



Knox College

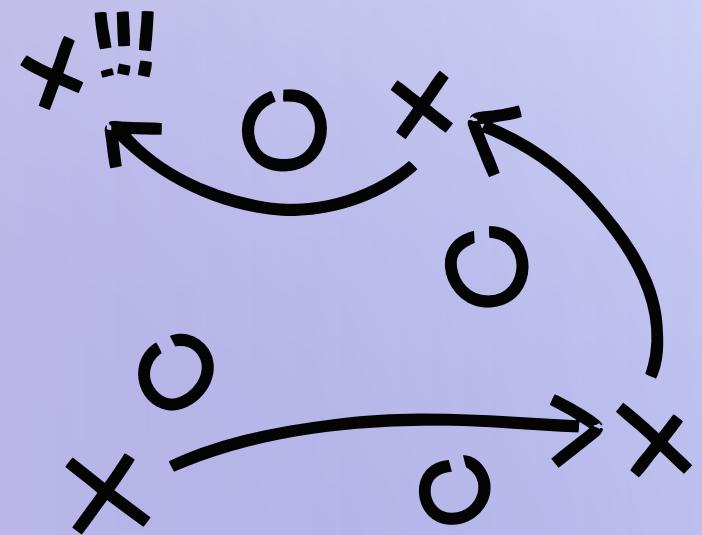
SIMULATING AND OPTIMIZING AI STRATEGIES IN A SIMPLIFIED WINGSPAN GAME

Bishoy Tadrous

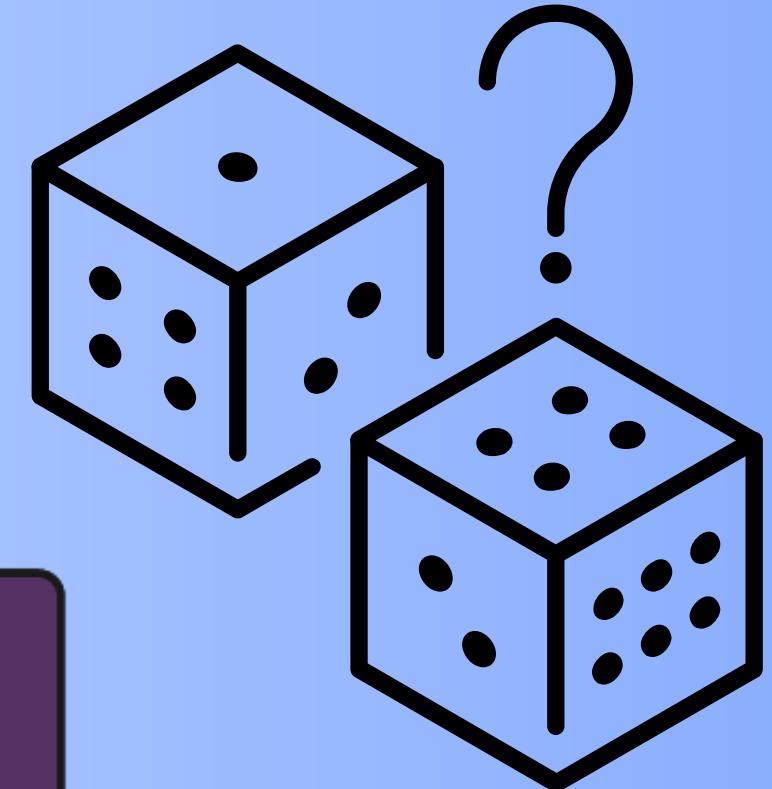
Prof. David Bunde



GAME THEORY



- Game theory is used to study decision-making and strategies in situations where many players can interact.
- In many board games, like Wingspan, players interact with the game system and each other. Every player makes decisions that impact their own outcome (points, powers, etc.).



PLAY A BIRD



GAIN FOOD
FROM BIRDFEEDER

THEN ACTIVATE ANY BROWN
POWERS IN THIS ROW



LAY EGGS
ON BIRD(S)

