Planning Takeouts and Raises

Canadian Curling Association
Level 4 Research Project
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List of Figures

1 Introduction

The purpose of this presentation is to give curlers and coaches a better understanding of the principles involved in the selection and execution of shots when other rocks are involved in take-outs and raises. This knowledge will become more important when more rocks come into play as a result of any rule changes.

2 Dimensions and Geometry

Figure 2 reviews the dimensions of the house area used in this project.

A curling rock must have a maximum circumference of 36", giving a maximum diameter of $36/\pi = 11.5$” ($C = \pi D$).

Rocks at curling clubs locally were in the 10.5" to 10.75" range (can navigate smaller ports!). Rocks in this study were $10\,{}^{5}/_{8}$” in diameter.

$$\frac{a}{d} = \frac{r}{l}$$

$$a = \frac{r \cdot d}{l}$$

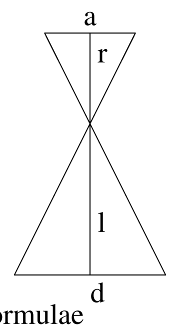

Figure 1: Formulae

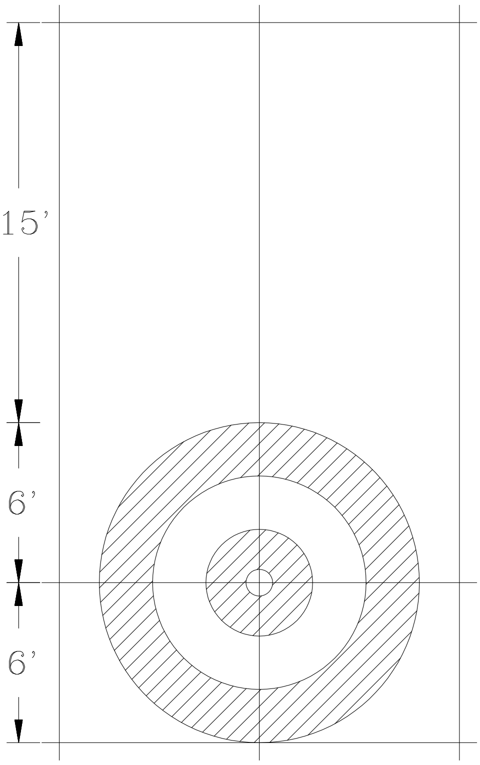

Figure 2: Dimensions

Assumptions

- The striking band of the rocks are free from pitting and chips.
- The ice surface is free of debri.
- The ice is broken in over all areas and is 13–14 seconds hog to hog for a tee weight draw (23-24 seconds hog to tee).

Formulae

The formula in figure 1 will be used later in this presentation.

3 Proper angles

Many curlers judge angles by instinct with varying degrees of success. Judging angles does not come naturally and is learned by experience. A common mistake is shown in figure 3. Rock B is to be raised onto rock C and rock A is the thrown rock. "×" is the proper spot to hit since it is a direct line between the centres of rocks B and C. If an attempt is made to hit mark × with the centre of the thrown rock, then rock B will be too full since the contact point is wrong.

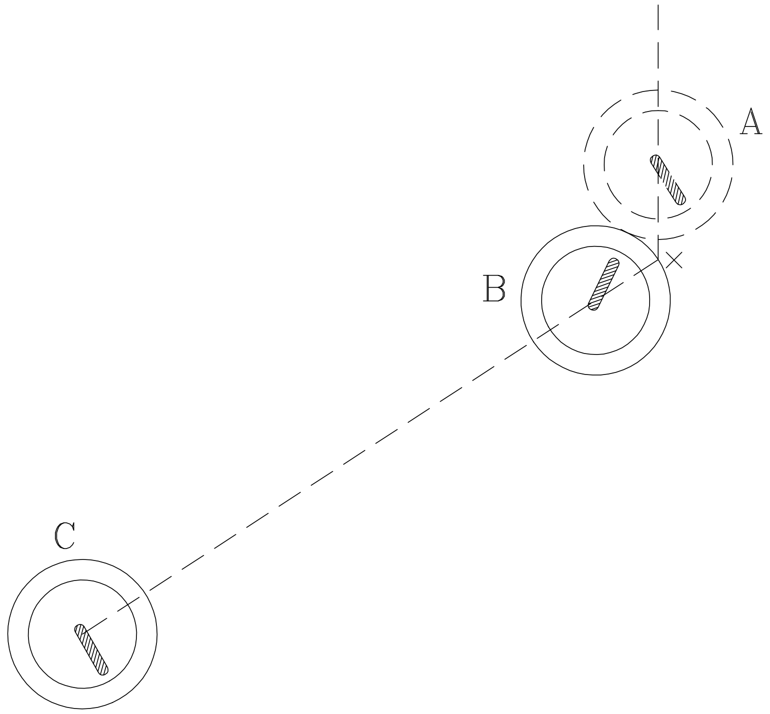

Figure 3: A Common Mistake

Line up the centres

The proper way to play the shot is shown in figure 4. Visualize the thrown rock A touching rock B at spot "×" so that the three centres are lined up, then visualize an *area of overlap* between the thrown rock and rock B. The skip and vice skip can then call the line properly. Figure 5 shows five common areas of overlap that curlers should become familiar with.

