the community started exploring variations on the same base pattern and found 81 variations. Of course, it is also possible to combine various combinations of those for a 5-person pattern, for example, *Chippy-Zippy*.



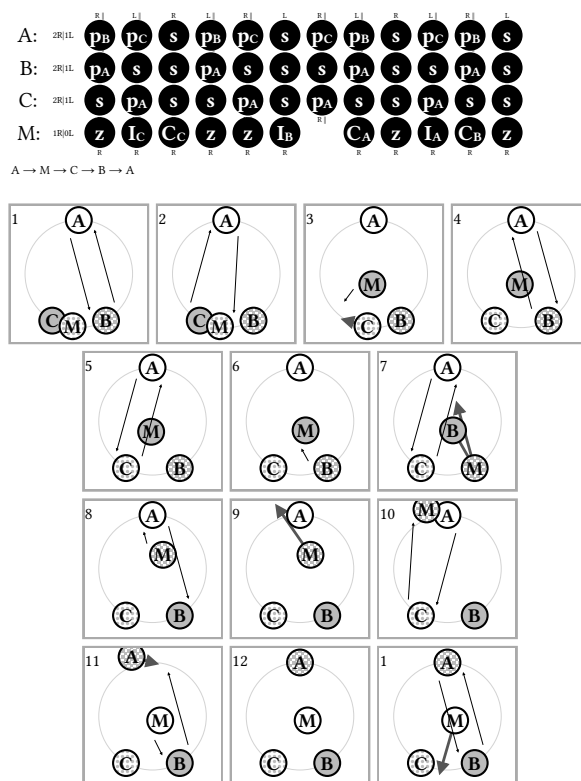
Spreadsheet with 81 zippy variations

Beyond Zippy

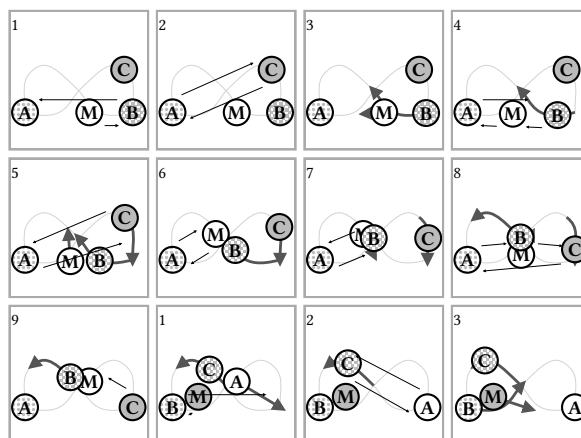
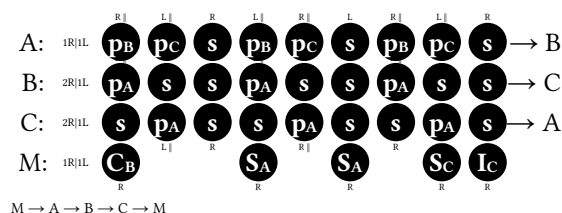
After *Zippy*, some more patterns explored synchronous ambidextrous base patterns. They can be challenging and interesting, but they tend to be less well known.

Dumb ways to die. *Dumb ways to die* is a pattern based on what's called a *civil war feed* as the base pattern. There

is no walking here in the base pattern, but positions rotate due to three manipulator switches within the sequence.



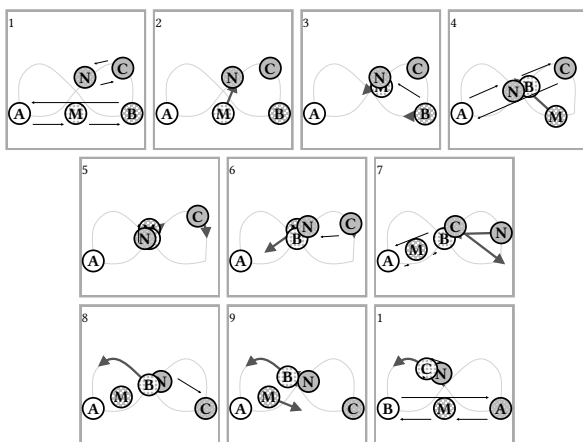
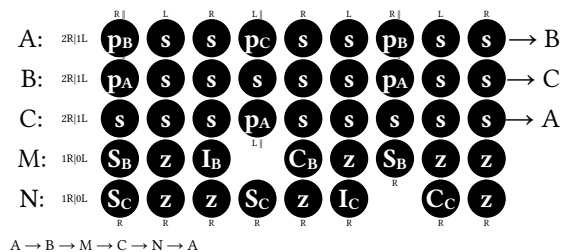
BrunEd. *BrunEd* was an early attempt to have a 4-person pattern with the *MinuEd* (Ch. 29) manipulator sequence, using a pass-pass-self version of *Bruno's nightmare* (Ch. 36) as a base pattern. This one is very challenging for the feeder, who needs to pass around the manipulator to various different locations. It has not caught on.



There is no equivalent of a north-wall pattern for 3 passers and a manipulator where everybody cycles through the pattern both left- and right-handed. Even pe-

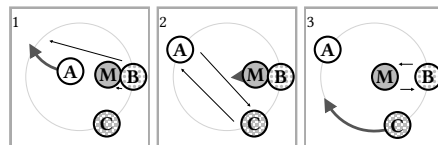
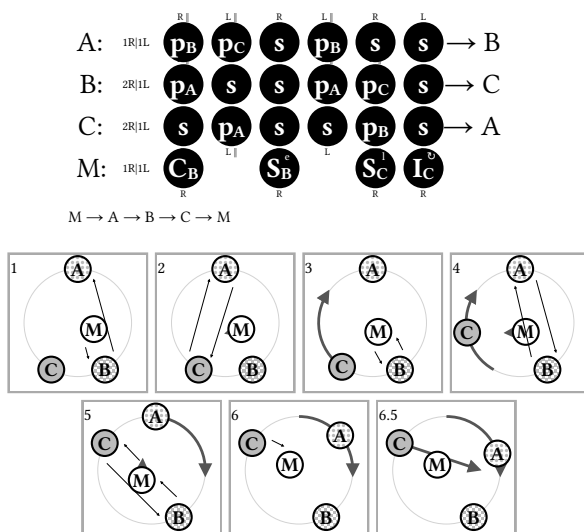
riod patterns like *Zippy* and *Dumb ways to die* do not flip sides, and odd period patterns like *BrunEd* simply have two passers doing the right side of the pattern and two passers doing the left side, without ever swapping.

Brunickolf. *Brunickolf* is a 5-person takeout pattern on the standard *Bruno's nightmare* (Ch. 23) base pattern. It is composed of two 4-person patterns that have only one of the manipulators each.



The 5-person pattern is a north-wall pattern with two sides, but the two 4-person patterns again have two passers do the right-handed sequence and two passers do the left-handed sequence.