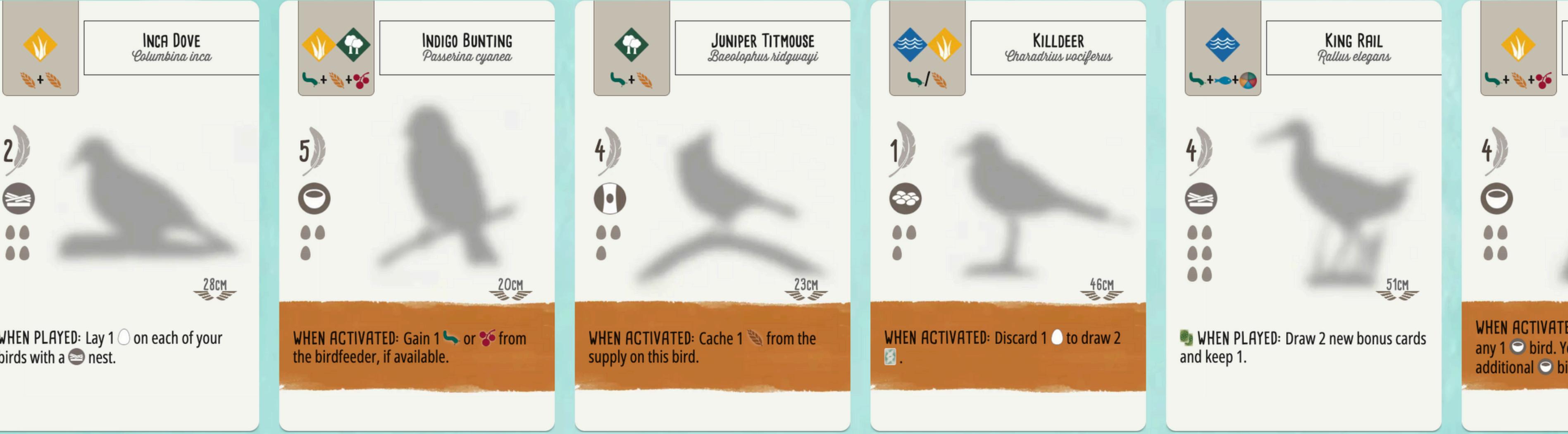
THEN ACTIVATE ANY BROWN
POWERS IN THIS ROW



DRAW BIRD CARDS

THEN ACTIVATE ANY BROWN
POWERS IN THIS ROW





PLAY A BIRD

GAIN FOOD FROM BIRDFEEDER

THEN ACTIVATE ANY BROWN POWERS IN THIS ROW



LAY EGGS ON BIRD(S)

