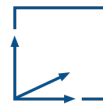


A.I. Noire

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07.09.2023



Final: Masters Practical Course

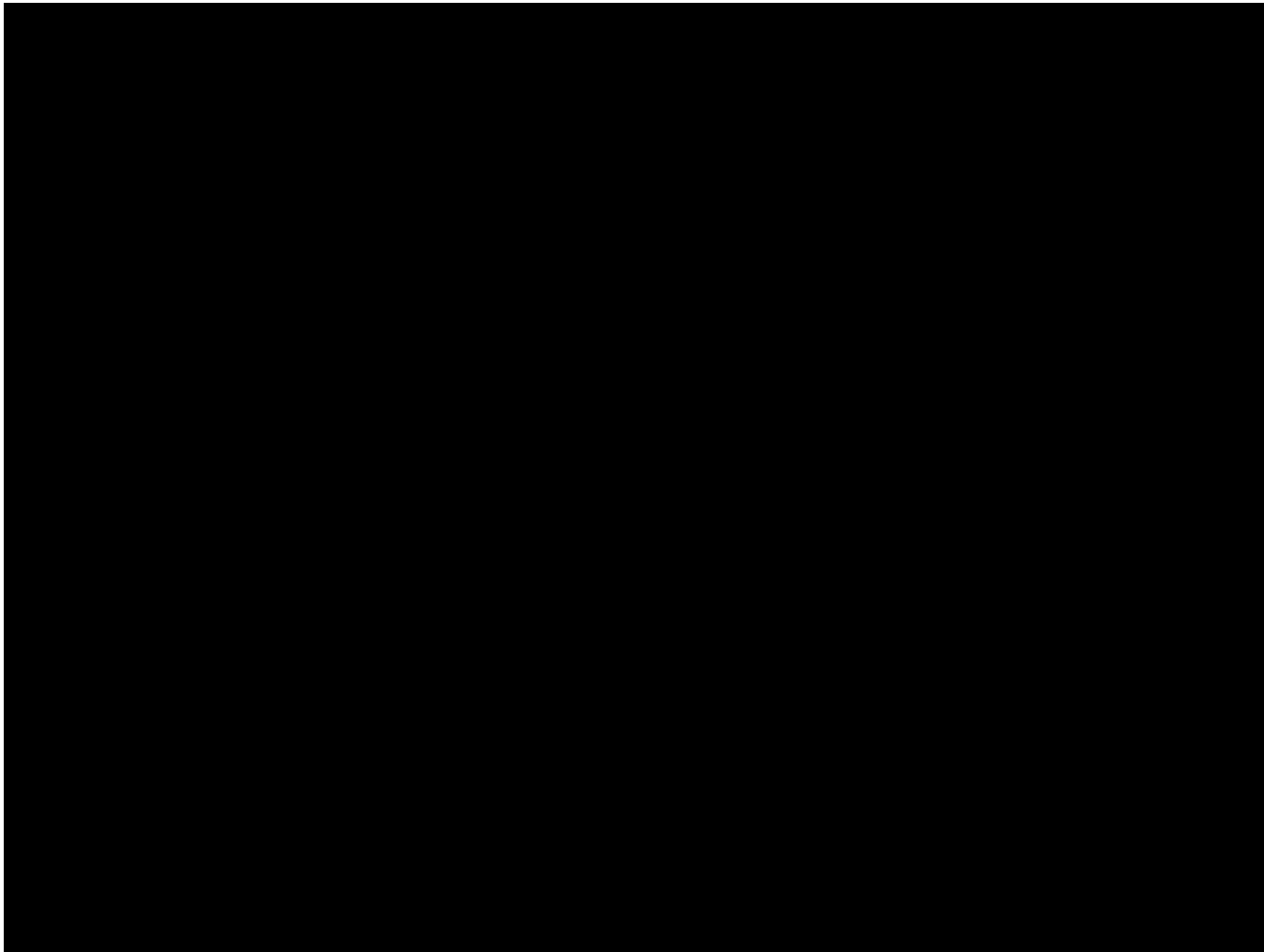
Supervisor: Daniel Dyrda

AI in Games

- Our ideas to integrate AI in games
 - AI generated Assets
 - AI for usability (Text2Speech | Text2Asset)
 - Intelligent NPCs
 - AI generated static story
 - Story about AI
- Initial Game Ideas
 - Player imitates NPC behavior and use AI as a decider
 - Player needs to tell apart AI from other players
 - Full AI asset pipeline