MiniEd. *MiniEd* is another attempt of a 4-person pattern with a part of the *MinuEd* (Ch. 29) manipulator sequence, this one based on a very fast pass-pass-self feed with *two* passers walking clockwise on a three-count (C on beat 2 and A on beat 4) as the base pattern.



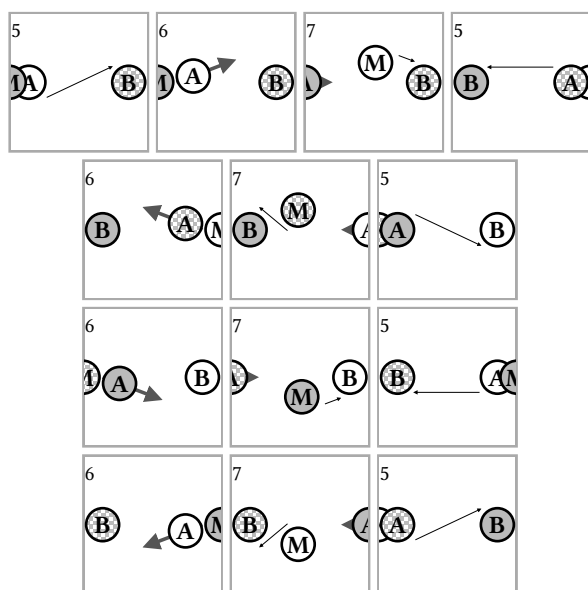
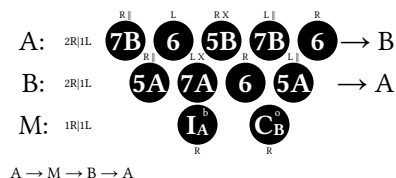
33. Siteswap takeout patterns

Prerequisite: Beginner four-handed siteswap (Ch. 10) | **Helpful:** Zaps (Ch. 13), doubles (Ch. 11), and heffs (Ch. 12) | **Next:** North-wall patterns (Ch. 29) and *Zippy* (Ch. 32)

Manipulator patterns on four-handed siteswaps form a category of their own, similar to north-wall patterns (Ch. 29). They are amenable to base patterns of different difficulty, from 5-club one-count (Ch. 1) to holy grail (Ch. 16). Just like four-handed siteswaps, they are truly ambidextrous. Each passer cycles through all positions four times: right-handed with straight passes, right-handed with crossing passes, left-handed with straight passes, and left-handed with crossing passes. As a consequence, even patterns with short sequences can take quite a while to repeat, and it can be tricky to track which side to walk to and whether to throw a pass straight or crossing.

567-about

For passers with a stable 756 (Ch. 13) (on both sides, straight and crossing singles), 567-about is probably the best entry into siteswap takeouts. It is fairly easy to learn and a good foundation for many others. (Passers without stable zaps might find *Catch the carrot* described below more approachable.)



The manipulator starts behind A and catches the second pass from B over A's shoulder, starting 756 with a self af-

terward. A becomes the new manipulator after their first zap and carries their next single pass to the same hand of B where they just threw their zap. Afterward, they walk behind B to intercept the next pass on the opposite side of where they just placed their carry. For the carry, it is common to always carry with the inside hand (i.e., left hand when walking to the right and vice versa) independent of which hand would have thrown the pass, and it is common to only flip one club or no club at all.

567-about has easy visual cues that make it much easier than many siteswap takeouts to remember where to go and where to throw things: (1) The carry always goes to the same hand as the previous zap, whether straight or crossing. (2) The intercept is always on the opposite side, so the manipulator always walks around B's back to the other side. (3) Rather than remembering crossing vs straight zaps and passes, throw the first zap after the intercept always to the opposite hand of where the manipulator just walked, then stack the single pass on the same side.

The easiest way to turn back is to turn back two positions at a time and simply switch from left- to right-handed start for each role.

Other Takeouts of Period 3 Siteswaps

The exact same takeout sequence on single passes from *567-about* can be straightforwardly applied to all other siteswaps of length 3 with at least one single pass, including 726 (Ch. 10), 786 (Ch. 12), 777 (Ch. 10), 972 (Ch. 11), 978 (Ch. 11), 975 (Ch. 16), *a77* (Ch. 14) and *aa7* (Ch. 14). The principle is always the same, with the exact same manipulator actions: intercept the single pass behind one of the passers, who then becomes the manipulator carrying the next single pass.

Manège à trois. This pattern is based on French three-count (786; Ch. 12) and fairly challenging at first. After the manipulator intercepts the pass to A, they start with a self to catch A's heff. It feels like intercepting two throws in a row.

Guillotine. In this fairly manageable 972 (Ch. 11) version, the passer throws their first double to the side where the manipulator carries their single pass, so it is useful to keep that double pass somewhat short and prudent for B to try to catch it.

Holy-grail-about. An exceedingly difficult pattern that requires a very stable *holy grail* (Ch. 16) pattern on both the straight and the crossing side, with lots of experience to recover.



Video collection on
passing.zone



Holy-grail-about
video

Lazy and about-about-about variations. All of these patterns have (somewhat silly) variations for 4 and 5 passers. With four passers, rather than walking around the passer they just carried to, the manipulator can go back to the side that they came from after the carry, which results in one passer continuously doing the base pattern against

three manipulators on the other side. This is now known as *lazy variations*, for example, *lazy 567-about*. With five passers, three manipulators are doing the same original carry-intercept action just offset, like in *Opernball* (Ch. 29), resulting in a quick pattern where all single passes are carried. I like the name *about-about-about*-patterns for these, for example, *567-about-about-about*.



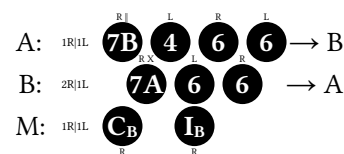
Lazy 567-about
video



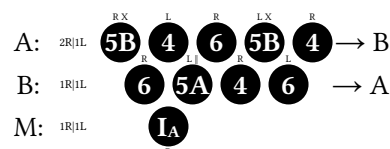
Holy-grail-about
video

Easier patterns

Catch the carrot. Fairly easy and short pattern based on Jim's three-count, async (Ch. 10) with useful color coding: one for the only club that gets passed (first throw of A) and two for the clubs that get intercepted with a pop ("the carrots"). The video is very helpful.



Killer-bunny-about. Based on 564 (*killer bunny*) (Ch. 13), with an intercept on the flip: The intercepted passer flips the club over and gives it to the manipulator next to them. This pattern (like all patterns that intercept flips or zips) does not have a carry since the new manipulator is already down to a single club; instead the new manipulator directly walks across the pattern to stand next to the other passer to intercept the next flip. In one direction, the manipulator walks straight; in the other they walk through the pattern crossing. In practice, the passers effectively stand in 3 corners of a rectangle and the manipulator always walks to the empty corner next. Again, watching the video is very helpful.



Catch the carrot
video



Killer-bunny-about
video

The same idea is possible with 78456 for a much faster pattern.