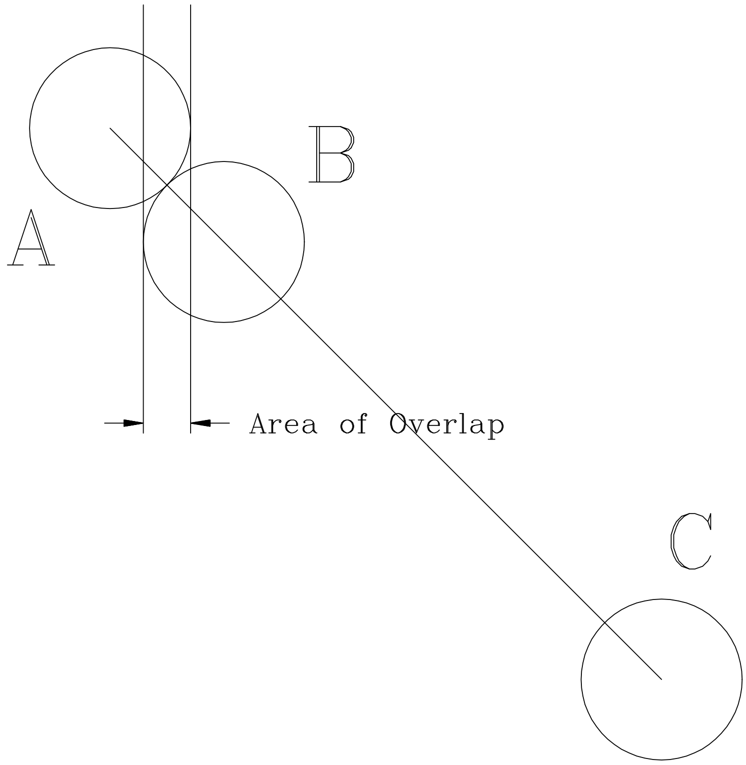

Figure 4: Rock A coming from above hitting B, B moves on to position C. Touching spot A/B is on line with centre of A, B, C.

The "T" principle

When playing a horizontal double as in figure 6, the $\times$ point to hit rock B is determined by visualizing the letter "T" as shown, then visualize the thrown rock in position A to then determine the area of overlap to make the shot.

This "T" principle is very important and can be used in many crucial situations.

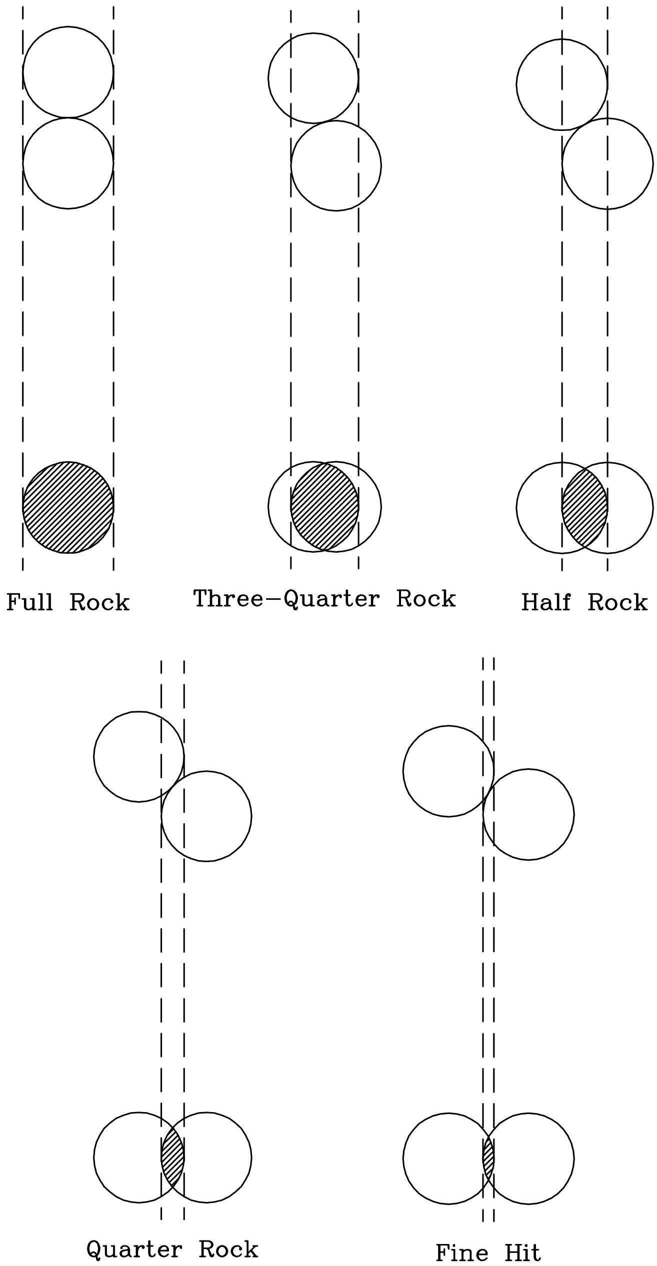

Figure 5: Common Areas of Overlap

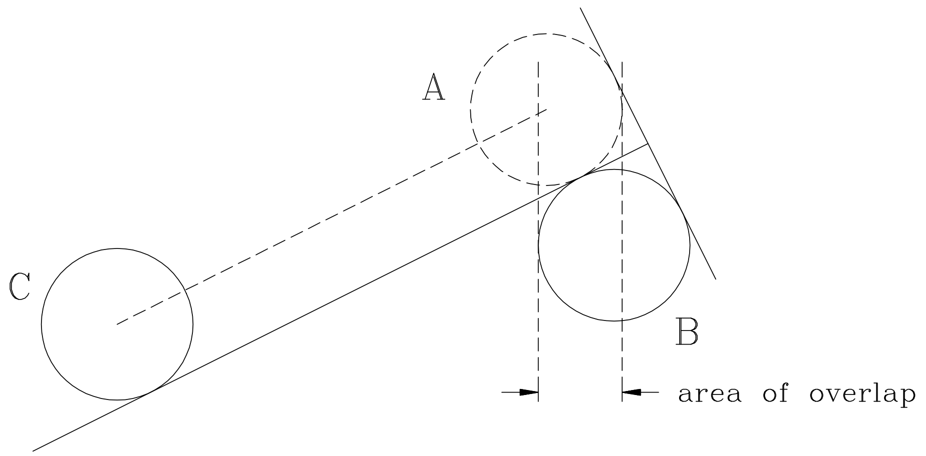

Figure 6: The T-priciple

An example is shown in figure 7. Figure 8 is Scotland's famous triple against the Canadian men's team at the 1992 World Championship (Hammy McMillan vs Vic Peters). The spot to hit rock A can be determined by using the "T" rule starting with rock C. This will prove why the shot was possible.