Trailer



Gameplay in A.I. Noire

- As a detective solve a mysterious murder case



Gameplay in A.I. Noire

- Talk to other characters



Gameplay in A.I. Noire

- A whole mansion to discover



Gameplay in A.I. Noire

- Interact with every item



Gameplay in A.I. Noire

- Inspect and investigate items

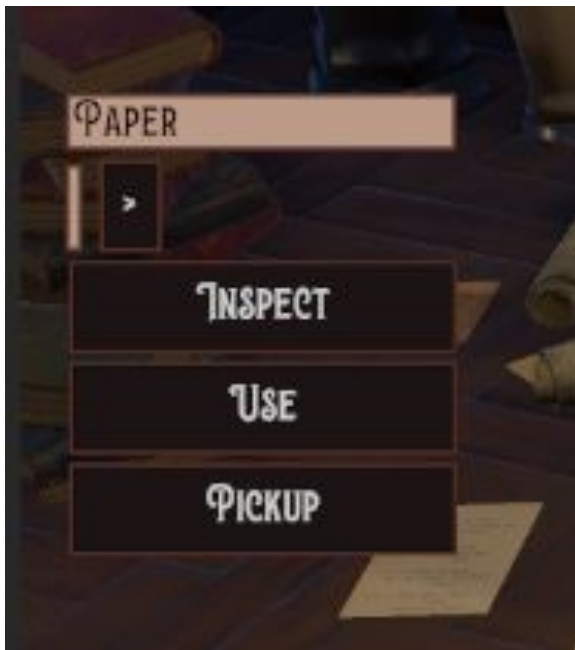
THIS PIECE OF PAPER BEARS THE IMPRINTS OF WORDS WRITTEN IN VIBRANT INK, TELLING A STORY OF ITS OWN.

AS THE PLAYER INSPECTS THE WHISKEY BOTTLE, THEY NOTICE SOME FINGERPRINTS ON IT. THE FINGERPRINTS SEEM TO BE SMUDGED, INDICATING THAT SOMEONE MAY HAVE HASTILY HANDLED THE BOTTLE.