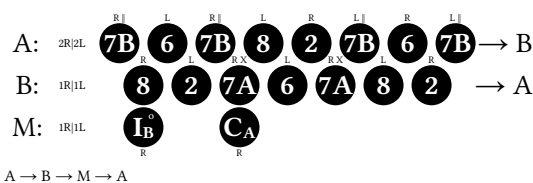
Why-Not Patterns

These patterns are long but fairly accessible for passers with a robust why-not (Ch. 12) pattern.

Dropbear. In this pattern, the crossing and the straight side are quite different: On the side with straight passes, the manipulator steps through the pattern in front of A between the carry and intercept (essentially following the club they just carried), and on the other side they simply remain on the same side and catch a crossing pass. The first action after the intercept is a pass that follows the last pass of B before the intercept.

```
<TODO-siteswap-group style='{ "components":
[ "aidan", "video" ] }' video="https://passing.
zone/pattern/why-not-about-2/">
A: 7 6 7 8 2 7 6 7 -- B
B: , 8 2 7 6 7 8 2 -- A
M: SB. IB,C
</TODO-siteswap-group>
```

What's that about. Probably the oldest siteswap takeout pattern (from 2014). The manipulator intercepts a heff, which is commonly thrown as a heffling (single spin). The pattern is fairly slow, with a long wait before the intercept.



Dropbear video



What's that about video

Techno Patterns

While not actually four-handed siteswaps, takeout patterns based on *techno* (Ch. 6) behave like siteswap patterns in that they repeat only after 12 segments, after going through all combinations of right/left and straight/crossing.

Tech-Yea. A fairly slow pattern, with extra time on the carry (since the last self can be skipped) and a very slow start after the intercept (wait, self, self, pass+self)

```
<TODO-sync-group video="https://passing.zone/
techno-manipulation-patterns/">
A: (4p 4x)(4x 2)(4x 4p)(2 4x)(4p 4x) -- BX
B: (4x 2)(4x 4px)(2 4x)(4px 4x)(4x 2) -- A↔X
M: CB . IB
</TODO-sync-group>
```

Tech-No. A shorter and much more challenging version where the manipulator catches both a pass from A and a self from B at the same time, starting self-self-pass+self in response, with the first self from the hand catching the pass. The movement for carry and intercept is the same as for *567-about*.

```
<TODO-sync-group video="https://passing.zone/
techno-manipulation-patterns/">
A: (4p 4x)(4x 2)(4x 4p) -- B↔X
B: (4x 2)(4x 4px)(2 4x) -- AX
M: CAB . IB
</TODO-sync-group>
```



Tech-Yea, Tech-No videos

Other patterns to try. The space of siteswap takeout patterns is still fairly new. There are several others based on *7-club three-count*, *five-count popcorn*, *parsnip*, and less common siteswaps. I previously collected a longer list with some additional explanation and some may have been posted to passing.zone with the tag “siteswap-about” since. To the best of my knowledge, there are no 4- or 5-person patterns yet.

34. Other Ideas

Prerequisites: *Roundabout* (Ch. 27) and *Scrambled V* (Ch. 30) |

Helpful: *Experience with many other takeout patterns* | **Next:** *Create your own patterns, find people at juggling festivals to teach you the latest, or explore passing.zone*

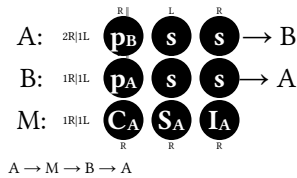
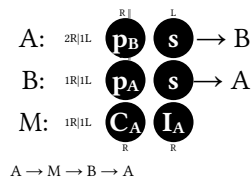
The history of takeout patterns seems to be a continuous pushing beyond the boundaries. When Aidan's takeout notation was introduced, it was useful to discover many more patterns with a similar style. Then new ideas were introduced, sometimes beyond what the notation could express, sometimes intentionally so. The following is a loose list of ideas that people have explored for takeout patterns.

Different base patterns. After early patterns on *6-club four-count* and a standard *four-count vs two-count feed*, many more base patterns were explored. First, other synchronous patterns, like *three-count* for *three-count roundabout* (Ch. 28) and *pass-pass-self* for *MinuEd* (Ch. 29), then unusual feeds (e.g., *pass-pass-self* and *civil war feed* for *Zippy* (Ch. 32) and *Dumb ways to die* (Ch. 32)), patterns with double passes like *Ambled V* (Ch. 31) and *Ronjabout* (Ch. 28), and finally various siteswaps like 786 for *Manège à trois* (Ch. 33).

Multiple manipulators. Many patterns combine multiple manipulators. There are many classic combinations of Aidan patterns like *Scrambled 3-V* (Ch. 30), but also simple ideas like having two manipulators do the same action but in different directions like in *Two Manipulator Roundabout* (Ch. 28) and multiple manipulators doing the same action but offset like in *Opennball* (Ch. 29) and *567-about-about-about* (Ch. 33).

Interacting manipulators. In most patterns with multiple manipulators, the manipulators are entirely independent. However, some patterns have played with ideas of having manipulators exchange clubs with each other, like in a pattern called *Kennedy*.

The pop. The realization that manipulator actions do not always need to be two beats apart enabled many more patterns. For example, in *MinuEd* (Ch. 29), the manipulator intercepts the self that is thrown to catch the placed club from the substitution on the previous beat, which is solved with *the pop*. This kind of action enabled many other patterns, including the very silly shortest takeout patterns (effectively just *pass-pop* and *pass-pop-pop* respectively):



Porting manipulator sequences to different base patterns. Using a familiar takeout sequence on a new base pattern can create an interesting challenge. In the simplest case, standard patterns can simply be juggled left-handed. For example, left-handed *Roundabout* (Ch. 27) is a substantial challenge for many experienced passers. More interestingly, many ambled patterns (Ch. 31) use the familiar takeout sequences from Aidan patterns (Ch. 30); *MinuEd* (Ch. 29) has been ported to *BrunEd* (Ch. 32), *MiniEd* (Ch. 32), and several others. Also some Aidan patterns have been juggled by having B walk through the pattern to the other side of A, resulting in “crossed” patterns.

Another idea is to leave out the substitution beat in Aidan patterns, resulting in shorter *Mini Scrambleds*. By furthermore leaving out the unmanipulated self beats, this results in two-beat long *Micro Scrambleds*.



Crossed patterns on passing.zone



Mini scrambleds on passing.zone

More intercepts. Usually the manipulator swaps with a passer once on a single intercept in the manipulator sequence, but it is easily possible to have multiple switches like in *Dumb ways to die* (Ch. 32).

More walking. There is no reason why the base pattern needs to be a feed with a single walk. For example, *MiniEd* (Ch. 32) has two passers walking in a manipulation pattern, similar to *El Niño* (Ch. 23).

Minimal walking. With a little help, most manipulator patterns can be juggled stationary in a triangle or square. A pelf is already helping in a normal pattern, but can also be thrown a bit further, and the placement of a carry or substitution can be thrown as a zap.

