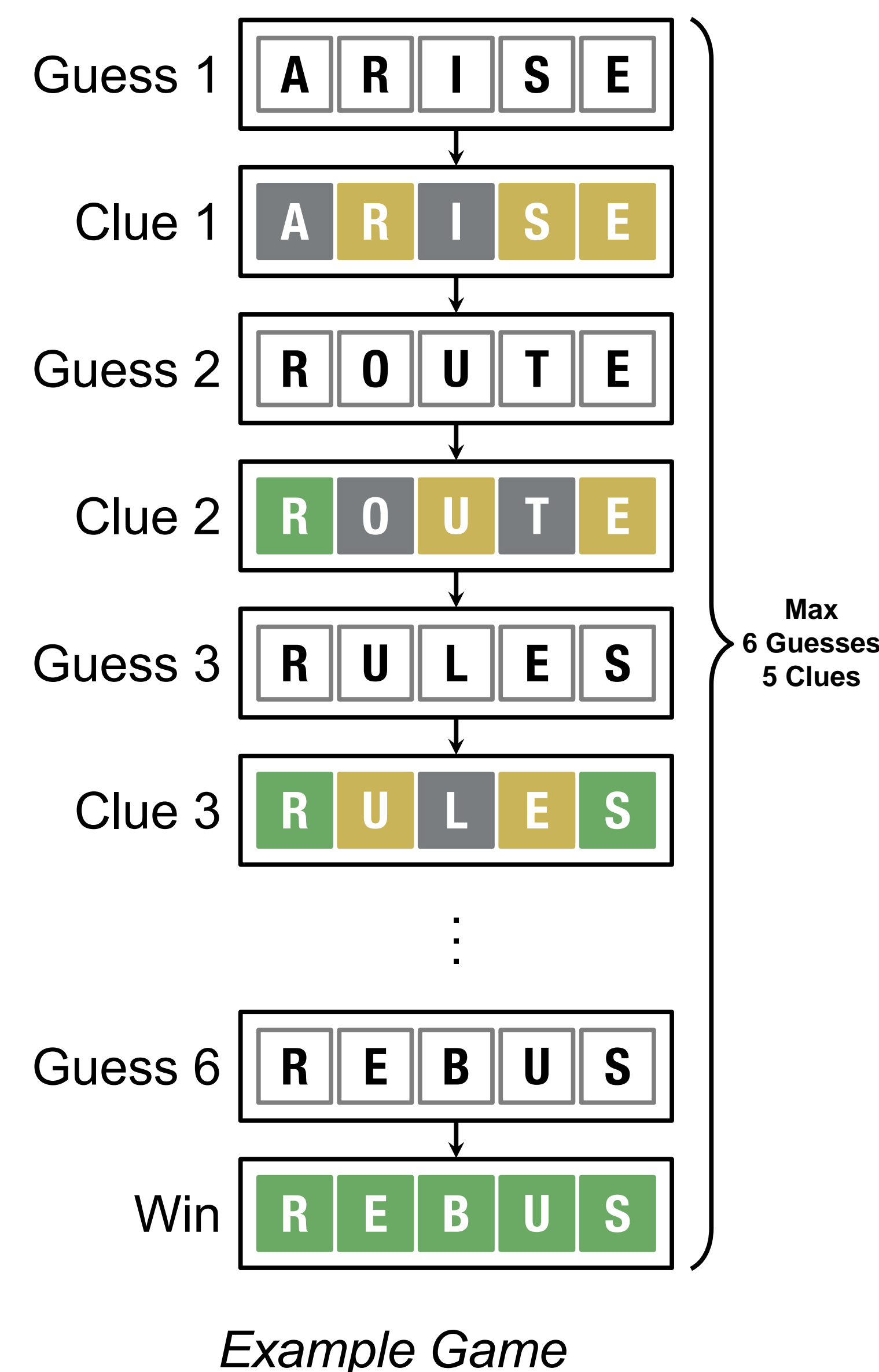


The Game of Wordle



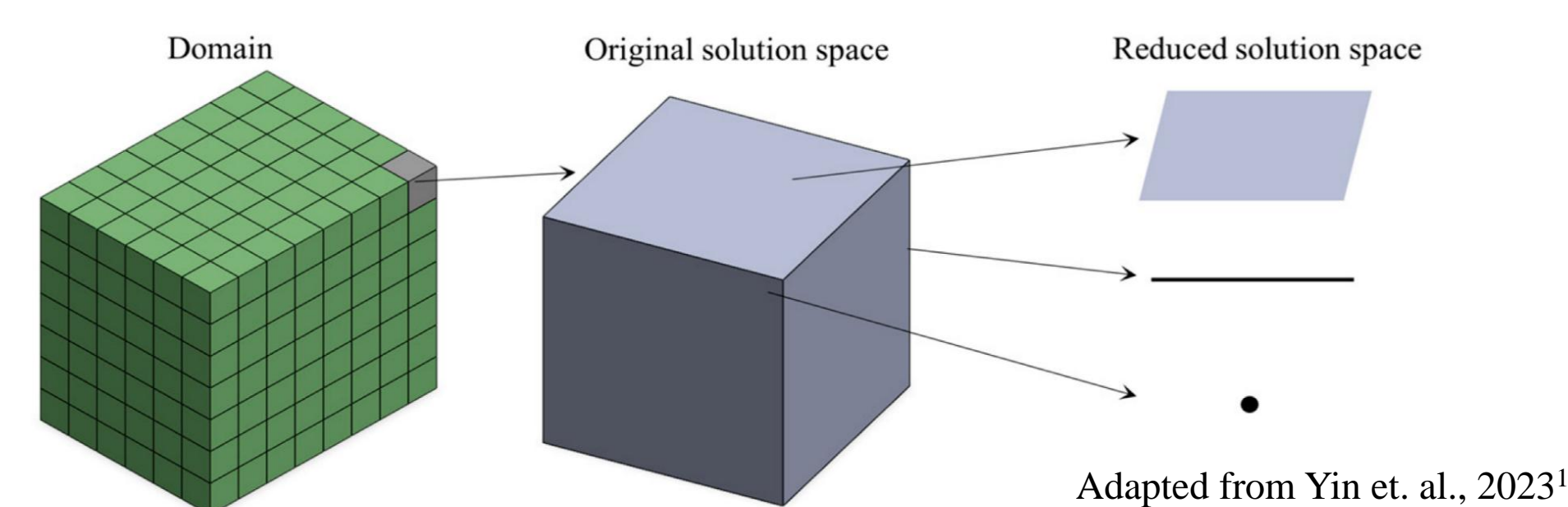
Playing The Game

- Find a 5-letter English word within 6 guesses
- Clue is provided upon each guess
- Each letter given a color
 - Green: Letter is in the solution in the right position
 - Yellow: Letter is in the solution in the wrong position
 - Black: Letter is not in the solution in any position
- Clue reduces list of possible solutions
- Two ways to play
 - **Individual:** Win within 6 guesses
 - **Competition:** Player who uses fewest guesses

Question

Can a Search Algorithm Outperform Humans?