- Last rock on last end
- A, B are opposition rocks
- You need a 3 ender
- C, D are your rocks
- Where will A go on a full or $^3/_4$ hit?

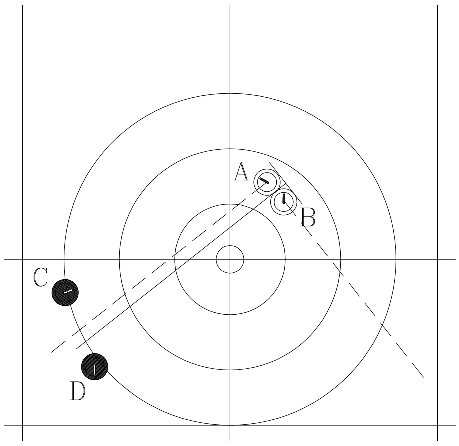

Figure 7: T-priciple in action

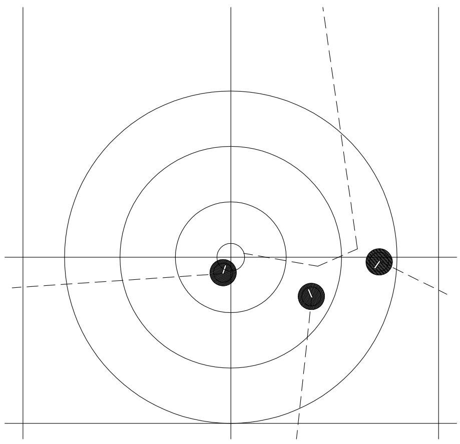

Figure 8: *The* Triple Scotland vs Canada, 1992 world mens semi final.

Turn selection

Figures 9 and 10 demonstrate the options of playing an in turn or an out turn double on rocks B and C assuming the ice curls quite a bit. **Regardless of which turn to play you must hit rock B at exactly the same spot.** The out turn in figure 9 gives you a larger area of overlap and thus is the better percentage shot. Similarly, the in turn in figure 10 is the better shot.

- Out turn the best here
- Ice curls a lot

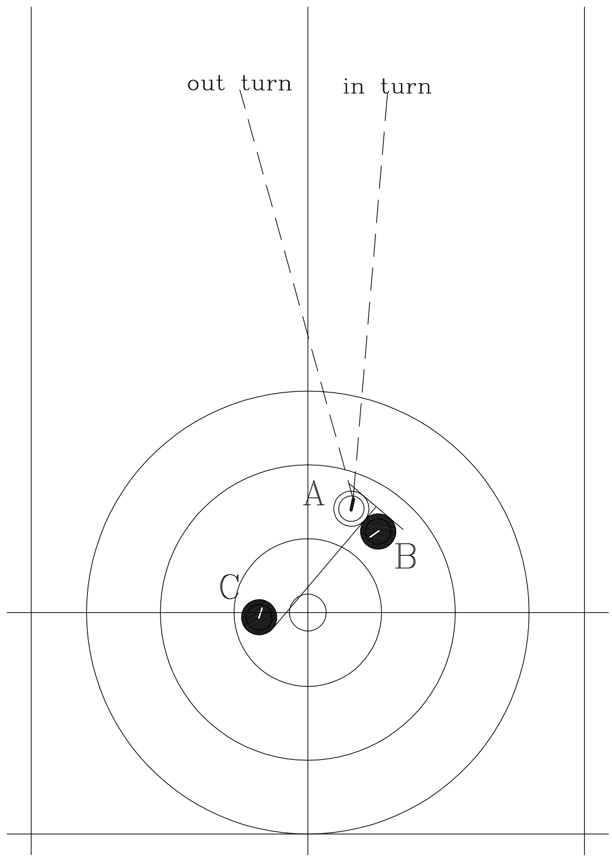

Figure 9: Turn decisions

This *area of overlap* is the most important factor in determining which turn to play. Many curlers believe the out turn in figure 9 causes the shooter to *"jump"* across at a bigger angle than an in turn. I believe this effect to be very minimal with a