Different takeout styles. While some patterns have a canonical form, passers can always just try different forms of manipulator actions, for example, catching a substitution early rather than late, inserting a German turn or pirouette, or intercepting a pass at a different location from where it would usually go. Similar to *minimal walking*, this can make patterns easier and avoid unnecessary walking – for example, in *Scrambled 3* (Ch. 30) the manipulator usually turns out at the location where B would have walked eventually, not where B actually would be at the time of the carry. Changing takeout styles can also be used to make patterns intentionally harder, introducing

chops or unnecessary pirouettes, like in the Aidan pattern *Pirouettes go crazy*, *Tech-Yea* (Ch. 33), and *Squirrl-Whirrl-Twirrl* (TODO).

Extra flips and zips. Many patterns have gaps that can be filled with more zips and flips. For example, *MinuEd* (Ch. 29) has a two-beat gap between two manipulator actions, where the manipulator can zip their club twice (usually once behind their back). Most standard patterns, including *Roundabout* (Ch. 27) and all Aidan patterns (Ch. 30), have a one-beat gap after the intercept where the previous manipulator can flip a club. Opportunities are usually very visible in the *local notation* (Ch. 26) of a pattern. Some passers also find it an interesting challenge to do all zips behind their back, for example, in *Zippy* (Ch. 32).

Drinking patterns. Several patterns have one or multiple clubs that are never thrown, but only manipulated or zipped, like the substituted pass in *Unscrambled B* (Ch. 30). Some patterns are specifically designed to have such a club. These clubs can be replaced with a bottle – passing.zone has a collection, and Lukas Bonauer wrote a web tool specifically to identify orbits in takeout patterns



Drinking patterns on passing.zone



Lukas' orbit computations

On socks. A way to integrate more passers into a pattern is to add a manipulator who for a long time does not have any actions, but give them the task of running around the entire pattern. This is called “on socks”. Again, passing.zone has a collection.

How many carries again? In almost every pattern, the manipulation sequence starts with a carry. This is because typically at every point, except the very start, each passer has two clubs and waits for the time that they need to throw one because they are about to catch another. Usually, a manipulator starts with one club and now needs an intercept to get to two clubs, and only then the next incoming club (whether a pass or a carry) will start them juggling. Conversely, a passer who does not receive an incoming club at some point (due to an intercept) has no reason to throw anything and will just hold two clubs. At this point, they can carry one to get down to one. If the intercepted club is a flip or a zip, we are effectively stealing one of the passer's two clubs so they are immediately down to one club and do not need a carry – this is what we see in *killer-bunny-about* (Ch. 33).

Moreover, it is conventional but not necessary for a manipulator to start with one club. (a) If the manipulator starts without any clubs, they need to get two clubs after the intercept before they start juggling. In this pattern, the intercepted passer needs to get rid of two clubs to get to zero and therefore has two carries – for example, in *Roundabout* they would carry two selfs to B (video). (b) In contrast, if the manipulator starts with two clubs, substitutions become awkward because they now require a self (the manipulator briefly has three clubs between stealing and placing), but the manipulated passer does not need

any carry because they already start with two clubs (video). This is also effectively what is known as *time travel* in some ambled patterns like *Ambled 3* (Ch. 31), where the manipulator briefly has an extra club.

Interestingly, in several patterns having the manipulator start without clubs can make the pattern more challenging, including *Phonecian Waltz* (Ch. 29) and *catch the carrot* (Ch. 33). I've been trying to establish the naming convention to leave out the last letter for those pattern names, including *Roundabou*, *catch the carro*, and *Opérnb. Macaren* is a good example of a pattern that feels substantially different with one fewer club.

Now the big question is, what would it mean to intercept an empty hand (i.e., siteswap 0)?

Multiple intercepts? Some patterns feel like they have multiple intercepts. For example, in *Manège à trois* (Ch. 33), the manipulator catches a pass and a heff from different passers, in *Tech-No* (Ch. 33) they catch a pass and a self at the same time. Technically though, every manipulator switch has exactly a single intercept and all other throws that were in the air on the way to the intercepted passer at the time the intercept is caught is redirected to the previous manipulator. Weirdly, in *Tech-No* (Ch. 33), either pass or self could be considered as the intercept. This distinction is really only necessary to ensure a consistent notation, in practice when juggling a pattern, it may still very well feel like two intercepts.

Appendix

35. Appendix: List of Siteswaps

The following list contains all four-handed siteswaps of length 3, 5, and 7 with throws up to an a (excluding 0s, 1s, 3s, and local 4-4 sequences). The patterns are grouped by length, compatibility interface (see compatible siteswaps (Ch. 17)), and number of clubs. Note that the siteswaps here are normalized to start with the highest throw, which is not necessarily the best start for actually juggling the pattern (see siteswap theory (Ch. 19)).

The website <https://www.cs.cmu.edu/~ckaestne/siteswaps.xhtml> has a version of this list that can be filtered by throws.

pxx

3 clubs: 522

5 clubs: 645, 726, 825, 852, 942

7 clubs: 867, 885, 948, 966, a29, a47, a56, a74

9 clubs: a89, aa7

ppx

4 clubs: 552

6 clubs: 756, 774, 855, 945, 972

8 clubs: 978, 996, a59, a77

ppp

5 clubs: 555

7 clubs: 777, 975

9 clubs: 999

pxxxx

3 clubs: 52242, 72222

5 clubs: 66625, 72466, 74662, 84562, 85246, 86227, 86272, 86425, 86722, 88522, 92428, 92446, 92842, 96622, a2247, a2292, a2445, a2562, a2742, a5244, a6252, a7242

7 clubs: 86867, 88586, 88847, 92888, 94688, 96686, 96884, a2788, a2968, a5668, a6289, a6469, a64a5, a6667, a6685, a6784, a67a2, a6964, a7288, a7468, a7a62, a8449, a8458, a8584, a85a2, a8647, a8692, a8944, a8a52, aa249, aa258, aa294, aa564, aa645, aa744

9 clubs: a8a89, aa7a8, aaa69, aaaa5

ppxxx

4 clubs: 62525, 72425, 72722, 92522

6 clubs: 85746, 85845, 86727, 88572, 92586, 92847, 92928, 94692, 95628, 95646, 95844, 96627, 96924, a2495, a2585, a2747, a2792, a2945, a5249, a5258, a5645, a5744, a6257, a7247

8 clubs: a6969, a69a5, a7968, a7a67, a8949, a8958, a8a57, aa5a5, aa695, aa794

pppxx

4 clubs: 55244, 74252, 75224, 77222

6 clubs: 75666, 77466, 84567, 85566, 86277, 86475, 86772, 88527, 92478, 94458, 96456, 96672, 96852, 97428, 97446, 97842, 99642, a2297, a2567, a5294, a5564, a6455, a6752, a7292, a7445, a7562, a7742, a8552

