Last rock decision cards

A curling Moneyball pilot for experienced club curlers

Compare two calls on the same house. Count the outcomes that matter. Then test the choice with your own team.



Start with one decision

These cards turn a familiar question into a testable one: how often must we get the useful result for this call to be worth playing? The three situations use the last stone of the scheduled final end, so most branches end in an immediate win or loss.

Every execution rate and extra-end sensitivity value in the worked examples is invented. This is a teaching and data-collection pilot, not a validated shot-selection system.

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BEFORE THE FIRST CARD

Read the decision correctly

All three cards assume standard four-player curling, our hammer and exactly one stone left to deliver. The opponent has no reply. Use your event's rules if they differ from this pilot. [1]

Read the house

- A stones belong to us and are dark blue. O stones belong to the opponent and are gold. Letter labels remain readable in black-and-white printing.
- The tee is (0, 0). Coordinates describe stone centres in feet: positive x is right; positive y is toward the delivery end. The arrow points in the delivery direction.
- Only the pictured stones remain in play. There are no hidden guards. Rings are shown to scale; stone size is approximate. The X marks one possible finish, not a prescribed line or turn.
- Agree on a playable path, turn, weight and target tolerance on the actual ice. The diagrams do not predict curl or contact physics.

Use the scoreboard after every branch

Before our last stone	What the end scores	Game status
Tied	We score at least 1 / opponent scores	Win / loss
Down 1	We score 2 / we score 1 / opponent scores	Win / tie / loss
Up 1	We score / concede 1 / concede 2	Win / tie / loss

A tie after the scheduled final end goes to extra ends under this model. After we score, the opponent has hammer; after the opponent scores, we have hammer. A blank retains hammer. [1]

Keep execution and result separate

F = full intended result. P = a specified useful partial. M = the specified miss. These are local card definitions, not an official scoring scale. The worked trees assume only their listed branches occur. Real shots can create additional outcomes.

Log unexpected contacts, blanks and measures with a U flag and the actual end score. Keep those trials in the dataset. Add their branches before estimating real win chances; do not hide them inside a convenient F, P or M label.

What the percentage means

Win chance means the chance of eventually winning the game, including extra ends. A shot rating or an overall shooting percentage is not that probability. A well-executed shot can still leave a tied game. [4]

CARD 1 / SETUP AND OUTCOMES

Tied with last rock

Score before the shot: 5–5. We can draw closer than O1, or remove O1 while preserving A1. Both calls use this same starting house.



STARTING HOUSE

A1 Our stone at (+4, 0)
O1 Opponent at (0, +2)

Only these two stones are in play.
O1 is shot stone. No guards.

X One possible draw finish
(-1, 0), closer than O1.

Coordinates are feet from the tee.
+x right; +y toward delivery end.

O1 is off the tee, so a closer draw is physically possible. A1 provides a useful fallback if the hit rolls out.

Outcome tree

Call → branch	Final position in this model	End score → game
Draw → F	Delivered stone finishes within 1 ft of tee, clear of O1.	We score 1 → win
Draw → P	Delivered stone misses that target but is still closer than O1.	We score 1 → win
Draw → M	O1 stays closer than our delivered stone and A1.	Opponent scores 1 → loss
Hit → F	O1 is out; delivered stone stays in the house; A1 stays.	We score 2 → win
Hit → P	O1 and delivered stone are out; A1 stays.	We score 1 → win
Hit → M	O1 stays shot stone; neither of our stones beats it.	Opponent scores 1 → loss

Model limits. Draw branches assume no contact. Hit branches preserve A1. Other contacts, a blank or a tied measure are outside this example; record them and expand the tree. Final scores override execution labels.

CARD 1 / BREAK EVEN

Count the useful partials

ALL INPUTS BELOW ARE HYPOTHETICAL

Call	Full	Partial	Miss	Win chance
Draw	70%	5%	25%	75%
Hit	60%	20%	20%	80%

Each row totals 100%. In this model both full and partial results win. The hit's lower full-make rate does not settle the decision because its useful partials also win.

