JL Hand siteswap feature

Pattern: `R5xL5L5xL5xR5R5x` 

Pattern: `5`
Manual settings: `hss = 411`

Background

- Given an asynchronous siteswap, it is by default assumed to be juggled with right and left hands throwing alternately.
- For patterns where hands do not throw alternately, multiple confusing terms and notations are prevalent.
  - Terms like ‘galloped patterns’, ‘hurries’ and ‘polyrhythms’ are used.
  - JoePass supports a notation to comprehend ‘hurries’. Usual mathematical rules of siteswap notation like average test and permutation test are rendered irrelevant in this notation.
  - Juggling Lab supports use of hand specifiers (R and L) and throw modifiers (x) to represent such patterns. This complicates the notation, check for a valid sequence and invention of new sequences.
- Further complications in notation (passing, synchronous) arise when more than two hands (i.e., more than one juggler) are involved in an asynchronous pattern.

Alternative Solution

- Just as the siteswap sequence decides the order in which objects are thrown, a ‘hand siteswap sequence’ (HSS) can be specified to capture information about the order in which the hands throw[1].
  - The default of hands throwing alternately corresponds to the HSS ‘2’.
- Any asynchronous object siteswap sequence (OSS) involving any number of jugglers can be accurately and succinctly represented with this approach.
  - For example, Prechac patterns containing fractional throws can be represented without needing either fractional throws or passing notation.
- The usual average and permutation tests apply to both OSS and HSS.
- Easy to invent new patterns.
  - Any valid OSS can be combined with any valid HSS to give a valid juggling pattern.
  - Only exception is if the HSS has a ‘0’, i.e., no hand is available at a beat where the OSS has a non-zero throw, i.e., there is an object scheduled to be thrown at that beat.
- Dwell times can be individually maximized for each hand based on when it throws next.

1. **Polster B, ‘The Mathematics of Juggling’, NY: Springer, 2003, pp. 110-112**

Example (Solo Juggler)

Pattern (oss): `42`

Manual settings: `hss = 13`

- Common Interpretation: “Galloped” 423
  - No straightforward way to mimic galloped timing in simulators.
  - Actual pattern looks rhythmic and not galloped.
- JL asynchronous notation: R4 R2x L4 L2x
  - Lengthy representation.
  - Need to change default dwell beats to a value less than 1.
  - Does not optimize the dwell time to enable 4 throws to be thrown lower.
- JL synchronous notation: (2, 2T)! (0, 2x)! (2T,2)! (2x, 0)!
  - Lengthy representation.
  - Why should we need synchronous notation for an asynchronous pattern?
  - Needs understanding of synchronous notation, throw modifiers and suppressed beats.

Example (Asynchronous Prechac)

Pattern: `5`

Manual settings: `hss = 4`

- Common (Prechac) interpretation: 2.5p
  - Involves fractional throws and modifiers to indicate passes.
  - Need modified average theorem and permutation test to check validity and determine number of jugglers and objects.
- JL synchronous notation: <(0,5xp) (5xp,0) | (0,0)! (0,5p) (5p,0)!>
  - Apart from synchronous notation, suppressed beats and throw modifiers, also needs knowledge of passing notation to represent what is essentially an asynchronous pattern.
- The oss/hss approach is essentially how Tarim envisaged asynchronous Prechac patterns.
  - Tarim suggested class of patterns which combined any oss with hss = 2*(number of Jugglers).
  - Hand assignment envisaged by Tarim was same as our default hand assignment.

Example (Experimenting with patterns)

Take any oss and combine it with any hss. For example,

Pattern: `7`

Manual settings: `hss = 423`

- Though all throws are 7's, the difficulty level for individual hands is different. Arguably, the hand throwing every third beat has the easiest role.
- Roles can be identified and assigned for jugglers with different skill levels*. For example
  - Manual settings: `hss = 423; handspec = (2,1)(,3)`
    - assigns the easy role to Juggler 2, right hand.
  - Default handspec is (3,1)(,2). This also creates different difficulty levels for jugglers 1 and 2 and also different difficulty levels for the 2 hands of Juggler 1.
  - Use `handspec = (,1)(,2)(,3)` to view pattern with 3 jugglers. Jugglers 1 and 2 have same difficulty level, Juggler 3 has easier role.

*See next slides for `handspec` feature.

Additional Manual Settings

- Automatic dwell time maximization can be disabled/reenabled by setting `dwellmax` = false/true.
  - For single juggler this allows equivalent behaviour to JL extended notation using hand specifiers R and L and throw modfier x.
- If at a beat oss number = hss number, hold can be enabled/disabled by setting `hold` = true/false.
  - With `dwellmax` = false and `hold` = true, it will mimic JL extended notation with throw modifier H explicitly specified for all throws which can be ‘held’.
- Hand assignments for different jugglers can be customized with `handspec` key.
  - Number of hands determined from HSS.
  - Max number of jugglers allowed = number of hands = numHands.
  - Default number of jugglers = ceil of (numHands/2)
  - For default and custom hand assignment, see examples on next slides.

Example default hand assignment

Let `hss = 375`. Then numHands = 5 and number of Jugglers = ceil(5/2) = 3.

Hand numbering is as follows for hss = 375:

Beat	1	2	3	4	5	6	7	8	9	10	11	12
hss	3	7	5	3	7	5	3	7	5	3	7	5
Hand	1	2	3	1	4	5	1	3	2	1	5	4

Default hand assignment assigns all right hands, then loops back to assign left hands.

Hand #	1	2	3	4	5
Assignment	Juggler 1, Right hand	Juggler 2, Right hand	Juggler 3, Right hand	Juggler 1, Left hand	Juggler 2, Left hand

Example custom hand assignment

`hss = 375`. Number of hands, number of jugglers and hand numbering same as previous slide.

Let us define the following custom hand assignment:

Manual settings: `hss = 375; handspec = (2, 3) (1, ) (, 5) (4, )`

Interpretation:

- nth bracket pair in handspec represents nth juggler. Thus, we now have 4 jugglers.
- In each bracket pair, the first number is the left hand of the corresponding juggler and the second number the right hand.
- If a juggler should use only one hand, do not specify any number for the unused hand.

The custom hand assignment for the above handspec is as follows:

Hand #	1	2	3	4	5
Assignment	Juggler 2, Left hand	Juggler 1, Left hand	Juggler 1, Right hand	Juggler 4, Left hand	Juggler 3, Right hand