- Live generated descriptions give clues of what could have happened

Gameplay in A.I. Noire

- Use any item on any other item
- Secrets and interactions to discover



Gameplay in A.I. Noire

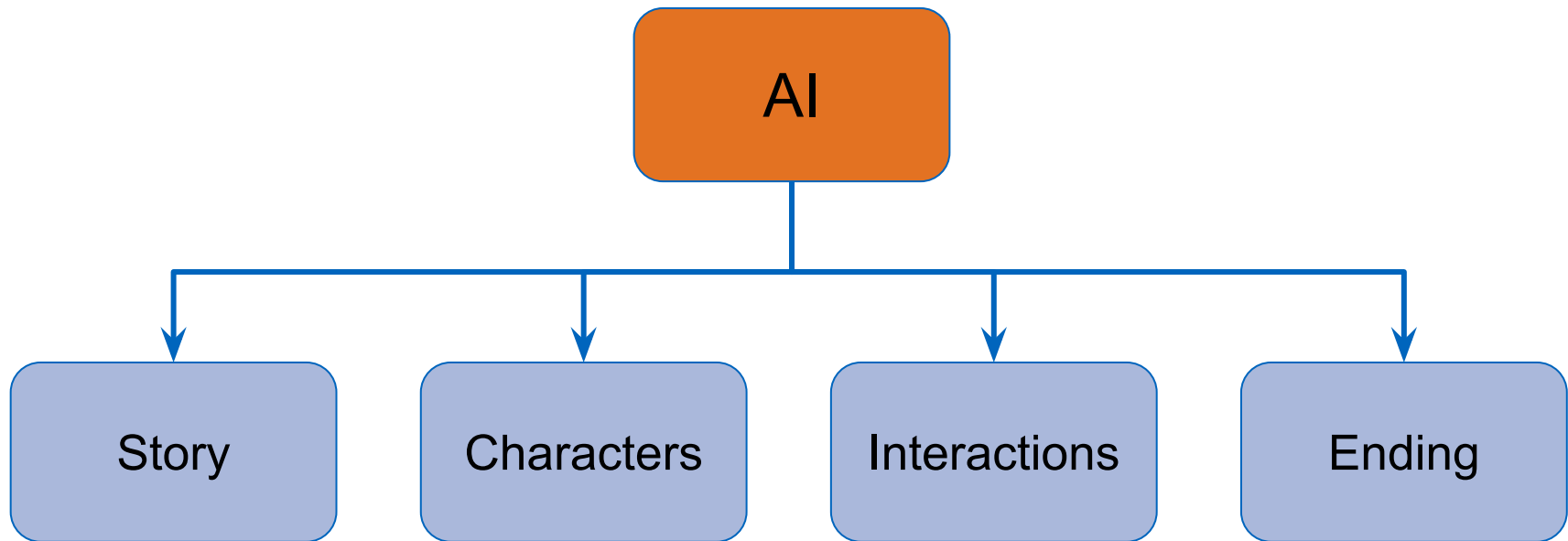
- Solve the case with your own words

MR. DALTON WAS KILLED INSIDE HIS STUDY ROOM.
THE MURDER WEAPON WAS A SIMPLE KITCHEN KNIFE STOLEN
FROM THE MANSIONS MAIN KITCHEN.
MY MAIN SUSPECT IS BOB, HIS 3 SON.
MR. DALTON WANTED TO HAVE ELIOTT INHERIT 100% OF HIS
FORTUNE, SO BOB PLANNED TO KILL HIM BEFORE HE COULD
WRITE HIS WILL LATER THAT WEEK.

I THINK IT WAS SUICIDE OF MR. DALTON BECAUSE HIS
SUCCESSOR IN THE GOVERNMENT STARTED AN INVESTIGATION
ABOUT HIS ALLEGED TAX FRAUD.
I FOUND THAT HE HID MILLIONS FROM THE GOVERNMENT AND
WOULD HAVE BEEN PROSECUTED.

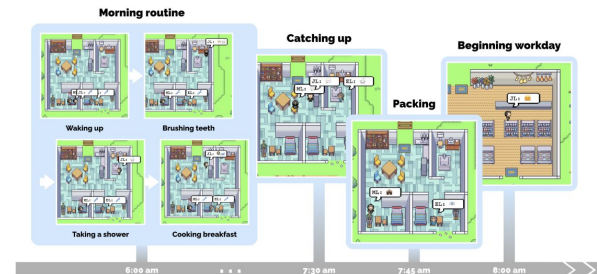
AI in our game A.I. Noire

- Using AI to impact the game at runtime
- AI as a game master



AI as a game master

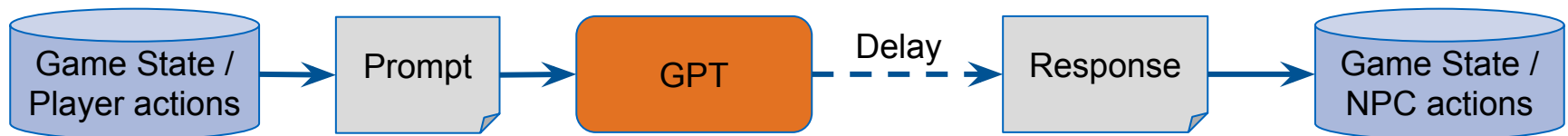
- Inspired by the concept of a Pen-&-Paper game master:
 - Player decides to do something
 - AI decides impact on the game
- Inspired by: Generative Agents: Interactive Simulacra of Human Behavior [1]



- How to do that in a virtual game setting?
- How to integrate AI?