8 clubs: 97888, 99688, a6789, a7788, a8499, a8589, a85a7, a8697, a8994, aa299, aa569, aa749, aa758, aaa55

pppxx

5 clubs: 75625, 75724, 77272, 85525, 92527, 92572, 95524

7 clubs: 95858, 95894, 96857, 96956, 97847, 97928, 97946, 99584, 99692, a2797, a2995, a5695, a5749, a5758, a5794, a5a55, a6757, a6955, a7747, a7945

ppxpx

5 clubs: 64555, 74455, 75256, 75274, 77425, 77722, 94552, 97522

7 clubs: 86777, 88577, 95678, 96677, 97478, 97496, 97586, 97892, 99458, 99647, 99944, a5299, a5569, a7297, a7495, a7567, a7585, a7792, a8557, aa555

9 clubs: a8999, aa799

ppppx

6 clubs: 75756, 77475, 77772, 85575, 92577, 94557, 95556, 95574, 97527, 97572, 99552, a5555

8 clubs: 97978, 99697, 99958, 99994, a5799, a7797, a7995

ppppp

5 clubs: 55555

7 clubs: 77777, 97577, 99557

9 clubs: 99999

pxxxxxx

3 clubs: 6222522, 7222242, 9222222

5 clubs: 6662564, 6662645, 7266266, 7446662, 8244566, 8246726, 8256266, 8258246, 8274266, 8278226, 8426627, 8446625, 8526626, 8526824, 8622584, 8622647, 8626256, 8626274, 8627246, 8642564, 8642645, 8642744, 8672264, 8682245, 8822627, 8824256, 8824274, 8827226, 8842625, 8842724, 8852264, 8882225, 9222488, 9224486, 9224882, 9244862, 9248822, 9262268, 9264266, 9268226, 9448622, 9488222, 9622682, 9642662, 9662264, 9682262, a425248, a426229, a426292, a426427, a426922, a446722, a448522, a456262, a458242, a466225, a478222, a496222, a522448, a522a42, a526426, a526822, a622249, a622447, a622582, a622942, a625246, a626272, a629242, a642562, a642742, a662245, a672262, a692242, a722248, a726226, a822229, a822292, a822427, a822922, a824272, a825226, a829222, a842722, a852262, a862225, a892222, aa42522, aa52242, aa72222

7 clubs: 8686867, 8858686, 8884786, 8884867, 8884885, 8888827, 9268888, 9468688, 9488488, 9668686, 9668884, 9688486, 9688882, a466788, a466968, a468588, a468948, a478488, a47a468, a496488, a49a448, a566868, a568848, a568a46, a626889, a646869, a6468a5, a648849, a666786, a666867, a666885, a666966, a668586, a668847, a668946, a66a566, a678486, a678882, a67a466, a696486, a696882,

a69a446, a6a6269, a6a62a5, a6a6467, a6a6485, a6a6782, a6a6962, a726888, a746868, a746a66, a748848, a748a46, a7a6268, a824889, a8248a7, a8249a6, a825888, a829488, a82a478, a82a496, a82a829, a842a69, a8447a6, a844869, a8448a5, a845868, a845a66, a848829, a848892, a848a72, a849a62, a8582a6, a858486, a858882, a85a466, a862788, a862968, a862a67, a862a85, a864786, a864867, a864885, a864966, a868278, a868296, a868827, a868926, a869268, a86a726, a86a825, a892488, a892a82, a8942a6, a894486, a894882, a89a426, a89a822, a8a4269, a8a42a5, a8a4467, a8a4485, a8a4782, a8a4962, a8a5268, a8a8229, a8a8292, a8a8427, a8a8922, aa425a8, aa42a49, aa445a6, aa45848, aa45a46, aa46829, aa46892, aa46a72, aa49a42, aa562a6, aa56486, aa56882, aa5a446, aa5a842, aa62588, aa62948, aa62a47, aa64586, aa66278, aa66296, aa66827, aa66926, aa69248, aa6a526, aa722a8, aa72488, aa72a82, aa742a6, aa74486, aa74882, aa7a426, aa7a822, aaa4582, aaa5248, aaa6229, aaa6292, aaa6427, aaa6922, aaaa522

9 clubs: a8a8a89, aa7a8a8, aaa69a8, aaa6a89, aaa6aa7, aaaa5a8, aaaa4a9

ppxxxxx

4 clubs: 6262525, 7242562, 7272262, 8242525, 8272225, 9242722, 9252262, 9262225, 9292222

6 clubs: 8672685, 8672784, 8682585, 8682747, 8858274, 8882727, 9258486, 9258882, 9262788, 9264786, 9264885, 9292488, 9448692, 9458682, 9488292, 9662685, 9662784, 9682485, 9682782, 9692682, a425948, a426929, a448592, a458582, a466727, a466925, a478292, a47a425, a496427, a496922, a522a49, a525848, a525a46, a526829, a562748, a562a45, a566726, a566825, a592448, a592a42, a596426, a596822, a622949, a625847, a625946, a6425a5, a662585, a662747, a662945, a6722a5, a672485, a672782, a692447, a692582, a692942, a722948, a722a47, a726827, a726926, a822929, a825827, a825926, a829292, a858272, a859262, a862727, a862925, a892427, a892922, aa42592, aa52582, aa56272, aa59242, aa72292

8 clubs: a6a6969, a6a69a5, a7a6968, a7a6a67, a8948a7, a8949a6, a8a47a7, a8a4969, a8a49a5, a8a5968, a8a5a67, a8a8929, aa5a5a6, aa6a596, aa7a496, aa7a892, aaa5948, aaa5a47, aaa6929, aaaa592

pxpxxxx

4 clubs: 6252445, 7262245, 7426252, 7427242, 8222527, 8252245, 8522524, 9222427, 9224272, 9229222, 9522622, a522522

6 clubs: 8574666, 8584566, 8626857, 8627847, 8648574, 8672667, 8678274, 8682567, 8824857, 8827827, 8852685, 8852784, 8857266, 8858256, 9264867, 9268278, 9268827, 9269268, 9468627, 9488427, 9488922, 9562668, 9564666, 9564864, 9568626, 9568824, 9582468, 9584466, 9584862, 9588426, 9588822, 9648672, 9662667, 9662964, 9668274, 9669264, 9682467, 9682962, 9688272, 9689262, a445748, a446729, a446792, a456485, a456782, a45a445, a466295, a468527, a478427, a478922, a495248, a496229, a496292, a562568, a564566, a568526, a572468, a574466, a574862, a578426, a578822, a5a4562, a626279, a629249, a629582, a62a572, a642749, a645746, a645845, a648572, a649562,

a662567, a672467, a672962, a678272, a679262, a692249, a695246, a6a5245, a726278, a729248, a742748, a742a45, a746726, a746825, a792248, a796226, a7a6225, a824279, a825278, a829229, a842729, a842792, a845726, a845825, a8522a5, a852485, a852782, a862295, a892229, a892292, a895226, a8a5225, aa44572, aa49522, aa62527, aa72427, aa72922, aa74272, aa79222