THEN ACTIVATE ANY BROWN POWERS IN THIS ROW



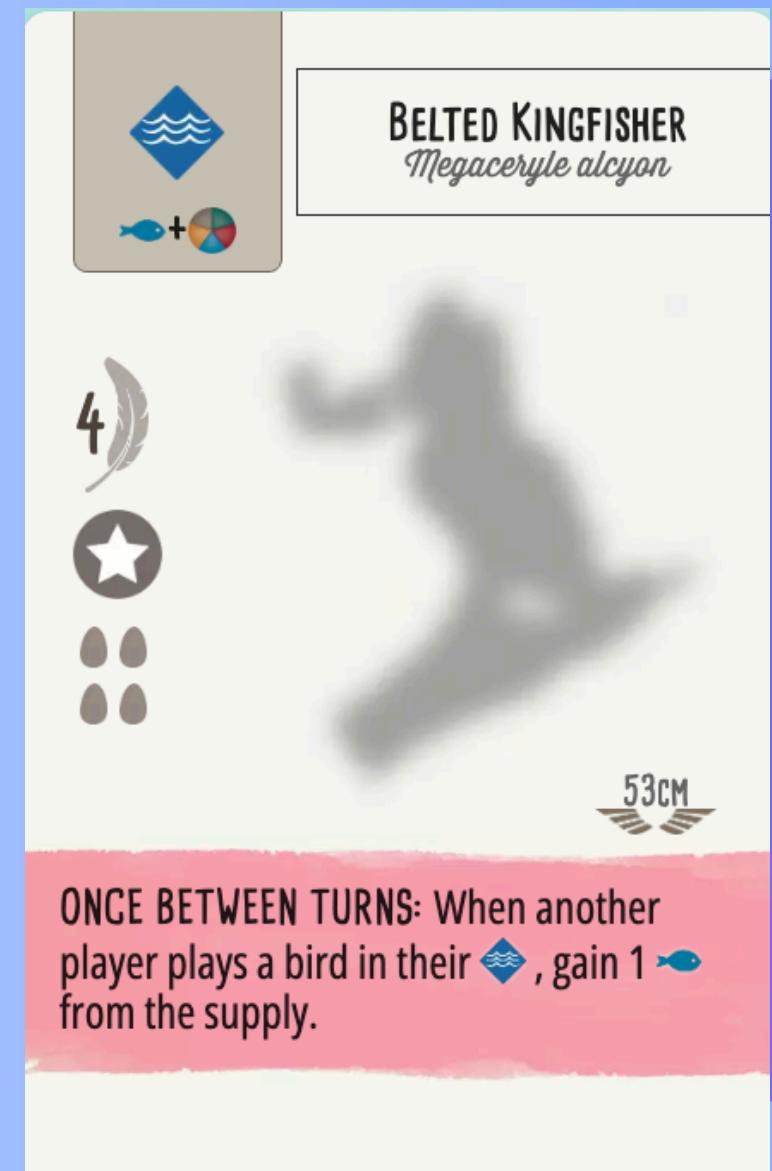
DRAW BIRD CARDS

THEN ACTIVATE ANY BROWN POWERS IN THIS ROW



SIMPLIFIED VERSION

- One-Player game
- No Round Bonuses
- No Pink Powers
- No Multiple Food Types
- No Powers that depend on another player



WINGSPAN SIMPLIFIED

- In a one-player game, game theory still applies, but it focuses more on optimizing decisions to achieve the highest score.
- AI Strategy:**
- We first tried some strategies like prioritizing high-point birds and low-point birds.
 - First, the AI checks its hand for birds with **best card value** to play and also when it draws a card.
 - The AI selects a bird to play based on available resources (food and eggs).
 - If the AI can't play any birds due to lack of resources, it will choose to lay eggs or gain food or draw a card(depends on what is it lacking to play a card).