Work the threshold

Let p be the chance of the full hit. Hold its useful-partial chance at 20% and the draw's total win chance at 75%. Use decimals in the calculation.

Hit win chance = p + 0.20

Break even when p + 0.20 = 0.75

p = 0.55, or 55%

Above 55% full hits, the hit has the higher modeled win chance. Below 55%, the draw does. At 55%, they tie. Because the partial rate is fixed at 20%, p must be between 0% and 80%; the remaining probability is a miss.

Change the input and the answer can change

Full hit rate	Hit win chance	Against the same 75% draw
50%	70%	Draw is higher
55%	75%	Break even
60%	80%	Hit is higher

The 5-point gap in the first example is not evidence that a hit is better for your team. No real observations have been used. The partial rate may also change with weight, line and the player.

Before you throw

Our estimated draw wins: _____ / _____ attempts = _____ %

Our full hits: _____ % Useful partial hits: _____ %

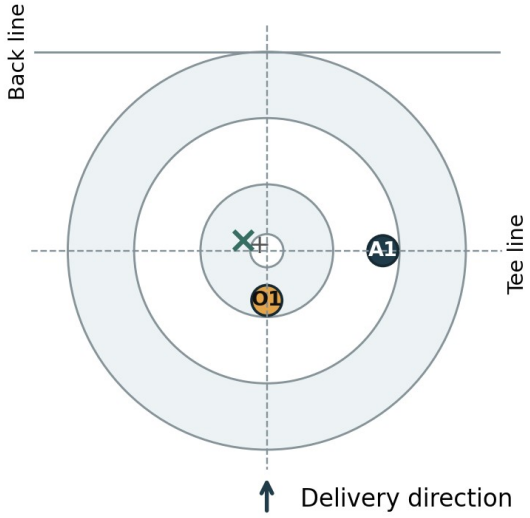
Matching turn, line, ice and target tolerance: _____

What result would change our call? _____

CARD 2 / SETUP AND OUTCOMES

Down one with last rock

Score before the shot: 4–5. A clean draw can score one to tie. Removing O1 and keeping the shooter in the house can score two to win.



STARTING HOUSE

A1 Our stone at (+3.5, 0)
O1 Opponent at (0, +1.5)

Only these two stones are in play.
O1 is shot stone. No guards.

X One possible draw finish
(-0.7, -0.3), closer than O1.

Coordinates are feet from the tee.
+x right; +y toward delivery end.

For a two-point hit, both A1 and the delivered stone must remain counting after O1 is removed.

Outcome tree

Call → branch	Final position in this model	End score → game
Draw → F	Delivered stone reaches the agreed target, closer than O1.	We score 1 → tie
Draw → P	Outside target tolerance, but still closer than O1.	We score 1 → tie
Draw → M	O1 stays shot stone.	Opponent scores 1 → loss
Hit → F	O1 is out; A1 and delivered stone remain in the house.	We score 2 → win
Hit → P	O1 and delivered stone are out; A1 stays.	We score 1 → tie
Hit → M	O1 stays shot stone.	Opponent scores 1 → loss

Every listed tie is 5–5 and sends us into an extra end WITHOUT hammer, because we scored. Let t be our unknown chance of eventually winning from that position.

Model limits. Draws make no contact; A1 stays for each listed hit branch. Other contacts, blanks and tied measures need additional branches. Do not turn a tie into an automatic 50% win chance.

CARD 2 / BREAK EVEN

Price the chance to win now

ALL INPUTS BELOW ARE HYPOTHETICAL

Call	Full	Partial	Miss	Win chance
Draw	70%	10%	20%	0.80 × t
Hit	30%	20%	50%	0.30 + 0.20 × t

t is unknown. It is the chance of eventually winning from a tied extra-end start without hammer, including any later blanks. These cards supply no measured estimate for it.

Work the threshold

Let p be the full-hit chance. Hold hit partials at 20% and the draw's combined full-plus-partial rate at 80%.

Hit: p + 0.20t Draw: 0.80t

Break even when p = 0.60t

The hit is higher above this threshold; the draw is higher below it. Here 0% ≤ p ≤ 80% so the miss rate, 80% minus p, remains valid.