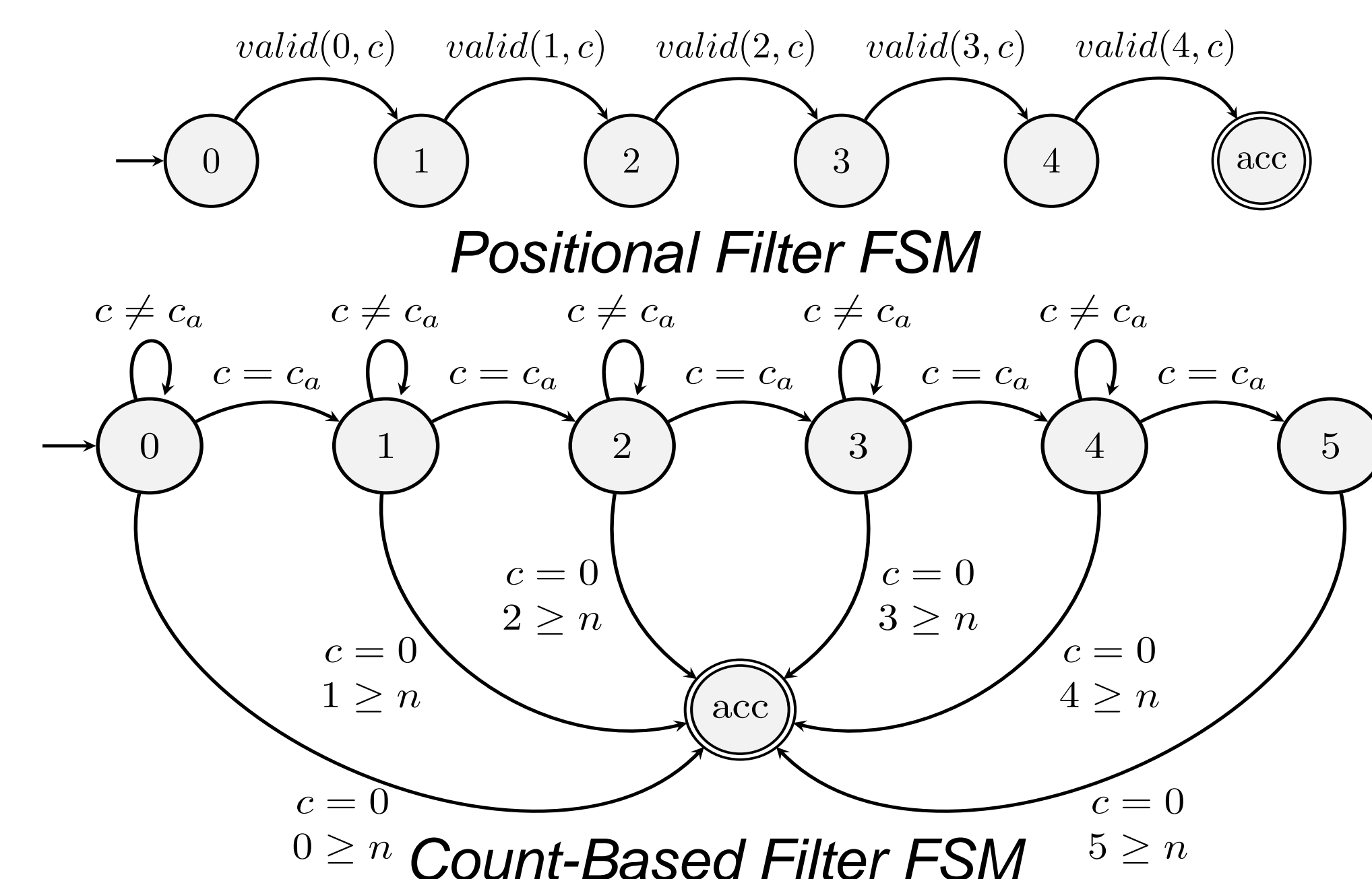
- Wordle is a solution space reduction problem
- Full solution space is known: all 5-letter English words
- Algorithm as follows:
 - Guess random word from solution space
 - Use clues to filter solution space
 - Repeat until solution found or guess limit reached
- Would this algorithm outperform human players?