DIFFERENT STRATEGIES/SIMULATIONS

1

Random Cards

- Games Simulated: 1000
- Average score: 43.546
- Highest score: 70

2

Low-Points Birds

- Games Simulated: 1000
- Average score: 44.351
- Highest score: 70

3

High-Points Birds

- Games Simulated: 1000
- Average score: 46.631
- Highest score: 71



Best-Cards Value

- Games Simulated: 1000
- Average score: 56.694
- Highest score: 83

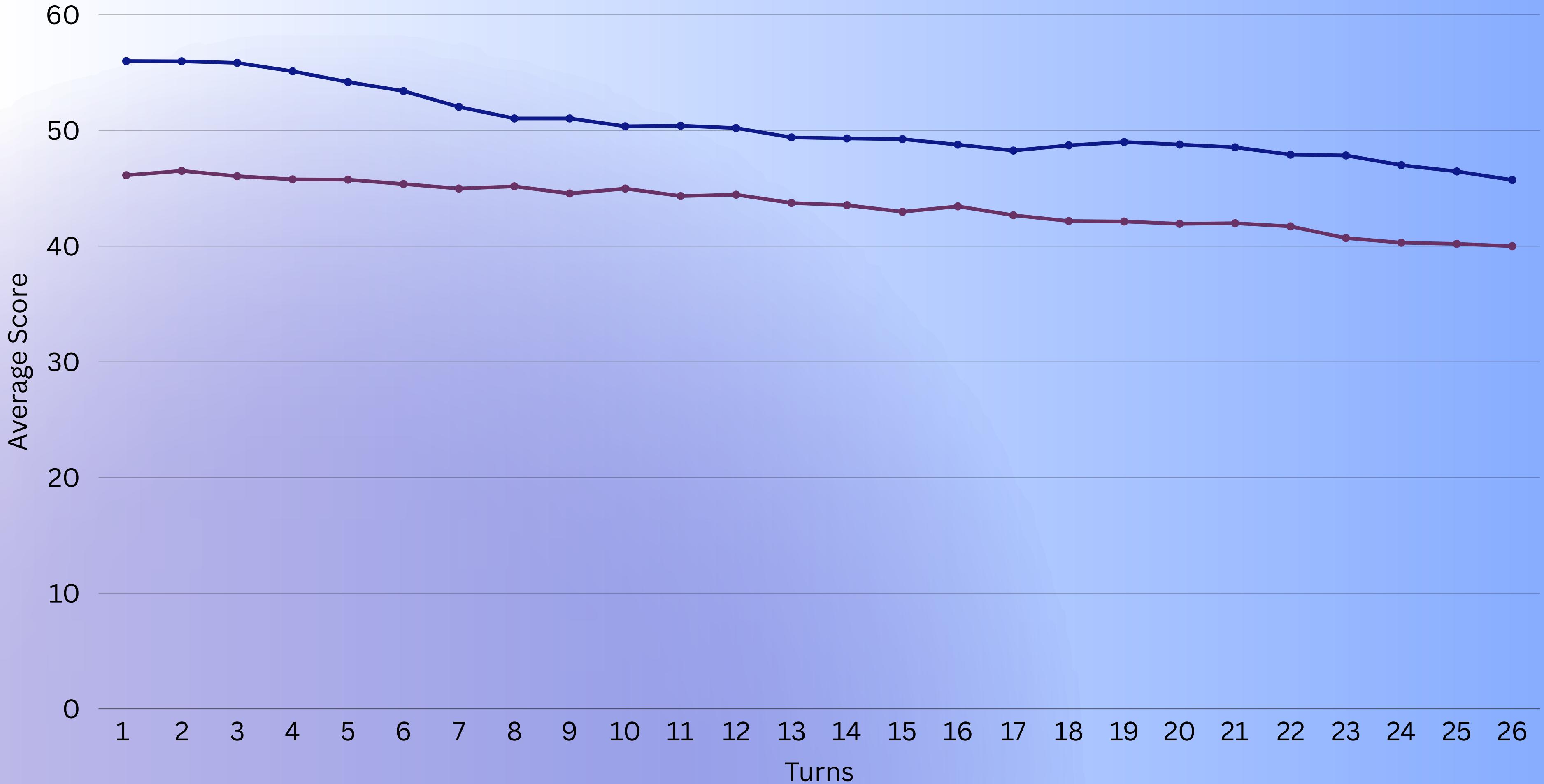


DECIDING CARD VALUE

- A simulation that forces to play a specific bird in each turn of the 26 turns. It plays 1000 games for each of those situations. Collects one important piece of data for every turn:

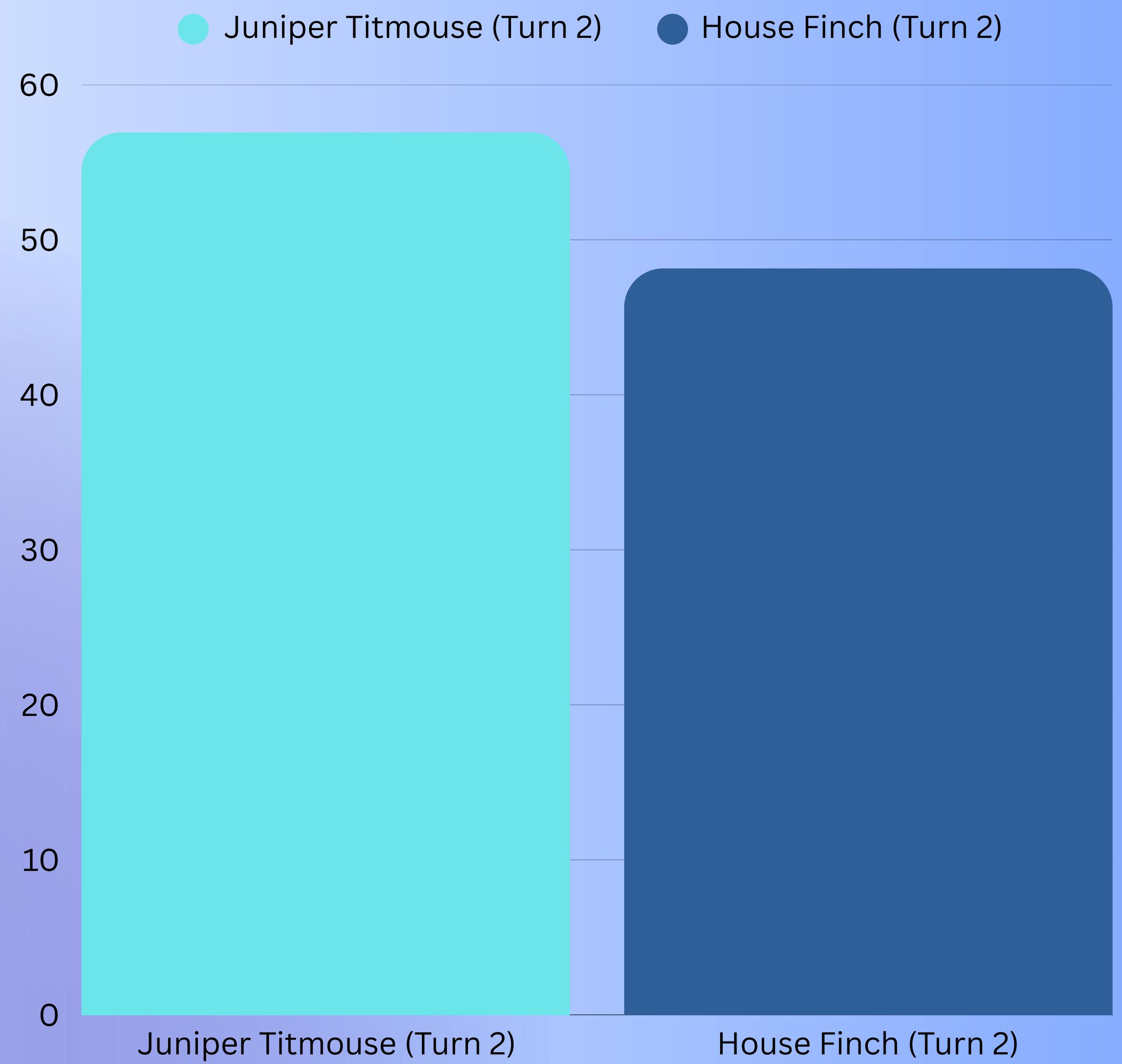
Average Total Score

Great Horned Owl vs Mallard



BIRDS COMPARISON

Comparison between two different birds played in the same turn:



HUMAN VERSION

There's also a human mode where a real person can:

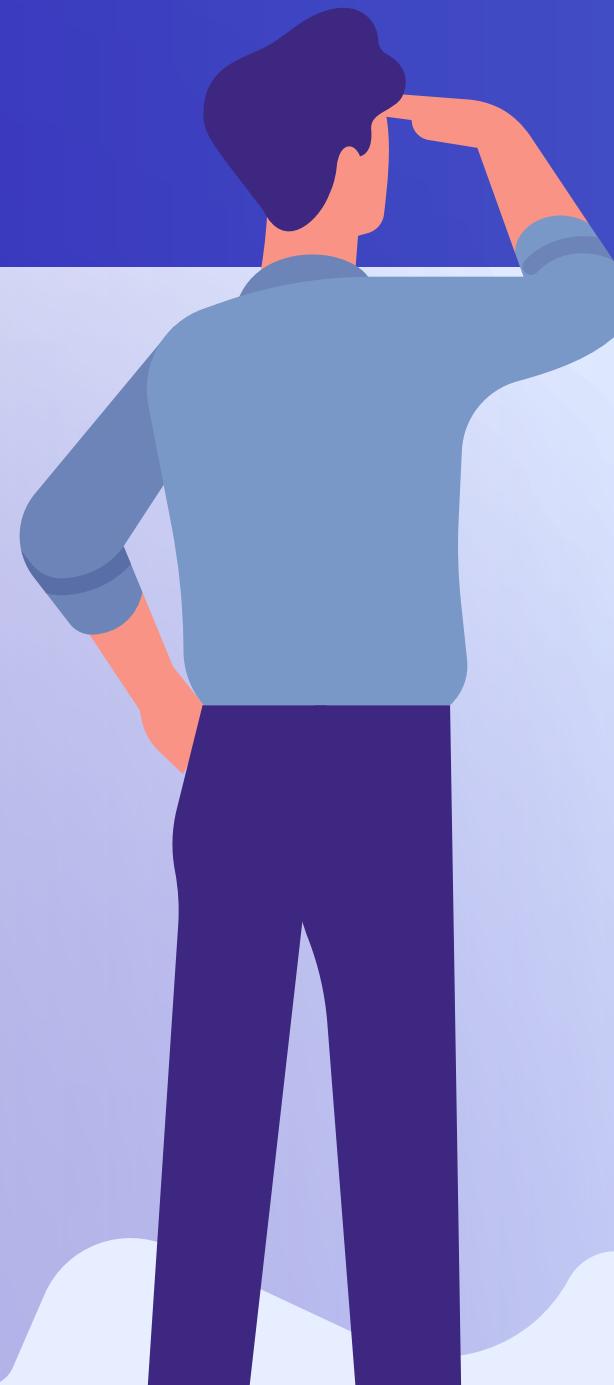
- Choose actions each turn (Play Bird, Gain Food, etc.)
- Decide where to play birds
- Interact with powers (example: choose which card to tuck or which habitat to move to)



FUTURE WORK



- **Full Wingspan Game**
 - Round goals and bonus cards
 - Multiple food types
 - All Bird powers
 - Nest types
- **More than one-player game**
 - Considering other players moves



THANK YOU!



Bishoy Tadrous



bntadrous@knox.edu