Assume t only to test sensitivity	Full-hit rate needed to break even
20%	12%
40%	24%
60%	36%

At an illustrative t = 40%, the first table gives draw = 32% and hit = 38%. At t = 60%, it gives draw = 48% and hit = 42%. The preferred call changes when this unknown input changes.

Use a range when the input is uncertain

If your justified t range spans values that favor different calls, the model has not settled the decision. Discuss the quality of your hit and draw estimates, then use the actual ice and team judgment. Do not choose a t simply to support a preferred shot.

Our plausible t range and basis: _____

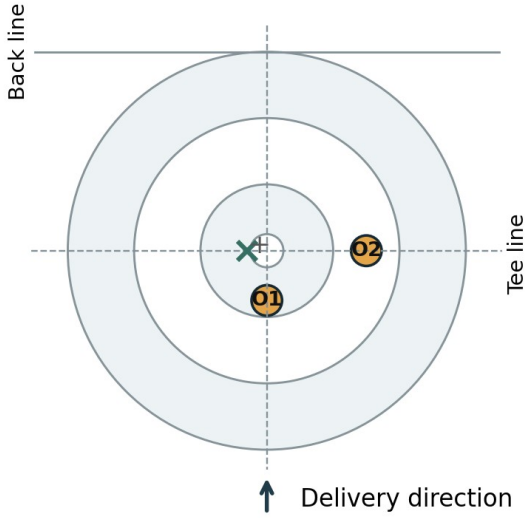
Full-hit estimate p: _____ % Partial-hit estimate: _____ %

What evidence is missing? _____

CARD 3 / SETUP AND OUTCOMES

Up one with last rock

Score before the shot: 6–5. The opponent lies two. Compare a draw with a controlled takeout of O1. A useful partial can preserve an extra end.



STARTING HOUSE

O1 Opponent at (0, +1.5)
O2 Opponent at (+3, 0)

Only these two stones are in play.
We have no stones in the house.

X One possible draw finish
(-0.6, 0), closer than both.

Coordinates are feet from the tee.
+x right; +y toward delivery end.

O1 is nearer the tee than O2. For the takeout to win immediately, the shooter must finish nearer than O2.

Outcome tree

Call → branch	Final position in this model	End score → game
Draw → F	Delivered stone is nearer the tee than O1 and O2.	We score 1 → win
Draw → P	Delivered stone lies between O1 and O2 in distance to tee.	Concede 1 → tie
Draw → M	Both opponents remain nearer than our stone.	Concede 2 → loss
Hit → F	O1 is out; shooter stays nearer the tee than O2.	We score 1 → win
Hit → P	O1 is out; shooter rolls out or stays farther from tee than O2.	Concede 1 → tie
Hit → M	Both opponents remain closer than the shooter.	Concede 2 → loss

Every listed tie is 6–6 and sends us into an extra end WITH hammer, because the opponent scored. Let h be our unknown chance of eventually winning from there.

Model limits. Draws make no contact. The listed hit outcomes leave O2 in place. Other contacts, blanks or tied measures need additional branches; log their actual scores.

CARD 3 / BREAK EVEN

Value the escape route

ALL INPUTS BELOW ARE HYPOTHETICAL

Call	Full win	Partial tie	Miss loss	Win chance
Draw	40%	30%	30%	0.40 + 0.30h
Takeout	25%	65%	10%	0.25 + 0.65h

These deliberately different branch rates illustrate a trade-off: more immediate wins versus more ties and fewer immediate losses. They are not estimates of club curling performance.

Work the threshold

h is our eventual extra-end win chance with hammer, including later blank ends. Hold the two rows of branch rates fixed.

0.25 + 0.65h = 0.40 + 0.30h

0.35h = 0.15

h = 3/7, approximately 42.9%

Above 3/7 (about 42.9%), the takeout has the higher modeled win chance. Below 3/7, the draw does. At 3/7, both give a win chance of 52.9%, rounded.