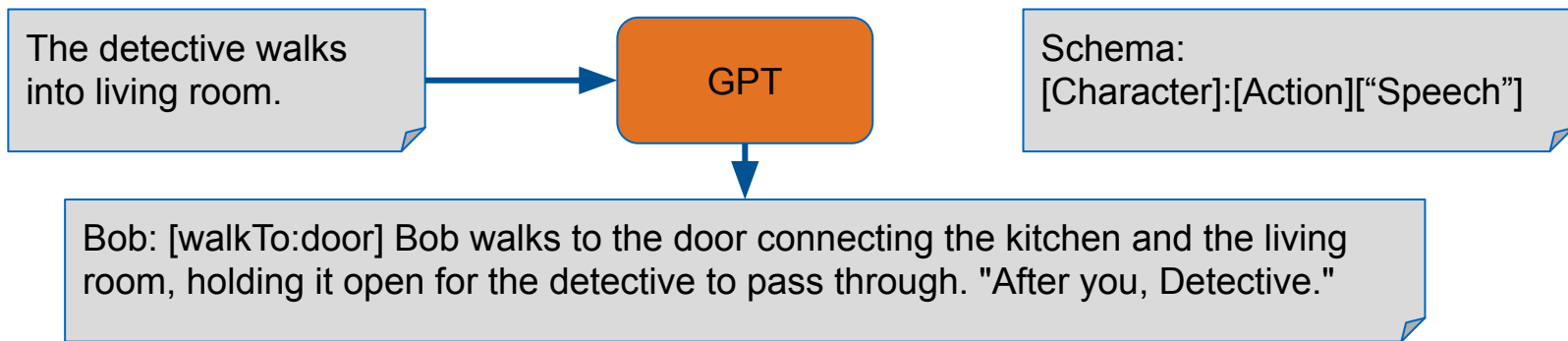
AI in A.I. Noire

- OpenAI GPT model
- Send information about game state or player actions
 - Receive update on:
 - game state
 - story progression
 - npc behavior



Prompting approach 1

- Create own output schema and use text based input



- Relatively easy to generate input
- Problems:
 - Response hard to parse
 - Response schema was not followed
 - No reference to specific objects possible

Prompting approach 2

- Input also follows schema
- Add parameter to actions
- Distinguish different response types

➤ Schema

```
[Character]:[Action:Parameter]
```

```
Actions:
```

```
  [Talk:Sentence]
```

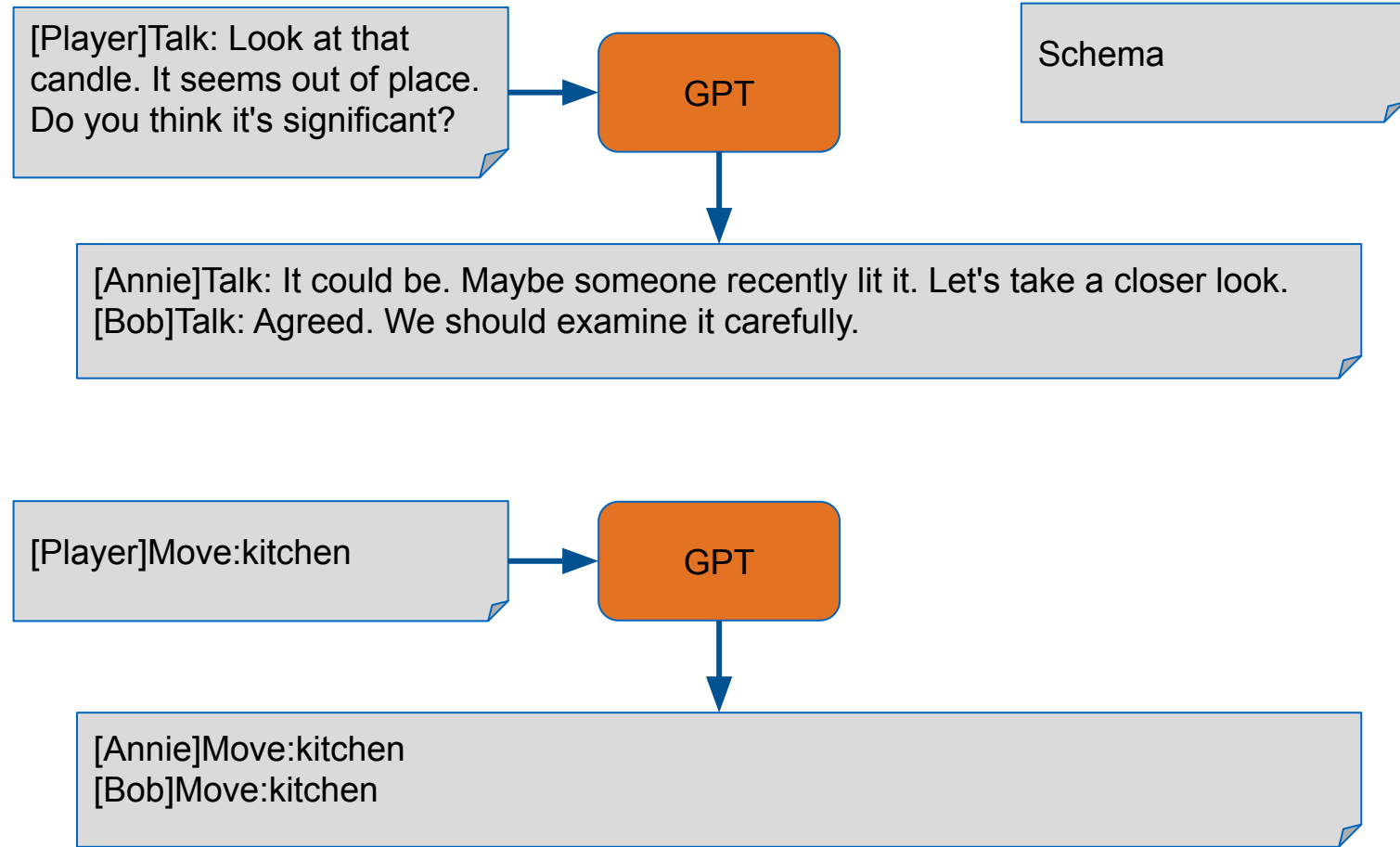
```
  [Use:Object]
```

```
  [Move:Room]
```

```
[ObjectID]:[Description]
```