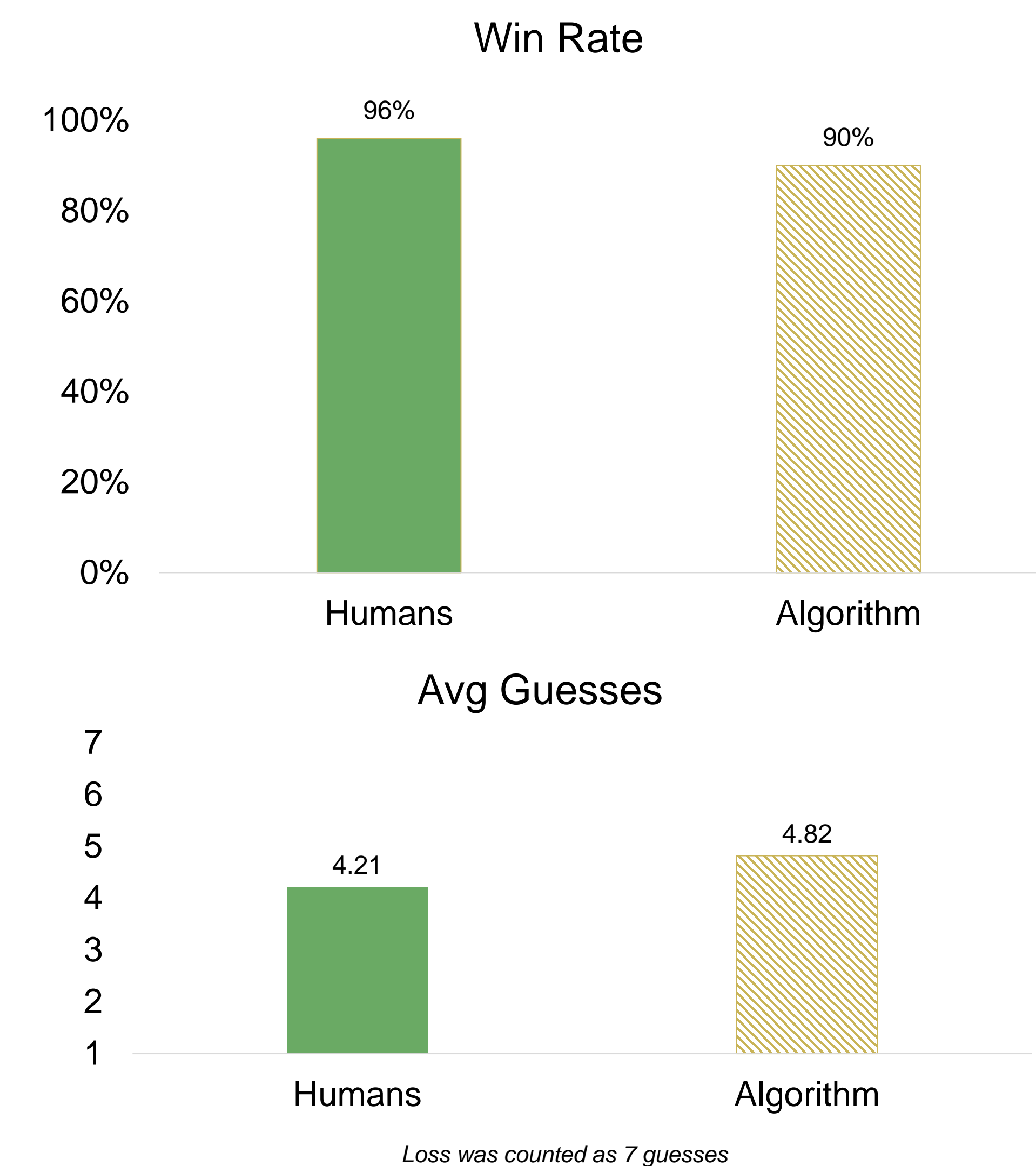
Filtering System

Filtering The Solution Space

- Clues impose constraints
 - **Positional:** Which characters allowed in each position in solution
 - **Count-Based:** How many occurrences of each character allowed in solution
- Update system parameters upon parsing clues
 - List of valid characters in each position
 - List of known characters and counts
- Remove word from solution space if rejected by filters



Results



Discussion

- Humans outperform the algorithm in both metrics
- Filtering solution space is not enough
- Humans employ more advanced strategies to choose guesses from the solution space