- In turn the best here
- Ice curls a lot

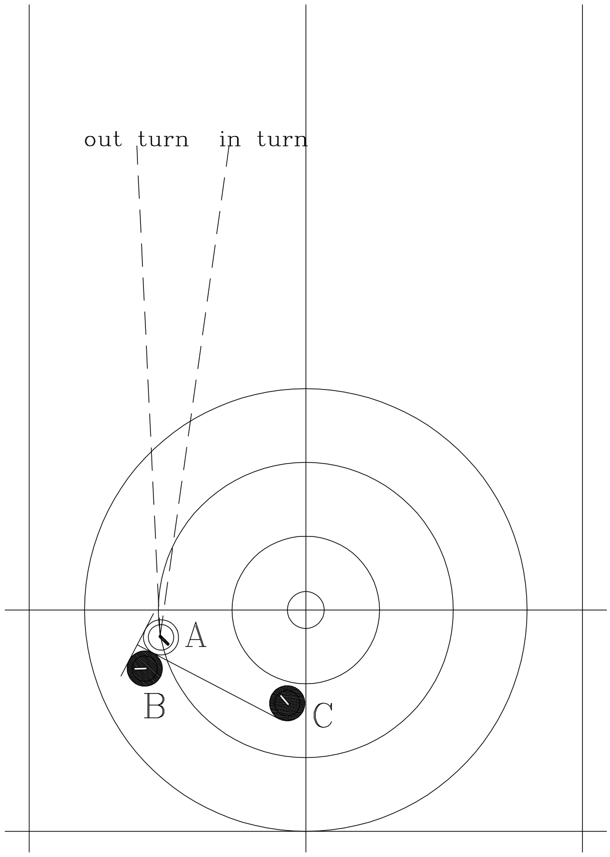

Figure 10: Turn decisions

normal rotation. The major consideration should be the larger area of overlap in the different turns. On straight ice either turn can be used.

Another interesting fact is shown in figure 11. Rocks A and B are both on the same angle from rock C, but rock B has a smaller *area of overlap* than A to make the double. You can not make a fixed rule that a 30° double for example is always a half hit on the first rock.

Area of overlap decreases as rocks on the same angle get closer together.

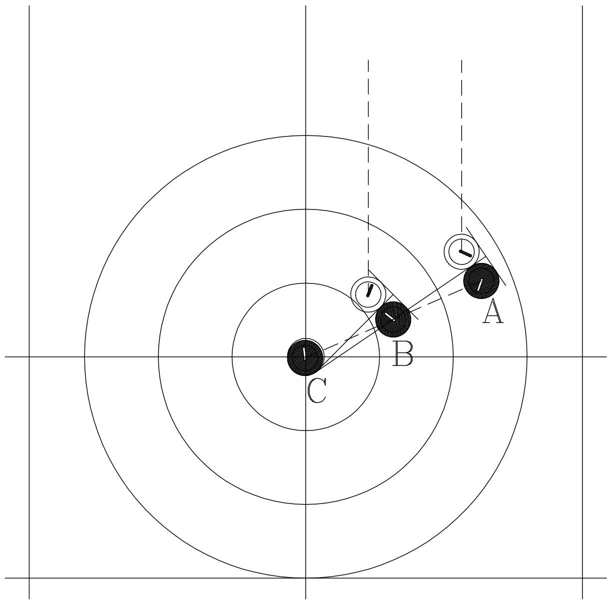

Figure 11: Doubles

4 Accuracy required for raises

Figure 12 shows two rocks a distance "L" apart. Assume rock B will be raised onto rock C with at least half hit on rock C. This will ensure C is removed from play.

$$
\begin{aligned}
a &= \frac{r \cdot d}{l} \\
&\approx \frac{5.5'' \cdot 11''}{l} \\
&= \frac{60.5}{l}
\end{aligned}
$$

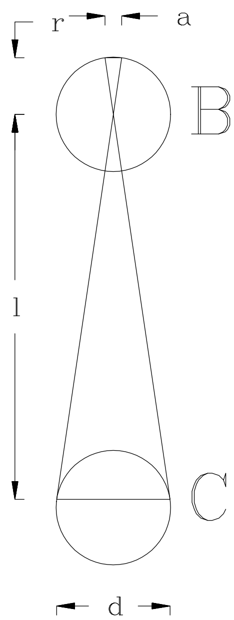

Figure 12: Accuracy

Propabilities

The odds of making the raises above depend on

1. The distance apart
2. The skill level of your team
    - reading ice
    - sweeping
    - throwing

$$
\begin{aligned}
a &= \text{area to hit} \\
&\approx \text{radius} \cdot \frac{\text{diameter}}{\text{length}} \\
&= 5.5 \cdot 11/240 \\
&= 0.25\text{''}
\end{aligned}
$$

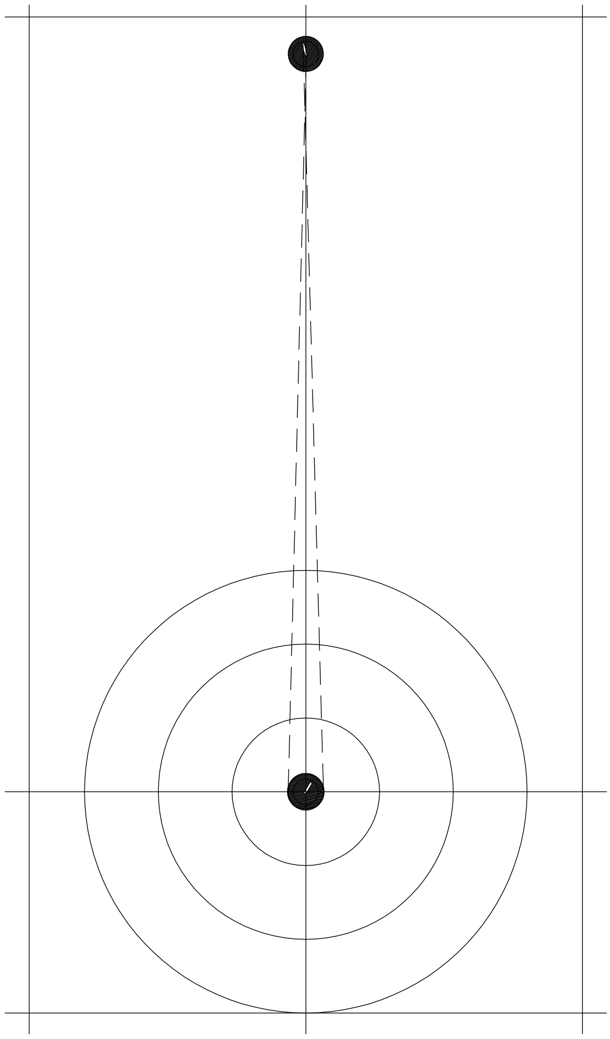

Figure 13: Accuracy — 20 foot raise

$$
\begin{aligned}
a &= \text{area to hit} \\
&\approx \text{radius} \cdot \frac{\text{diameter}}{\text{length}} \\
&= 5.5 \cdot 11/120 \\
&= 0.50\text{''}
\end{aligned}
$$