- Send information about all Objects, Characters and Rooms

Prompting approach 2



Prompting approach 2

- Very easy to generate input
- Object can be identified for description changes



- Problems:
 - Still hard to parse response
 - Action parameters not identifiable
 - AI tries to control player character
 - AI immediately generates whole conversation
 - AI does not remember correct object ids

Prompting approach 3

- Use JSON for input and response

```
List<Interaction> Interactions;  
List<DescriptionUpdates> DescriptionUpdates;  
String InnerDialog;
```

Interaction

```
Int SourceObjectID;  
String InteractionType;  
List<String> Parameter;
```

DescriptionUpdate

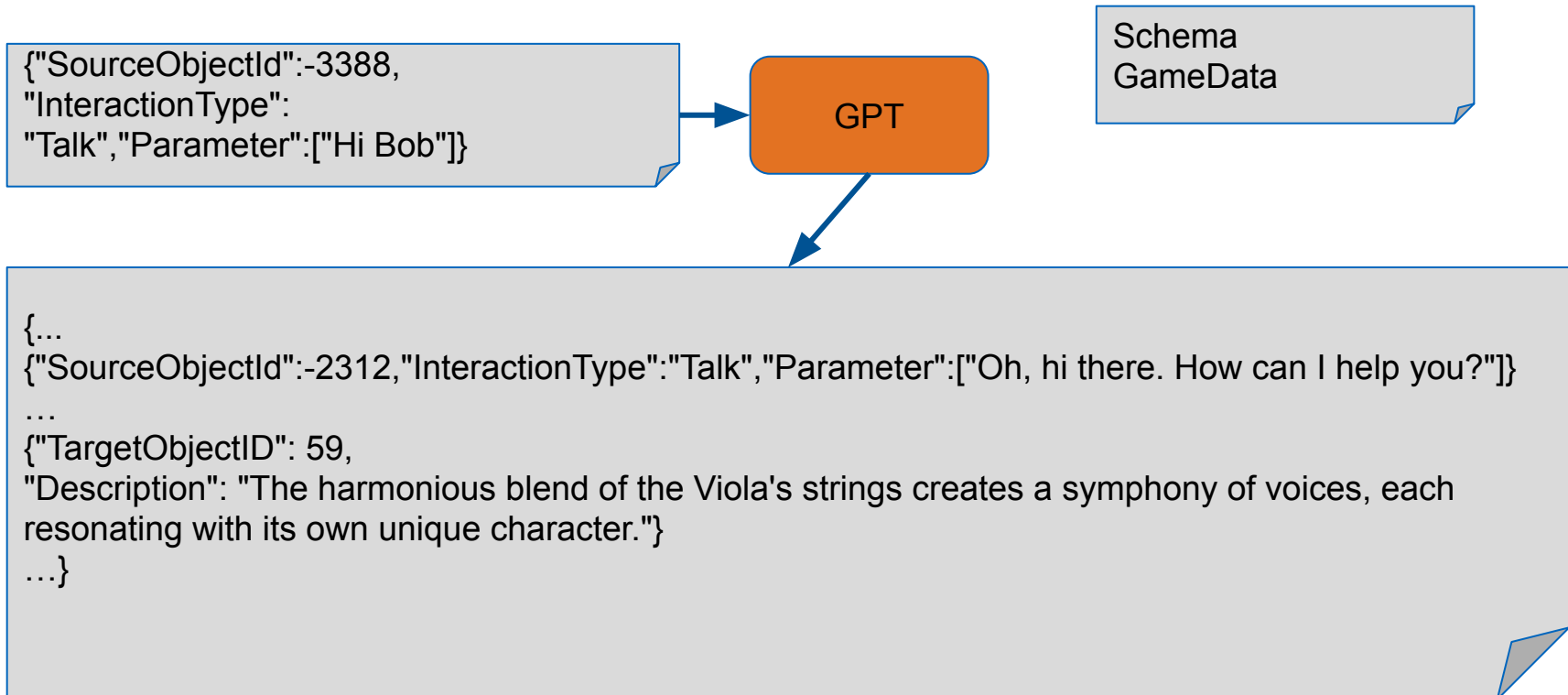
```
Int ObjectID;  
String Description
```

