



*Love Letter™*

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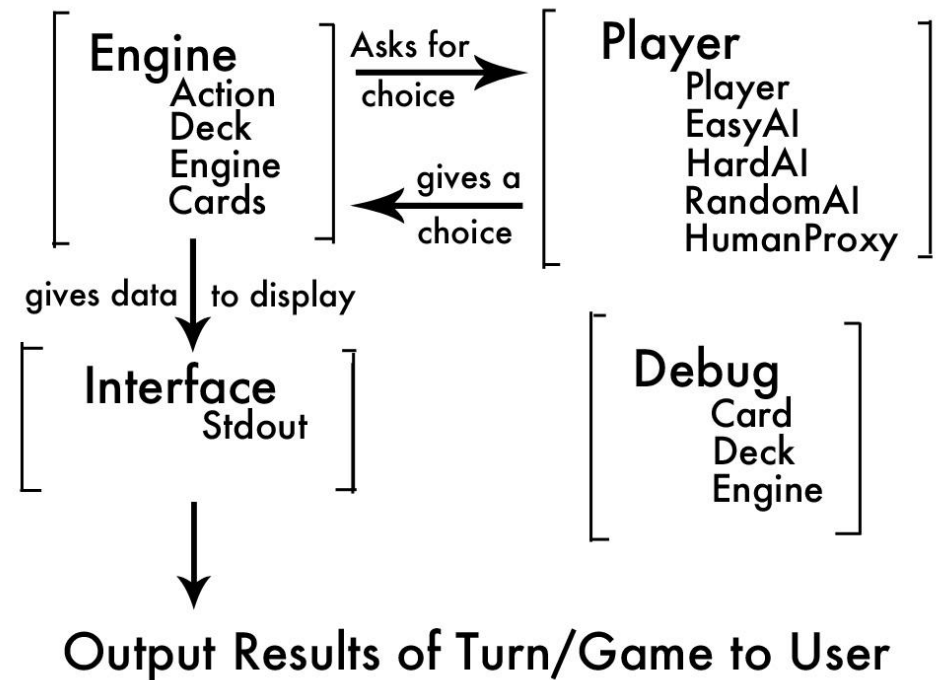
# What is Love Letter?

- Love Letter is a strategy card game
- Games are very brief
- Quick Demo of Love Letter



# Structure Design & Implementation

1. Game Engine  
(environment)
2. Human Players (actor proxy)
3. Artificial Players (actors)
  - a. Random AI
  - b. Easy AI
  - c. Hard AI
    - i. Also has two play styles: aggressive and defensive



# Engine Loop



# Structure Design and Implementation Cont.

- You can play against the AI!
- Abstractions allow for various human interfaces
  - Currently only works at the CLI, could be used with a GUI in the future
    - Could even be skinned for various “themes”
  - Easily modified for even network games
- Player and Bot are the same type and are interchangeable



Original



Reskin

# AI Implementation: Random

- Always plays a random card
- Targets a random player (except for Handmaid)
- Chooses a random card type for Guard

# AI Implementation: Easy

- A Simple Reflex Agent that chooses whichever card has the lowest value.
- Attempts to maximize its score by keeping the highest value it can get.

# AI Implementation: Hard

- AI keeps a live range of predictions of other players' hands based on game actions and the graveyard state.
- Prediction ranges are *pruned* through gameplay and by counting the cards left in the game
- Actions are chosen based on the AI's playstyle (Aggressive or Defensive) and the hand prediction ranges of other players.
  - Aggressive playstyle - Focused on eliminating other players quickly.
  - Defensive playstyle - Focused on maintaining the highest card in the game.



# Experimentation Design

- The levels of AI are designed to outperform each other
  - Random < Easy < Hard (< Human?)
- Love Letter has a lot of random chance in it.
  - Luck of the draw has a large factor in performance
  - Random AI does not always lose to Hard AI
- Love Letter also has elements of potential prediction
  - Counting cards (to an extent)
  - Knowledge of other players' hands
  - Knowledge of what's been played
- Which AI has the highest win rate?

**Live Demo!**

# Experiment Results

- 300 games with Random AI, Hard (Aggressive), and Hard (Defensive)
- Love Letter has a lot of random chance: DefensiveHard and AggressiveHard are pretty close
- Playing intelligently and defensively seems best
- Random is the worst however due to the heavy influence of chance in the game Random can win a reasonable number of games

```
The winner of the game 996 is HardAI1996
[<engine.Handmaid.Handmaid object at 0x000001DAB516C5C0>, <engine.Guard.Guard object at 0x0
The winner of the game 997 is RandomAI997
[<engine.Guard.Guard object at 0x000001DAB5182438>, <engine.Guard.Guard object at 0x000001D
The winner of the game 998 is HardAI1996
[<engine.Handmaid.Handmaid object at 0x000001DAB516CD30>, <engine.Priest.Priest object at 0
The winner of the game 999 is HardAI1999
Random Wins: 273
Aggressive Wins: 345
Defensive Wins: 382

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