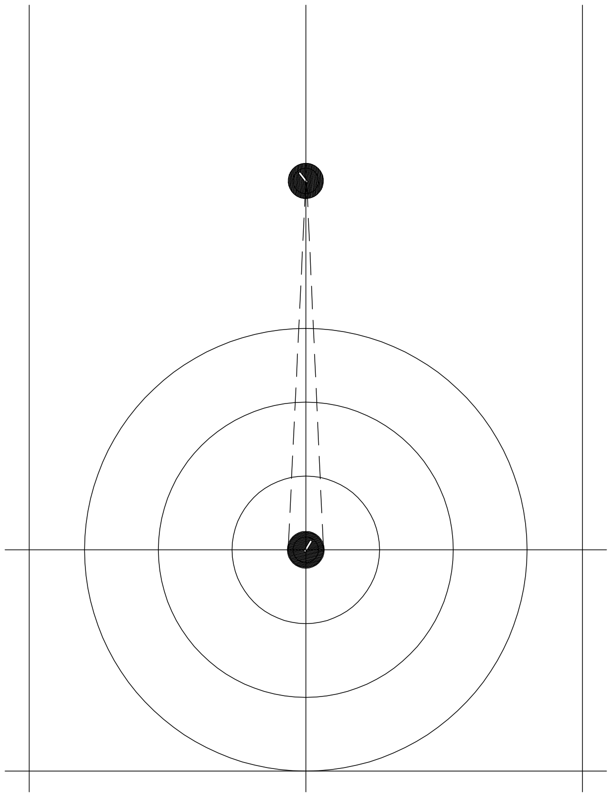

Figure 14: Accuracy — 10 foot raise

- calling line

3. Ice conditions

For example, on the 20" raise you have to be accurate to within $^1/_4$". If your team is only accurate to with 11" (ie. a half hit on either side), then the odds of making this shot are about 1 in 44 since there are 44 – $^1/_4$ inches in 11 inches. A highly skilled team may be accurate within 2" and thus have a 1 in 8 chance of making a 20" raise.

$$
\begin{aligned}
a &= \text{area to hit} \\
&\approx \text{radius} \cdot \frac{\text{diameter}}{\text{length}} \\
&= 5.5 \cdot 11/60 \\
&= 1\text{''}
\end{aligned}
$$

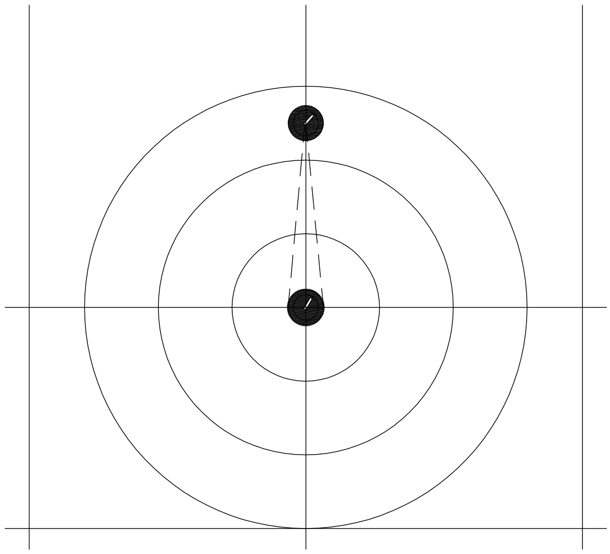

Figure 15: Accuracy — 5 foot raise

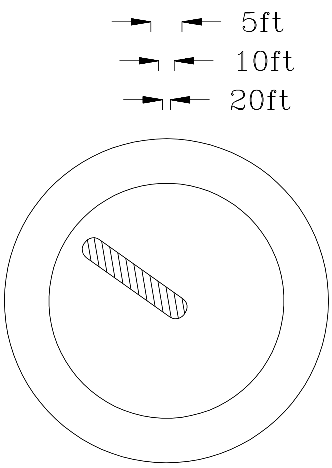

Figure 16: Accuracy — in relation to diameter

5 Loss of momentum

When a thrown rock strikes another rock there is a slight loss of momentum when struck full on. This is of no consequences in take outs, but is important in tap back raises. After many test trails, the pattern in figure 17 emerged. The general rule is that a diameter of one rock is lost for each rock raised. Remember our assumptions on broken in ice with no debri under any of the rocks (watch out for straw).