8 clubs: a696889, a6a6789, a796888, a7a6788, a848a79, a849a69, a85a7a6, a86a796, a894889, a895888, a895a86, a89a496, a89a829, a89a892, a8a4789, a8a5788, a8a5a85, aa46a79, aa495a8, aa49a49, aa69588, aa6a578, aa729a8, aa748a7, aa749a6, aa792a8, aa79488, aa79a82, aa7a478, aa7aa72, aaa45a7

pxpxxxx

4 clubs: 6622552, 7225246, 7522642, 7722244, 9225226, 9427222, 9622252, 9722224, 9922222

6 clubs: 7566666, 7746666, 8456667, 8556666, 8626677, 8646675, 8646756, 8646774, 8646855, 8647566, 8647746, 8647845, 8648556, 8677266, 8678256, 8686275, 8824677, 8844675, 8844756, 8844774, 8844855, 8847726, 8847825, 8852667, 8884275, 9225888, 9245868, 9425688, 9427488, 9445668, 9467268, 9468258, 9485268, 9625686, 9625884, 9627486, 9627882, 9645666, 9645864, 9647862, 9648852, 9667266, 9668256, 9685266, 9722688, 9724686, 9724884, 9742668, 9744666, 9744864, 9748626, 9748824, 9782268, 9784266, 9788226, 9922488, 9924486, 9924882, 9944862, 9948822, 9962268, 9964266, 9968226, a425588, a426299, a426497, a426992, a445568, a448529, a456269, a456467, a456962, a458249, a458447, a458942, a475268, a478229, a526478, a526496, a526892, a529448, a529a42, a556466, a556862, a558446, a558842, a622589, a625586, a626477, a626972, a629447, a629942, a642569, a645566, a646772, a649742, a666275, a669245, a672269, a675266, a696272, a699242, a722588, a724586, a726296, a72a526, a742568, a744566, a748526, a756266, a758246, a772268, a774266, a778226, a822299, a822497, a822992, a824477, a824972, a825296, a829427, a829922, a844772, a849722, a852269, a852467, a852962, a855266, a864275, a869225, a894272, a899222, aa42529, aa45526, aa52249, aa52447, aa52942, aa55246, aa72229, aa75226

8 clubs: 9788888, 9968888, a678889, a778888, a848899, a858889, a8588a7, a8589a6, a868897, a868978, a868996, a868a77, a869788, a869968, a869a67, a869a85, a86a778, a899488, a899a82, a89a478, a8a8299, a8a8497, a8a8992, aa46899, aa56889, aa568a7, aa569a6, aa5a849, aa66897, aa66978, aa66996, aa66a77, aa69948, aa69a47, aa72a89, aa74889, aa75888, aa75a86, aa7a829, aaa4589, aaa5588, aaa6299, aaa6497, aaa6992, aaaa529

pppxxxx

5 clubs: 8272727, 8572625, 8572724, 8582525, 9252485, 9252782, 9258272, 9262727, 9262925, 9292427, 9292922, 9562625, 9562724, 9582425, 9582722, 9592622, a562525, a572425, a572722, a592522

7 clubs: a495948, a495a47, a496929, a592a49, a595848, a595a46, a596829, a5a5748, a5a5a45, a6729a5, a692949, a695847, a695946, a6a5747, a6a5945, a792948, a792a47,

a796827, a796926, a7a6727, a7a6925, a892929, a895827, a895926, a8a5727, a8a5925, aa49592, aa59582, aa5a572, aa79292

ppxpxxx

5 clubs: 7562564, 7572662, 7726256, 7727246, 8252567, 8256275, 8552564, 9245726, 9245825, 9252467, 9445625, 9485225, 9522692, 9552662, 9627272, 9629252, 9742625, 9742724, 9782225, 9792224, 9924272, 9929222, a445525, a475225, a522592, a552562, a742525, a772225

7 clubs: 9485788, 9568894, 9588892, 9685786, 9685885, 9695686, 9695884, 9782788, 9784786, 9784885, 9792688, 9794686, 9794884, 9929488, 9968278, 9969268, a468597, a475788, a478497, a478992, a495588, a529a49, a568596, a578496, a578892, a626979, a629949, a672789, a675786, a675885, a692589, a695586, a6a5585, a726978, a729948, a729a47, a772788, a774786, a774885, a77a726, a792588, a794586, a79a526, a7a4585, a824979, a825978, a825a77, a829929, a849792, a8592a5, a859485, a859782, a85a475, a85a772, a869295, a899292, aa525a7, aa62597, aa72497, aa72992

ppxxpxx

5 clubs: 6662555, 7245566, 7525646, 7526672, 7742564, 7772264, 8447525, 8477225, 8642555, 8672255, 9255266, 9425258, 9447722, 9467225, 9625256, 9642752, 9662255, 9692252, 9722258, 9722294, 9724256, 9727226, 9752264, 9925226, 9942722, 9962225, 9992222

7 clubs: 8686777, 8858677, 8884777, 9467788, 9667786, 9667885, 9727888, 9747868, 9748696, 9748858, 9748894, 9758686, 9758884, 9788296, 9925888, 9945868, 9962788, 9964786, 9964885, 9992488, 9994486, 9994882, a426999, a448599, a456969, a458589, a458949, a478299, a526899, a556869, a558849, a566778, a569748, a569a45, a596478, a599448, a599a42, a666777, a666975, a669747, a669945, a696477, a696972, a699447, a699942, a726897, a726996, a72a596, a748596, a756867, a756966, a758586, a758847, a758946, a75a566, a778296, a822999, a825897, a825996, a829497, a829992, a852969, a855867, a855966, a858477, a858972, a859467, a859962, a864777, a864975, a869727, a869925, a894477, a894972, a899427, a899922, aa42599, aa45596, aa52589, aa52949, aa55586, aa55847, aa55946, aa56477, aa56972, aa59447, aa59942, aa72299, aa75296

9 clubs: a8a8999, aa7a899, aaa6999, aaaa599

ppxxpx

5 clubs: 7562645, 7562744, 7726274, 8244575, 8252747, 8274275, 8552645, 8552744, 9225827, 9244772, 9264275, 9269225, 9425627, 9427292, 9457262, 9458252, 9525626, 9525824, 9722627, 9722924, 9922292, 9952262, a425527, a522529, a525526, a552445, a552742, a722527

7 clubs: 9585868, 9685867, 9685966, 9689485, 9782968, 9784867, 9784966, 9788827, 9788926, 9948892, 9958486, 9958882, 9968296, a466797, a466995, a475968, a478929, a496497, a496992, a566796, a566895, a574869, a575868, a578829, a596496, a596892, a5a4569, a5a5568, a6495a5, a669585, a66a575, a672969, a675867, a675966, a6792a5, a679485, a679782, a67a475, a699582, a69a572, a6a5567,

a772968, a772a67, a774867, a774966, a778827, a778926, a7a4567, a829299, a8527a7, a8529a5, a858279, a859269, a862797, a862995, a892497, a892992, aa56279, aa59249, aa72929, aa75827, aa75926, aaa5527

pxpxpxx

5 clubs: 6456455, 7445645, 7466255, 7467245, 7526456, 7527446, 7742645, 7742744, 8224577, 8427527, 8456255, 8457245, 8524556, 8524574, 8527526, 8622557, 8852255, 9224477, 9225278, 9427427, 9427922, 9522458, 9524456, 9524672, 9524852, 9527426, 9527822, 9622457, 9622952, 9625274, 9724274, 9729224, 9922427, 9922922, a455245, a524572, a529522, a752245