InteractionTypes

```
Inspect  
Use  
UseOn  
Talk  
TalkTo  
ChangeRoom
```

Prompting approach 3

- Send full initial game data with every object-ID
 - Hundreds of objects / ids



Prompting approach 3

- JSON parsing
- Conversation with NPCs possible
- Inner dialog helps with the story

- Problems:
 - NPCs do not converse with each other
 - NPCs do not perform independent actions
 - Item descriptions are not updated after initialization
 - Varying response quality
 - Initial prompt information get lost over time (IDs)
 - Sometimes just empty response

Prompting approach 4

- Similar structure as in approach 3
- Explain schema with examples
- Differentiate between Player Interactions and NPC Interactions
- Add text description to input

Prompting approach 4

```
{"PlayerAction":  
{"CharacterId":-1696,  
"InteractionType":"Inspect",  
"Parameter":["36","1"]},  
"PlayerActionDescription":"Player inspects Bookmark on Item Book in room Study Room 1"}
```



```
"TargetObjectID":36,  
"Description":"The book appears to be an old journal belonging to Edward Dalton. Its pages are filled with handwritten entries detailing his political career and personal life. There was a bookmarked page that mentioned a hidden safe in the study room, accessible through the fireplace."  
  
"FeatureUpdates":[],  
  
"InnerDialog":"The bookmarked page confirms the presence of a hidden safe in the study room. I should focus my attention on the fireplace and see if there are any clues or mechanisms related to it."
```

