

# Dice Game Introduction

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# Dice Game

- Overview
- Gameplay
- Example
- Soar IO Link

# Overview

- Two or more players
- Each player starts with five dice
- Each round, one player wins or loses a die
  - Usually loses
- Last player with dice left wins the game

# Why is this interesting?

- Mixed symbolic / probabilistic reasoning
  - Heuristic reasoning vs. precise calculations
- Opponent modeling
  - Gleaning information from opponent's actions
- It's fun!
  - We're competitive; can Soar defeat us?

# Perception

During each player's turn, they perceive:

- The dice under their own cup
- Dice that any player has pushed
- How many dice are under each player's cup
- Move history
- Legal actions to take (affordances)

# Actions

- ***Bid***
- ***Bid*** and ***Push***
- ***Pass***
- ***Challenge*** previous bid or pass
- ***Exact***


# Bids


- A bid has a *face* and a *count*
  - e.g. “Three sixes”, “Two fours”, “One one”
- The first player may make any bid
- Subsequent bids must increase either the face or the count
- If the count increases, the face may decrease
- The count may not decrease

# Bids

 “One four”

 “One five” + face

 “One six” + face

  “Two twos” + count, - face

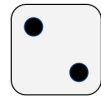
  “Two threes” + face



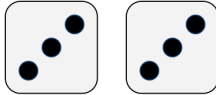
# Ones

- Ones are wild
- To compensate, bids on ones may halve the current count value (rounding up)
- Bids following bids on ones must double and add one to the count

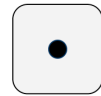
# Ones



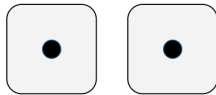
“One two”



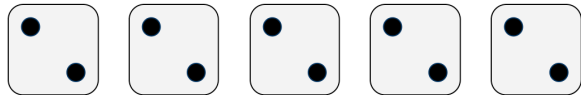
“Two threes” + face; + count



“One one”  $\frac{1}{2}$  count (ones)



“Two ones” + count



“Five twos”  $2x+1$  count; + face

# Push

- When a player bids, they may ***push*** some of their dice and re-roll their other dice
- Pushed dice are viewable by all players
- Advantage:
  - Higher probability of your bid being correct
- Disadvantage:
  - Opponents get to see some of your dice

# Pass

- You may *pass* once per round
- By passing, you are asserting that all your dice are showing the same face
- If you bluff a pass and are challenged, you lose a die

# Exact

- Once per game, if you think the previous bid was exactly correct, you may ***exact***
- If you exact and the previous bid was exactly correct, you gain a die (limit 5)
- Otherwise, you lose a die

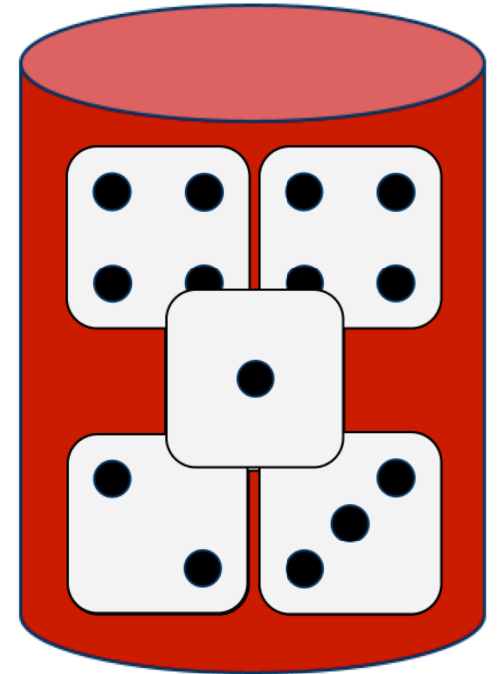
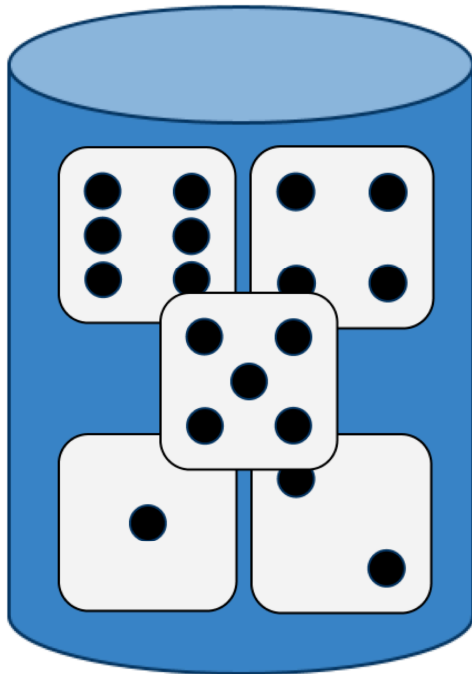
Player      Opponent