7 clubs: 8678677, 8857786, 8857867, 8858857, 9567868, 9568678, 9568858, 9588478, 9589468, 9667867, 9668677, 9668857, 9668956, 9669667, 9688477, 9689467, 9729688, 9748678, 9749668, 9788278, 9789268, 9962968, 9964867, 9964966, 9968827, 9968926, a446799, a456789, a496299, a568578, a569568, a578478, a579468, a629589, a62a579, a646779, a648579, a649569, a649749, a668577, a669567, a678279, a678477, a678972, a679269, a679467, a679962, a696279, a699249, a729588, a72a578, a746778, a746796, a746895, a748578, a749568, a749748, a749a45, a756786, a756885, a75a746, a778278, a779268, a796278, a796296, a799248, a7a6295, a842799, a844779, a845778, a845796, a845895, a845a75, a849729, a852789, a855786, a855885, a892299, a894279, a895278, a895296, a899229, a8a5295, aa44579, aa45578, aa49529, aa64577, aa69527, aa74279, aa74477, aa74972, aa75278, aa79229, aa79427, aa79922

9 clubs: a89a899, aa799a8, aa79a89, aa7aa79

ppppxxx

6 clubs: 9485727, 9485925, 9562794, 9582792, 9585726, 9585825, 9592692, 9595626, 9595824, 9782727, 9782925, 9792627, 9792924, 9929292, 9958272, 9959262, a475727, a475925, a495527, a562595, a572495, a572729, a572792, a575726, a575825, a592529, a592592, a595526, a5a5525, a772727, a772925, a792527

pppxpxx

6 clubs: 8477727, 8574756, 8574855, 8577726, 8577825, 8672757, 8857275, 9255786, 9255885, 9258477, 9455685, 9467727, 9467925, 9558672, 9562758, 9564756, 9564855, 9567726, 9567825, 9592458, 9594456, 9594852, 9662757, 9662955, 9692457, 9692952, 9727278, 9729258, 9742695, 9742794, 9752685, 9752784, 9782295, 9792294, 9925278, 9962727, 9962925, 9992427, 9992922, a445595, a455585, a475295, a529592, a558572, a559562, a742595, a752585, a772295

8 clubs: a599a49, a696979, a699949, a796978, a796a77, a799948, a799a47, a79a596, a894979, a895978, a895a77, a899929, aa595a7, aa69597, aa79497, aa79992

pppxpx

6 clubs: 8274777, 8574675, 8574774, 8584575, 9264777, 9447792, 9457485, 9457782, 9525858, 9564675, 9564774, 9584475, 9584772, 9589425, 9594672, 9625857, 9625956, 9722958, 9724857, 9724956, 9727827, 9727926, 9729294, 9758274, 9759264, 9925827, 9925926, 9942792, 9952485,

9952782, 9962295, 9992292, a455747, a455945, a552749, a555746, a555845, a564575, a569525, a574475, a574772, a579425, a579722, a594572, a599522, a752747, a752945

8 clubs: a496999, a596899, a6799a5, a796897, a796996, a7a6797, a7a6995, a892999, a895897, a895996, a8a5797, a8a5995, aa49599, aa59589, aa5a579, aa79299

pppxppxx

6 clubs: 7575666, 7747566, 7777266, 8256777, 8556675, 8556774, 8647575, 8677275, 9255867, 9445758, 9455667, 9525894, 9555666, 9555864, 9645756, 9645855, 9647772, 9667275, 9669255, 9695256, 9727296, 9742758, 9744756, 9744855, 9747726, 9747825, 9752667, 9752964, 9757266, 9758256, 9792258, 9794256, 9797226, 9925296, 9944772, 9945726, 9945825, 9949722, 9955266, 9964275, 9969225, 9994272, 9995226, 9999222, a425597, a455567, a522599, a525596, a552569, a555566, a556475, a556772, a559445, a559742, a722597, a752567

8 clubs: 9797888, 9969788, 9995888, 9999488, a478999, a578899, a778897, a778996, a829999, a858979, a8597a7, a859969, a8599a5, a869797, a869995, a899497, a899992, aa56979, aa59949, aa72999, aa75897, aa75996, aaa5597

ppxpxpx

4 clubs: 5525524, 7522552

6 clubs: 7567566, 7746675, 7746756, 7747746, 8456757, 8457567, 8457747, 8556756, 8557566, 8557746, 8557845, 8558556, 8627577, 8852757, 9245778, 9457467, 9458457, 9525678, 9527478, 9527892, 9529458, 9557466, 9557862, 9558456, 9558852, 9625677, 9627477, 9629457, 9645675, 9645774, 9685275, 9695274, 9724677, 9729627, 9744675, 9744774, 9749625, 9749724, 9784275, 9789225, 9794274, 9922497, 9924477, 9924972, 9929427, 9929922, 9952467, 9952962, a524579, a525578, a529529, a625577, a645575, a675275, a724577, a729527, a744575, a749525, a756275, a759245, a774275, a779225, a855275

8 clubs: 9789788, 9968897, 9968978, 9969968, a678979, a679789, a679969, a699589, a69a579, a778978, a779788, a779968, a779a67, a77a778, a799588, a79a578, a849799, a859789, a85a779, a899299, aa74979, aa75978, aa75a77, aa79929

ppppppxx

7 clubs: 9595858, 9595894, 9695857, 9695956, 9792958, 9794857, 9794956, 9797827, 9797926, 9949792, 9959485, 9959782, 9969295, 9995827, 9995926, 9999292, a475797, a475995, a495597, a569595, a572799, a575796, a575895, a579495, a579792, a592599, a595596, a599592, a5a5595, a772797, a772995, a792597

pppppxpx

5 clubs: 7562555, 7572455, 7572752, 8552555, 9255275, 9552455, 9552752

7 clubs: 9585778, 9595678, 9685777, 9695677, 9749695, 9759685, 9784777, 9784975, 9789295, 9789727, 9794677, 9794974, 9925978, 9929497, 9958477, 9958972, 9959467, 9962797, 9962995, 9992497, 9992992, a574779, a575778, a579729, a594579, a595578, a599529, a675777, a675975,

a695577, a749595, a759585, a75a575, a774777, a774975, a779295, a779727, a779925, a794577, a799527

pppxpppx

5 clubs: 6455555, 7445555, 7525556, 7525574, 7742555, 7772255, 9455255, 9752255

7 clubs: 8677777, 8857777, 9567778, 9667777, 9747778, 9747796, 9747895, 9757786, 9757867, 9757885, 9757966, 9758677, 9758857, 9758956, 9758974, 9759667, 9797278, 9797296, 9925897, 9945778, 9945796, 9945895, 9955786, 9955867, 9955885, 9955966, 9964777, 9964975, 9969727, 9969925, 9994477, 9994972, 9995278, 9995296, 9999427, 9999922, a529599, a556779, a558579, a559569, a559749, a729597, a756777, a756975, a758577, a759567, a759747, a759945, a855777, a855975, aa55577