Illustrative h	Draw win chance	Takeout win chance	Higher
30%	49%	44.5%	Draw
50%	55%	57.5%	Takeout
70%	61%	70.5%	Takeout

The execution threshold version

At an illustrative h = 50%, the draw in this table is worth 55%. If the takeout's partial-tie rate stays 65% and its full-win rate is p, break even is p + 0.65 × 0.50 = 0.55, so p = 22.5%. Valid p values run from 0% to 35%.

Our h range and basis: _____

Which partial do we actually produce on this ice? _____

Would plausible input changes reverse the choice? _____

COPY FOR EACH NEW SITUATION

Game or drill observation

Record the called shot before delivery. Keep the execution label and the scoreboard result separate. Use player codes if the sheet will be shared.

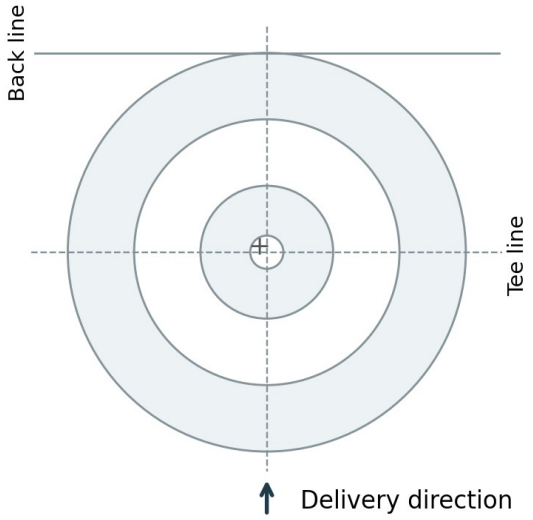
Session/date: _____ Game or drill: _____

Player code: _____ Observer: _____ Sheet/ice: _____

End: _____ Scheduled final end: _____ Score us/them: _____ / _____

Hammer: us / them Stones still to deliver us/them: _____ / _____

Layout ID: _____ Card/variant: _____ Trial ID: _____



EXACT LAYOUT RECORD

Label every stone A1, A2... or O1, O2...
Write each centre as (x, y) in feet.

Stone ID and coordinates
_____
_____
_____
_____

Add a second sheet for all other stones.
Photo or video reference: _____

For a game observation, include all guards and other in-play stones on an extra sketch or measured photo. Do not label a diagram “same layout” if a meaningful position changed.

Called shot and target tolerance: _____

Turn: clockwise / counterclockwise Weight: _____

Difficulty agreed before shot: low / medium / high Why: _____

Expected F: _____ P: _____ M: _____

Actual execution: F / P / M / uncertain Unexpected branch U: yes / no

Main error: light / heavy / narrow / wide / contact / other: _____

Final layout or photo ref: _____ End score us/them: ____ / ____

Result: win / tie / loss / unresolved Extra-end hammer: us / them / n/a

If later known, final game result: _____ Note: _____

COPY FOR MATCHED REPEATS

Trial log and player fit

Session: _____ Player: _____ Layout ID: _____

Call: _____ Turn: _____ Target tolerance: _____

Difficulty and ice notes: _____

Use this sheet only for the same stated setup and call. Link each trial to a full record or a shared setup sheet. Reset the house between attempts.

Trial ID	F/P/M or ?	U flag	Error	End score us/them	W/T/L or ?
1					
2					
3					
4					
5					
6					
7					
8					

Attempt count n: _____ Full: _____ Partial: _____ Miss: _____

Uncertain execution: _____ Unexpected branches: _____

Immediate wins: _____ Ties: _____ Losses: _____ Unresolved: _____

F + P + M + uncertain must equal n. U is a separate flag and may overlap any execution label. Win + tie + loss + unresolved must also equal n. Resolve uncertain scores or report them; never silently drop them.

Choose calls that fit the people playing

Compare a player's results for the same shot family, turn, target size and ice conditions. Keep useful partials and common error directions visible. A single overall shooting percentage hides this information.

Shot family and turn	Attempts	Useful outcomes	Practice priority
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Use this profile to choose a practice focus and inform a call. These last-rock samples do not identify an ideal roster or prove the best playing order. Sweeping, communication, reading ice and team coordination also affect the result.