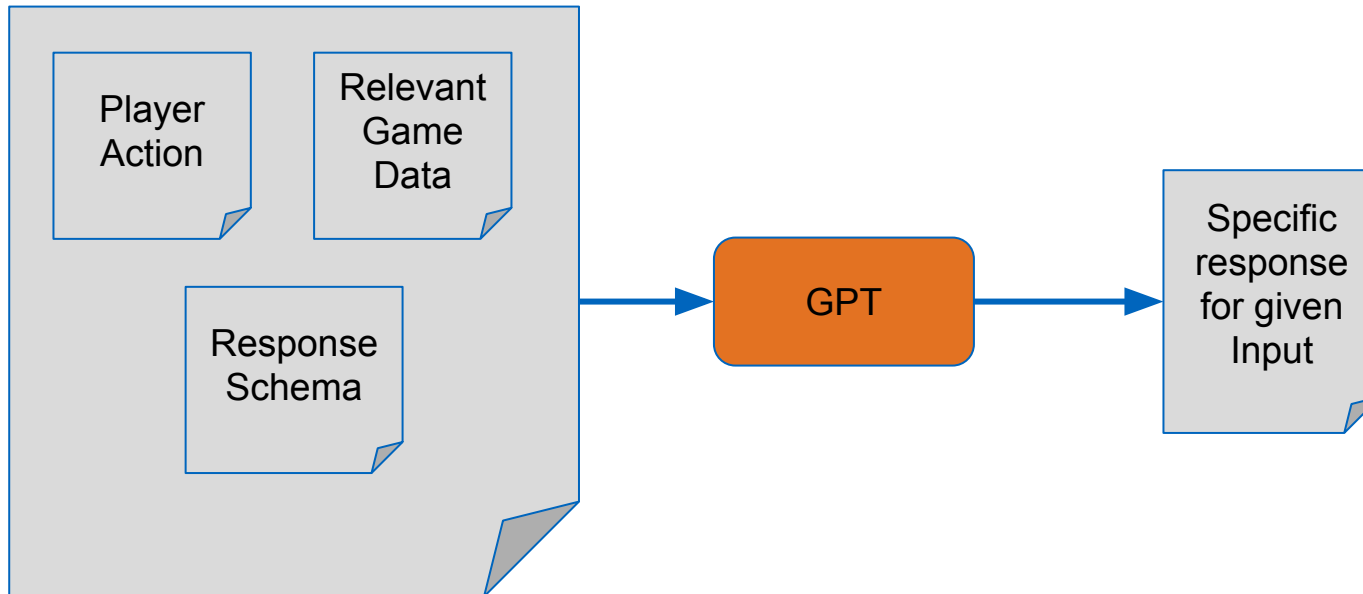
Prompting approach 4

- AI does not control player
- Better and more consistent responses

- Problems:
 - NPCs do not converse with each other
 - NPCs rarely perform independent actions
 - Item descriptions are sometimes not updated after initialization
 - Initial prompt information get lost over time (IDs)
 - Sometimes just empty response

Prompting approach 5

- Reduce interactions of NPCs to just talking
- Only send information of most important objects
- Split response into multiple different schemas
- Send expected schema and information in each input



Prompting approach 5 | Talking

Player talks "Hello Bob.. how are you doing" in room Study Room 1
Respond in the following valid JSON structure:

```
{
  "CharacterResponses":[
    {
      "CharacterID":'id of talking character',
      "Text":"Text that character says"
    },...
  ]
  "InnerDialog":"inner dialog send to the player"
}
```

The people in his room are:

Bob with id -1794; Player with id -1410;

Characters not in his room must not answer.

Remember to give more obvious hints towards the solution of the case as the player progresses the story.

Currently the player is in act 0 of 3.

Player Talk Action

Response Schema

Relevant game state data

Rule/Story correction

Current story progress

Prompting approach 5 | Items

Player inspects Soft Leather Chair of ID: 44 in room Study Room 1
Respond in the following JSON structure:

```
{ "ItemDescriptions": [
  { "ItemID": 'Id of the Item',
    "NewDescription": "new description of the item"}, ... ],
  "FeatureUpdates": [ {
    "ItemID": 'Id of the item',
    "FeatureID": 'Id of the feature',
    "FeatureDescription": "Description of the feature",
    "FeatureName": "Name of the feature"}, ... ],
  "NewItem": [
    { "Name": "Name of the new item",
      "Description": "Description of the new item" } ],
  "InnerDialog": "Inner dialog giving additional hints to the player if necessary"
}
```

If the player finds a new item describe it in the 'NewItem' array.
Only use the 'InnerDialog' if necessary.
Use FeatureUpdates if an item gains a new property like a hidden compartment, fingerprints, bloodstains, anything that is attached to that object.
Remember to give more obvious hints towards the solution of the case as the player progresses the story.
Currently the player is in act 0 of 3.

Player Action

Response Schema:

- Updated Description
- Added / Updated Item Feature (item property)
- Add new Items
- Inner Dialog

New Items hint

Only use InnerDialog rarely

Item features hin

Rule/Story correction

Current story progress

Prompting approach 5 | Solving

The player tries to solve the case.

He has found 0 out of 9 clues:

I think bob was the killer

Respond in the following JSON structure:

```
{  
  "Response": "Response to the player",  
  "Solved": 'true or false depending if the player has solved the case  
sufficiently and has found enough clues'  
}
```

Use the context of the number of clues found and the current act the player is in to return if the player has solved the case.

Current story progress

Player solve Action

Response Schema

Rule/Story correction

A.I. Noire interactions

- Interactions that generate a response
 - Talking
 - Inspect item
 - Use item
 - Pickup item
 - Use item on another item
 - Solving (describe what really happened)
- All characters use AI to generate answers
- Only some specified items use AI to generate responses

ChatGPT vs OpenAI API

- Game can be played with both
 - With ChatGPT you manually copy/paste prompts
- Difference in quality
- In general ChatGPT is worse following a schema

A.I. Noire Playtests

- Missing usability features (Added)
 - Enter to send text
- Missing story introduction (Added Intro)
 - What is the players purpose?
- Missing Tutorial (Added)
 - Unknown UI functionality
- Prompt Engineering (Player responsibility)
 - Trying to engineer a prompt to immediately solve the case
- Not waiting for API response (Still a problem)
 - Repeated actions before response arrived
 - Fills up history very quickly => Hard to follow
 - Increased API usage cost
- API Cost (gpt-3.5-turbo): Demoday (~3h) = ~1.50\$