- same weight on three draws
- A, B, C are the outcome
- A, no raise
- B, raise one rock
- C, raise two rocks

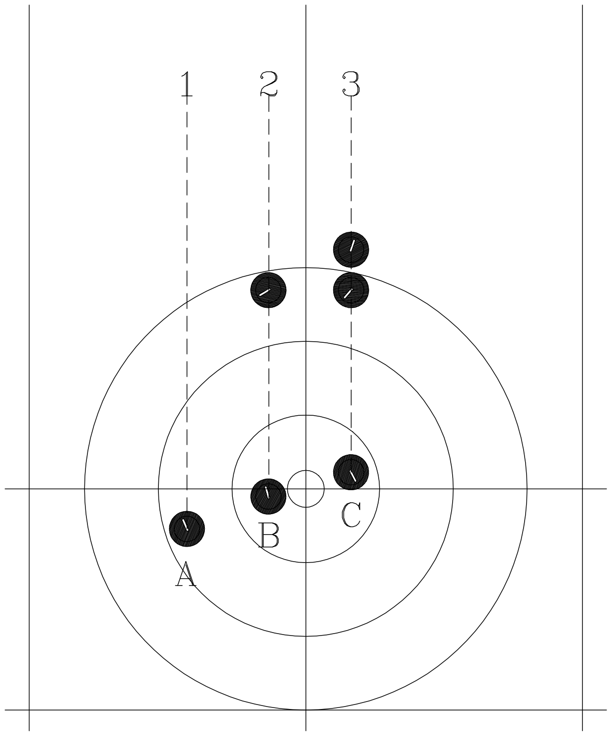

Figure 17: Loss of momentum

Figure 18 shows the other way momentum is lost. When raising rocks at an angle you need more weight. The smaller the area of overlap, the more weight you need. Path C shows the weight required to raise rock A onto the button. Distance C is about the sum of distances A and B.

This principle can be useful on "free" draws that are heavy but are going to hit one

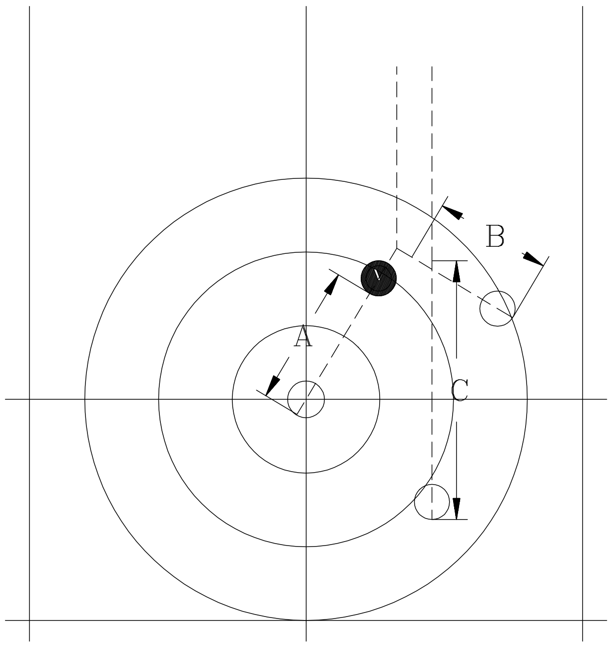

Figure 18: Angle draw raises. Distance $C \approx A + B$.

of your rocks in the house. An alert sweeping call would be to get a $^1/_2$ hit to save both rocks.

6 The *"Drag"* Effect

An interesting phenomenon occurs when playing raise take outs on rocks that are touching (frozen together). Figure 19 shows this effect. Rocks B and C are touching. Rock A is the thrown rock and is a half hit on B. C should go along the normal path but in this case C is *"dragged"* by B slightly towards B's path. **This drag effect disappears only after B and C are more than $^1/_2$" apart**.

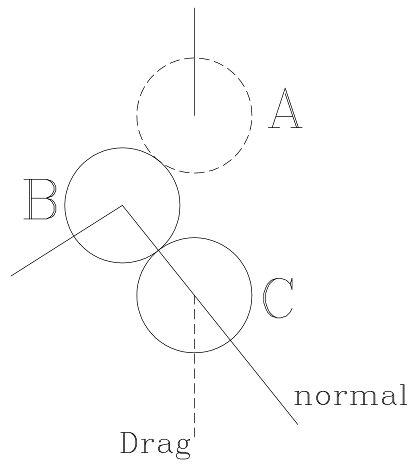

Figure 19: The *"Drag"* Effect

You can use this principle to your advantage but ist should be used only if you have practiced it and no other shots are available. Figures 20 and 21 show two examples.

Figure 22 shows a set up which many curlers believe is an *"automatic"* in that you can hit B anywhere. You must hit B in spot $\times$ to avoid the *"drag"* effect.

- B and C are lined up to just miss D
- A half hit on the right side of B will cause C to hit D
- The drag effect disappears after B and C are one half inch apart

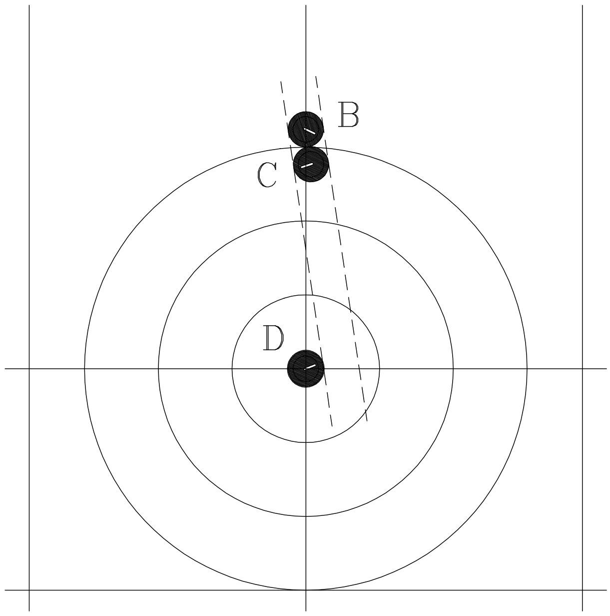

Figure 20: Drag Effect

- A $^{3}/_{4}$ hit on the right side of B will cause C to hit D
- Paths 1, 2 or 3 or any in-between are possible depending on where it is hit