“Three sixes”

“Four fours”

“Five fours”

**Round 1**  
“Challenge”



Result:

Three fours + two ones  
(Five fours)

Opponent loses a die

Player      Opponent

“Three twos”

“Three threes”

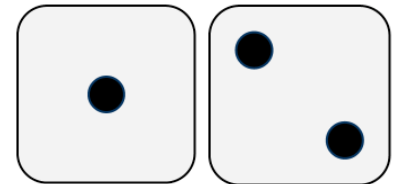
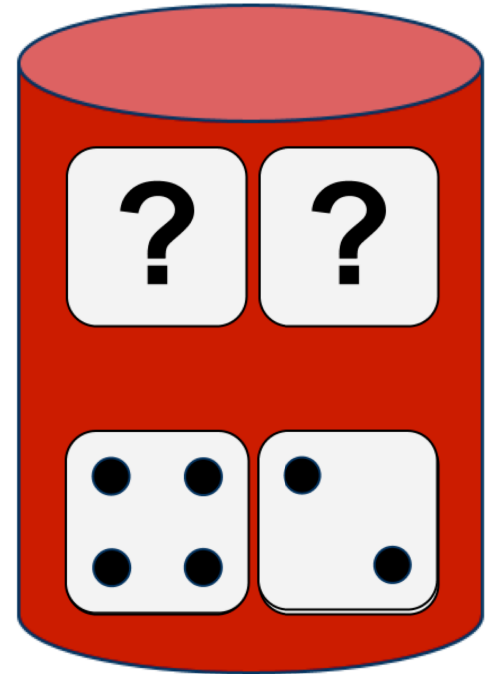
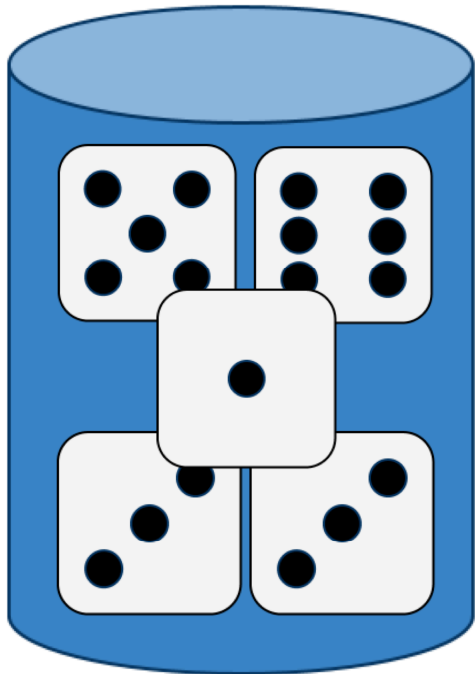
“Four twos & push”  
**Round 2**  
(re-roll hidden dice)

“Challenge”

Result:

Two twos + two ones  
(Four twos)

Player loses a die



# Agent Perception

<il>.players

^player \*

^id (int)

^cup

^count (int)

^die \*

^face (int)

<il>.state

^last-bid

^player <player>

^action (string)

^face (int)

^multiplier (int)

^next <bid>

*\*multi-valued attribute*



# Agent Actions

<il>.affordances

^action \*

^name (string)

^available (string)

^target <player>

<ol>

^bid

^face (int)

^multiplier (int)

^challenge

^target (int)

^exact

^pass

^push

^die \*

^face (int)

^sleep

*\*multi-valued attribute*

Questions / Comments?