Experiment Setup

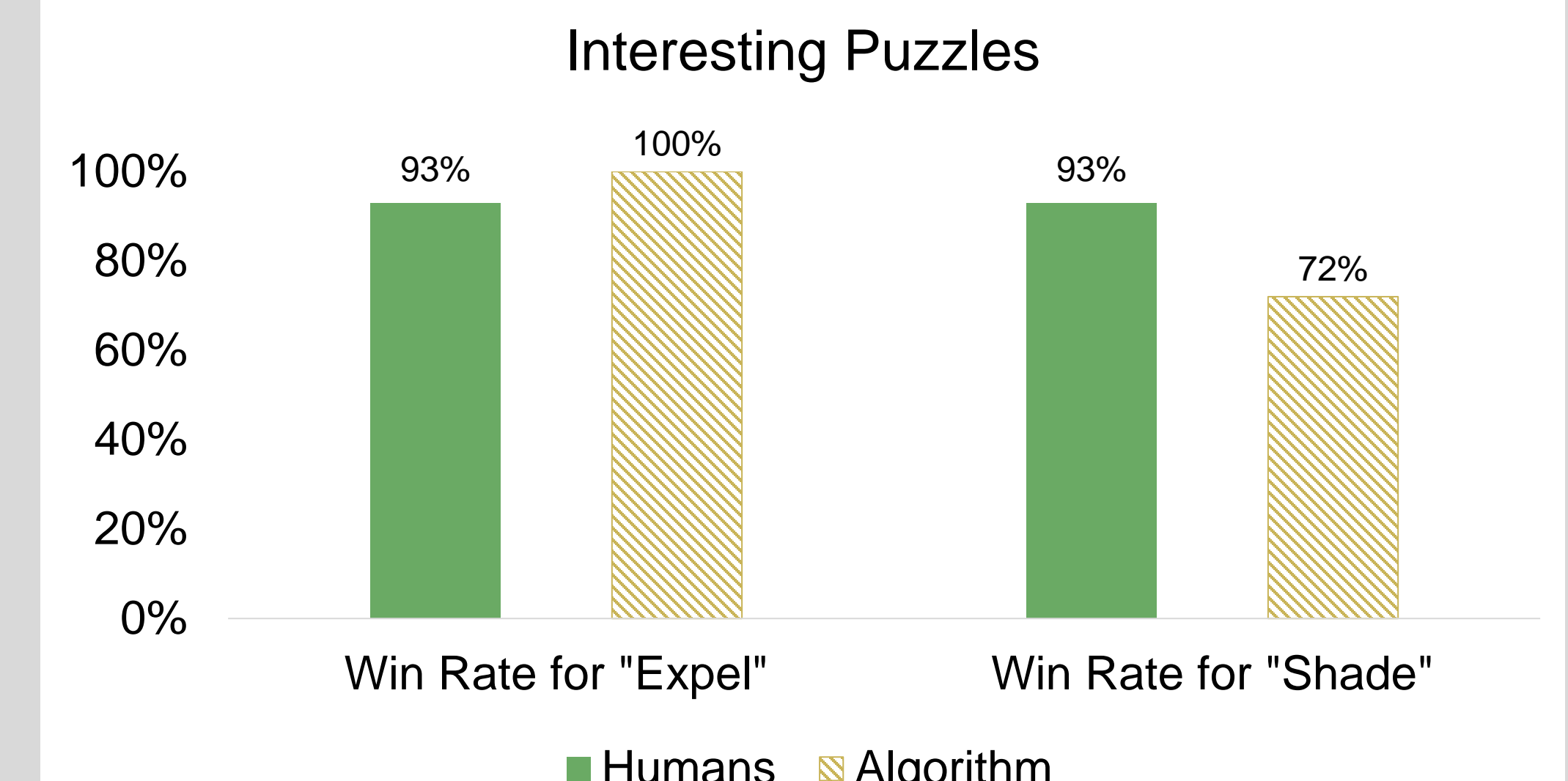
Human Data

- New York Times publishes player score data daily
- Chris Webb² compiled 915 days of data
- Recorded solution, guess counts, and win rate
- Compare this data against algorithm's performance

Algorithm Data

- For each puzzle in the human dataset, run 100 games with the algorithm
- Record guess counts and win rate

Insights



Words Starting With exp-			Words Ending In -ade		
expos	expel	expat	blade	glade	evade
			grade	clade	irade
			trade	shade	slade
			spade	stade	tsade
			ruade		

Two Interesting Puzzles

- Found two words where discrepancy between human and algorithm win rates was large
- Shows the difficulty of Wordle can be manipulated by choosing less or more commonly used words as the solution

Expel

- Only 3 5-letter words start with exp-
- Humans less likely to remember these words
- Algorithm has access to all 5-letter words
- Quickly filters out words without this uncommon spelling feature

Shade

- 11 words end in -ade
- Humans typically guess common words
- Algorithm stuck filtering out uncommon words
- Human solution space is effectively smaller

References

- [1] Shengwen Yin, Keliang Jin, Yu Bai, Wei Zhou, and Zhonggang Wang. 2023. Solution-space-reduction-based evidence theory method for stiffness evaluation of Air Springs with epistemic uncertainty. Mathematics 11, 5 (March 2023), 1214. DOI:<http://dx.doi.org/10.3390/math11051214>
- [2] Chris Webb. 2023. Wordle stats - how hard is today's wordle? (August 2023). Retrieved April 10, 2025 from <https://engaging-data.com/wordle-guess-distribution/>