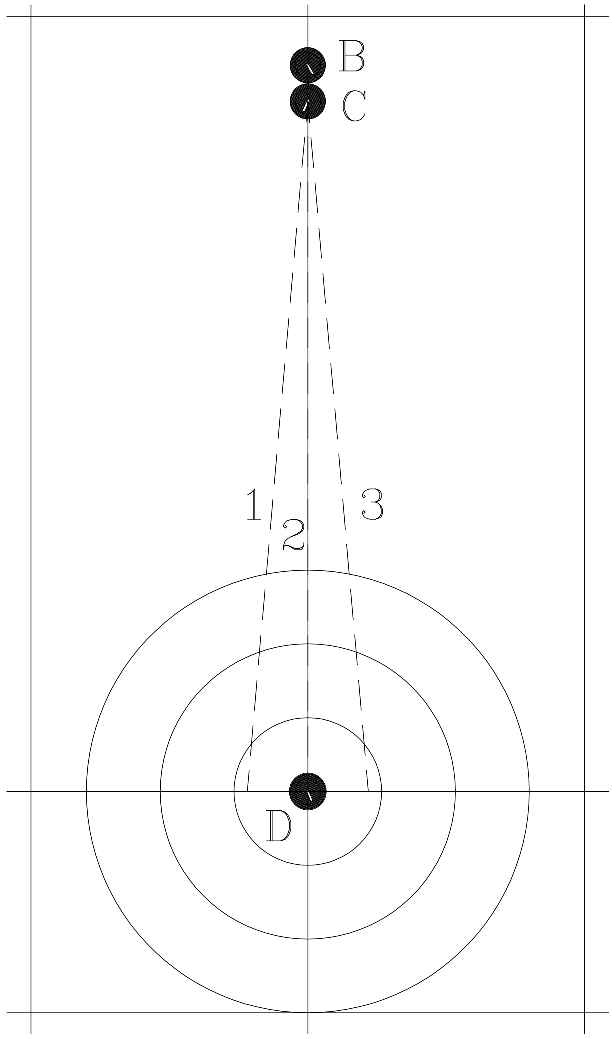

Figure 21: Drag Effect

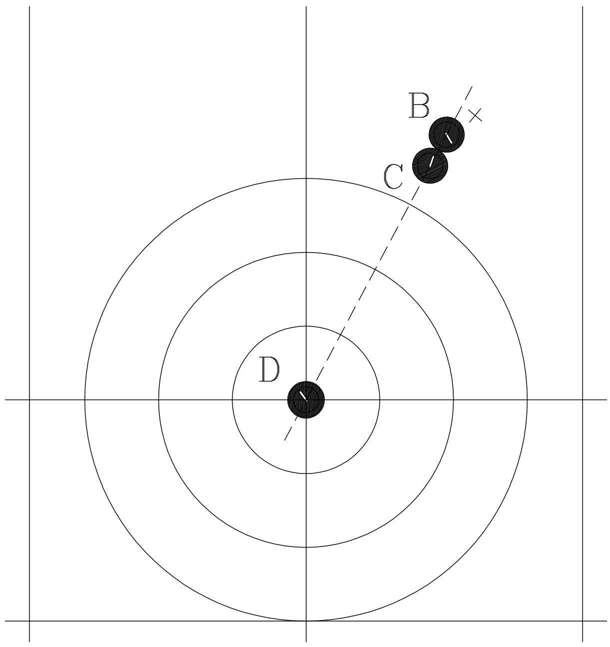

Figure 22: Avoid the Drag Effect. Hit B at the position $\times$, the same as if C wasn't there.

7 Ports

Figure 23 to 25 show the path the thrown rock takes when comingg through ports and wicking on one or both of the rocks. In figure 23 there is a small port between rocks B and C (1 or 2 inches to spare to each side). In figure 24 the port is slightly narrower than one rock. Figure 25 demonstrates the follow-through effect if simultaneously striking B and C when the port is narrowe than one rock. With $10^3/_4$" diameter rocks a port size down to 8" can be navigated. This is exactly the width of the plastic handle covers used in many clubs.

- B and C are 13 to 15 inches apart. Fine hit C first, glancing off B
- A very fine hit on C causes A to take path 1
- Slightly fuller hits on C progress A's position to 5

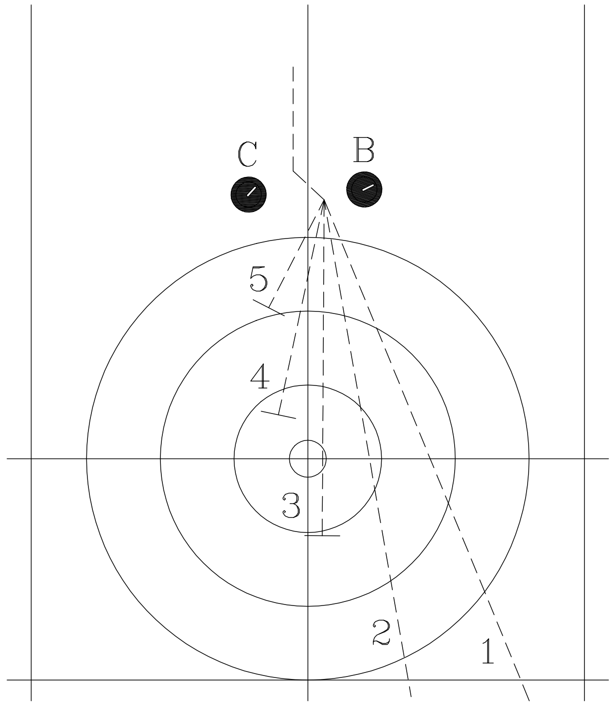

Figure 23: Splitting rocks

Figure 26 shows two different double situations. D, E is a *"natural"* double, in that a half hit on D is required. B, C is a very difficult double unless played properly. A half hit on the centre line side of B makes it as easy as a *"natural"* double.