9 clubs: a899999, aa79999

pppppppx

6 clubs: 7575756, 7747575, 7777275, 8557575, 9255777, 9455757, 9555675, 9555756, 955774, 9558555, 9557475, 9557772, 9559455, 9752757, 9752955, 9757275, 9759255, 9955275, a555575

8 clubs: 9797978, 9969797, 9995897, 9995978, 9995996, 9999497, 9999992, a579799, a599599, a779797, a779995, a799597

ppppppp

5 clubs: 5555555

7 clubs: 7777777, 9757777, 9759757, 9955777, 9955975

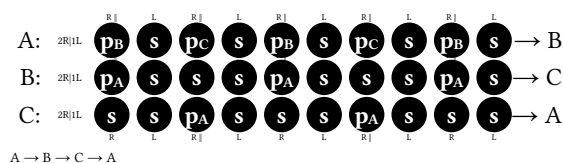
9 clubs: 9999999

36. Appendix: Bruno's Variations

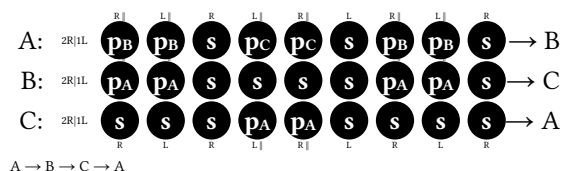
For completeness, here is a list of less common Bruno's nightmare (Ch. 23) variations.

Five-beat Bruno's.

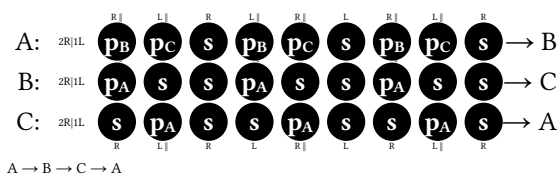
A longer version of Bruno's has the walking passer pass twice to the feeder while walking:



Pass-pass-self Bruno's. There is sufficient time in standard three-count Bruno's to double up on all passes:

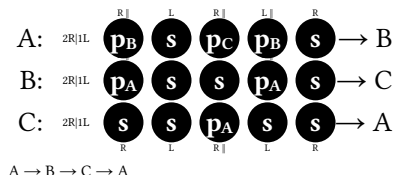


A pattern on a more traditional pass-pass-self feed is substantially more challenging, and the walking passer has two passes during their walk across the pattern, as in five-beat Bruno's:



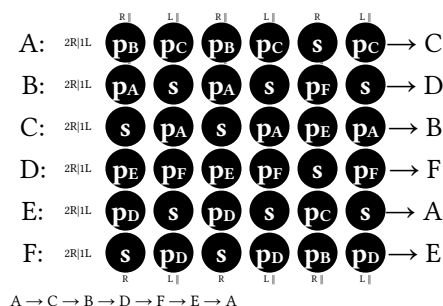
Pass-pass-self-pass-self Bruno's.

A much faster version (though not as fast as Bruno's one-count) is a feed in pass-pass-self-pass-self:



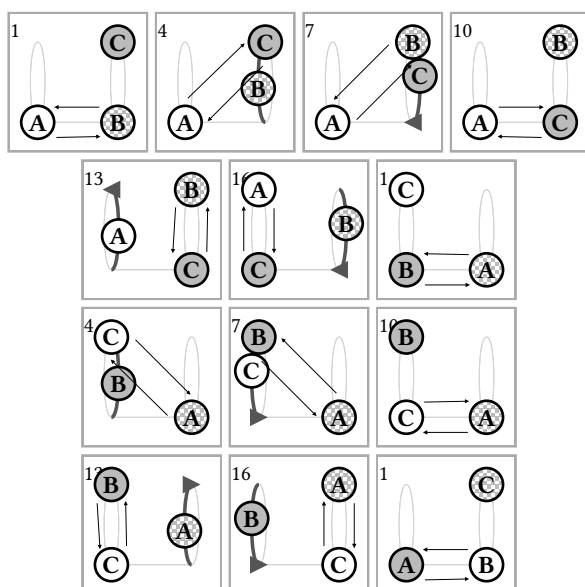
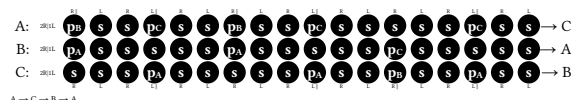
Magermix (one-count).

Magermix on one-count vs two-count is a very challenging pattern for six passers:



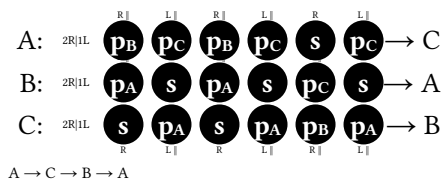
441 Bruno's.

Beyond the cascade, the passers can walk in the shape of any other juggling pattern – here is an example of a pattern with walking based conceptually on the solo pattern 441:



Babymix (441, one-count).

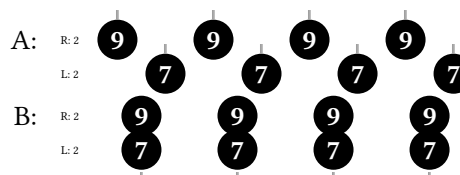
This 441-based pattern can also be passed in one-count vs. two-count:



37. Appendix: 8-club one-counts

There are many ways to juggle 8-club one-count, scattered through several chapters. This tries to collect them in one place:

- Singles vs doubles – Four-handed siteswap 79, see compatible siteswaps (Ch. 17)
 - both straight or both crossing (i.e., swapping A and B positions)
- Zaps vs triples – Four handed siteswap 5b
- Crossing doubles – Synchronous pattern 4p, see 7-club and 8-club patterns (Ch. 5)
 - usually crossing, but straight also possible
- Single, double, triple – Synchronous pattern 3p4p5p
 - trick throw in crossing doubles or run continuously
- Crossing singles – Synchronous pattern 4p, thrown with singles, see beyond classic patterns (Ch. 6)
- Straight singles – Synchronous pattern 4p, thrown with singles, see beyond classic patterns (Ch. 6)
 - Alternating hands or throwing left and right synchronously
 - Various lanes, e.g., all inside vs all outside, inside-outside, inside-inside-outside-outside, both hands passing left/right of all incoming passes, ...
- Blinky – Synchronous left and right hand passes from passer B



- Blinky variations
 - Straight and crossing
 - Async passer can switch between straight and crossing at any time
 - Throw 8 to change sides in blinky