A.I. Noire Challenges

- The AI never accepted a case solution ('Always more to uncover')
 - Introduce acts and key items as story progression measures
 - Player needs to find all key items to even have a chance to submit a valid solution
- AI conversation sometimes includes "Bob says:"
- Infinite story
 - As long as the player does not solve the case he will always progress and find new information
- Waiting for API response

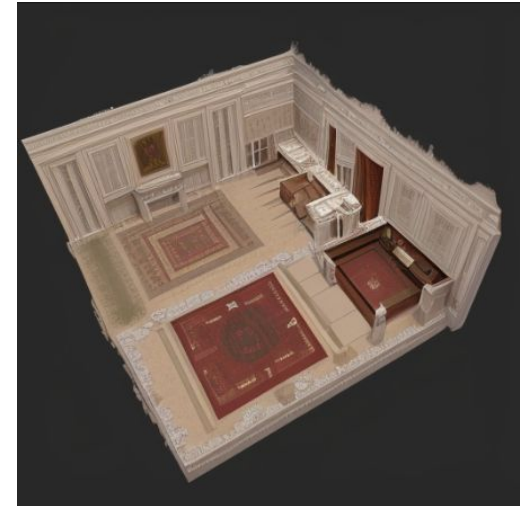
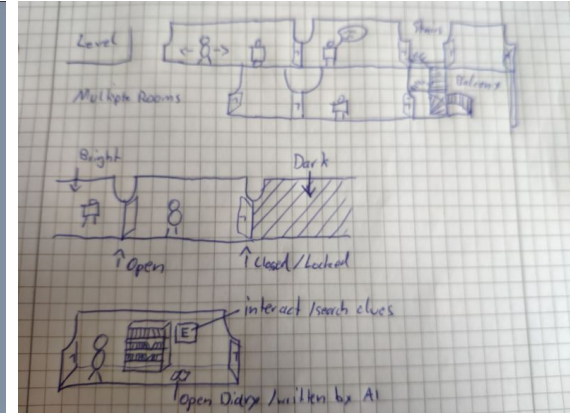
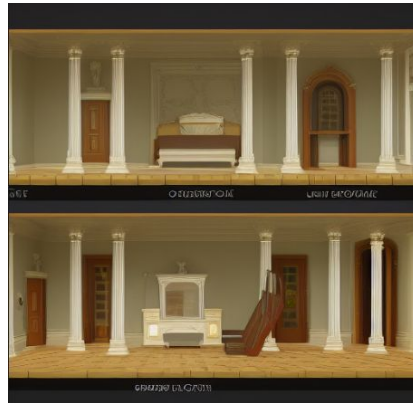
Future Work

- Bring back more advanced NPC interactions
 - Moving between different rooms
 - Inspecting and using items
 - Conversations without the player
- Relax solving requirement
 - Not necessary to find **every** clue
- Add story customization
 - Given different initialization prompts any type of story can be told

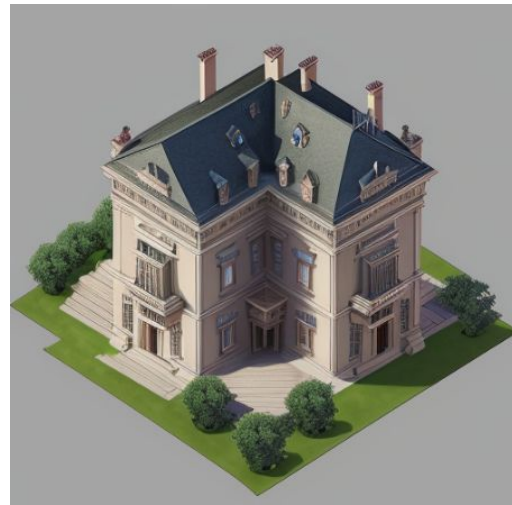
Conclusion

- Using AI in a live setting is definitely possible
- Integration in some components can improve immersiveness and user experience
- General purpose AI models vs. trained model
- OpenAI GPT stories are fun and interesting but worse than a carefully hand-crafted story
- AI ethical concerns
- Currently not possible in offline setting

Some concept art / inspirations



Some concept art / inspirations



Some concept art / inspirations



References

1. Generative Agents: Interactive Simulacra of Human Behavior. <https://doi.org/10.48550/arXiv.2304.03442>