NEXT TEST

Run a small honest pilot

1 Agree on the experiment

Start with Card 1. Have two experienced curlers check the setup and each intended path. Agree on full, partial and miss definitions, plus how to record unusual outcomes, before anyone throws. Keep one mirrored layout as a separate condition.

2 Collect both calls fairly

As a practical first pass, plan 20 attempts per call per player across at least two sessions. That is a pilot workload, not a statistically sufficient sample. Randomize which call starts and balance the order in short blocks. Reset measured positions, record every attempt and keep stone, turn, sweepers and target instructions consistent or log changes.

3 Check the records before the result

Have a second observer independently grade a shared set of attempts. Resolve disagreement with the final layout or video. If the tree misses a recurring outcome, add it and recalculate all attempts. Separate drill results from actual games and separate materially different layouts.

4 Report what the sample can support

Show counts before percentages: for example, 16 useful outcomes in 20 tries. Under an independent, stable-trial model, 16/20 has an approximate 95% Wilson interval of 58% to 92%. Repeated throws on one patch of ice may be related, so even that interval can overstate certainty. [5]

A five-point difference between calls may be noise. Compare the uncertainty in the difference itself; overlapping individual intervals do not provide a complete significance test. With small samples, report “not settled” rather than a confident winner.

5 Test on fresh attempts

Write down the decision rule and expected outcome range before the next session. Use new attempts from another day to check it. If the advantage reverses under reasonable probability ranges, keep both calls available and gather more matching evidence.

What this pilot cannot establish

Game logs show associations. Players choose shots based on the house, score, opponent and their own strengths, so a higher observed win rate does not prove the call caused the win. Balanced drills reduce some differences but do not recreate game pressure or establish an ideal team.

Pilot owner: _____ Review date: _____ Next layout: _____

Evidence we need before changing our default call: _____

METHOD AND SOURCES

Build the next card carefully

The reusable method is simple: describe every relevant end state, assign a probability to each, and multiply it by its chance of eventually winning. Add the results. Immediate wins count as 1 and losses as 0. Tie branches need a stated extra-end value, or a range.

General form: win chance = sum of [branch probability × eventual win chance from that branch]. The probabilities must total 100%, and branches must not overlap.

The break-even examples are algebra from the invented inputs printed on pages 4, 6 and 8. They are not drawn from a player dataset. Changing a full-make rate while holding a partial rate fixed is a sensitivity exercise; real changes in weight or line can change every branch.

Sources and what they support

Research and rules checked 10 October 2026. The sources below support the method, scoring conventions and measurement cautions. None validates the invented card percentages.

[1] World Curling. The Rules of Curling, 2026 edition. Rules R5, R6, R7 and R12 cover delivery order, early-end protections and scoring. All takeouts here occur on the last stone. Check local event variations.

https://worldcurling.org/wp-content/uploads/2026/10/Rules-2026_Clean.pdf

[2] Ahmad, Holte and Bowling. Action Selection for Hammer Shots in Curling, IJCAI 2016. Research on selecting hammer shots under execution uncertainty, using a simulator. It does not establish club-player execution rates.

https://www.ijcai.org/Proceedings/16/Papers/086.pdf

[3] Palmer and Geurts. The Evolution of Curling Analytics, MIT Sloan Sports Analytics Conference. Overview of curling data, efficiency, scouting and win probability. Broad game-state averages do not replace a precise house and player model.

https://www.sloansportsconference.com/research-papers/the-evolution-of-curling-analytics

[4] Sonnenberg. Win Probability, Shot Difficulty & Video, 2023 handout, pp. 6–8; and World Curling, Solid numbers, 22 November 2023. Context for recording intent, partials, errors, difficulty and observer judgment.

https://curlingnb.com/wp-content/uploads/2023/10/Analytics-MA-August-2023-handout.pdf
https://worldcurling.org/2023/11/solid-numbers/

[5] NIST/SEMATECH e-Handbook. Confidence intervals for proportions. Supports the Wilson interval used for the illustrative 16/20 count on page 11.

https://www.itl.nist.gov/div898/handbook/prc/section2/prc241.htm

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