- B and C are about 10 inches apart
- Fine hitting C first results in path 1
- Fine hitting B first results in path 2

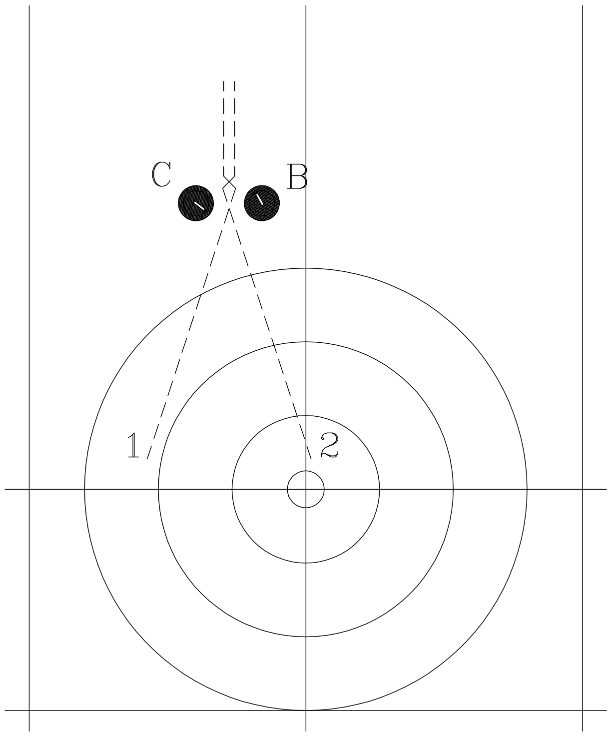

Figure 24: Splitting rocks

- Port sizes of less than 8 inches cannot be navigated. (Width of plastic handle).
- B, C must be hit simultaneously.

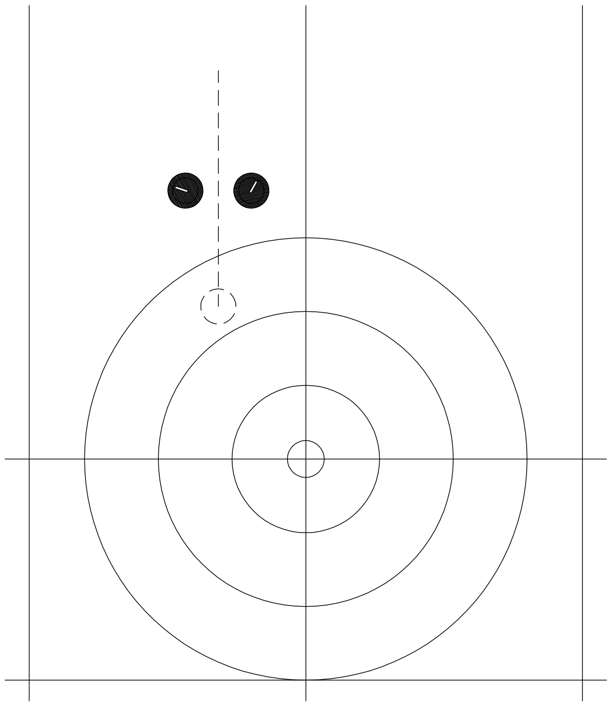

Figure 25: Splitting through a port

- Defined as two rocks situated so that a half hit on the first one hits the second one directly.
- D and E are a natural double.
- Characteristics: You cannot roll across the face of E.
- B, C are an extremely tough double if you attempt to split them. A half hit on the centre line side of B makes it as easy as a natural double.

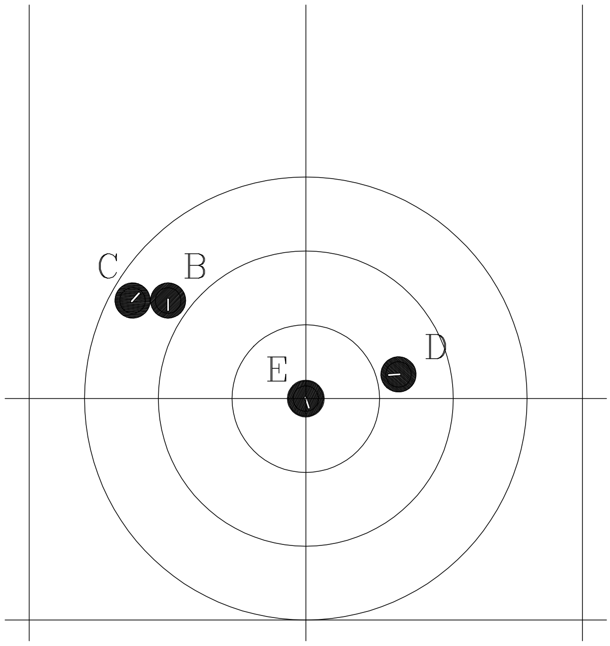

Figure 26: Natural doubles

8 Practice routines

All of the principles shown here should be set up in practices. Rocks can be delivered (pushed) from the nearest hog line to save time.

A very good off season routine would be to have the team practice various shots on a pool table. Specially:

- learning about proper area of overlap (full, three quarter, half, one quarter hits)
- learning to visualize the "T" rule for doubles
- learning about the drag effect

A more realistic environment can be set up on a pool table by making a scale drawing of the house area out to hog line on a sheet of paper. The scale is 5.5 to 1 since a billiard ball is 2 inches in diameter vs 11 inches for a rock.