Implementation of an **Emergent Narrative Generation System** for Video Games

A Presentation by Fahreen Bushra

COMPSCI 4490Z

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Introduction: General Context, Current situation and problem

Uniqueness of Videogames
- Video games offer interactivity, unlike other forms of media
- However, this is not taken advantage of when it comes to story telling

Narratives in video games
- Often follow the formula of films
- Contain predetermined cutscenes and story lines which do not respond to player input.

Some examples of Interactive story-telling in Commercial games
- Often reserved for side missions, in which a player may meet new characters and foster relationships with them, however this rarely changes the pre-determined main story

- Games such as "Life is Strange"(Dontnod Entertainment, 2015) and "Detroit Become Human" offer multi-branching storylines, where certain outcomes have been linked with specific choices of the player

- However, this is still quite limited they do not differ heavily between different outcomes, and rather have a small number of possible endings at the completion of the game.

Introduction: Research Gap addressed

Emergent narrative generation

- An *emergent narrative*…
    - grows naturally from an individual's particular actions
    - each telling of the narrative yields a unique outcome founded in the user's specific decisions
    - heightens a videogame's level of interactivity and permits highly individualized storylines, increasing immersion
- *Emergent narrative generation system* produces emergent narratives

Research Gap addressed:

- An *ideal* emergent narrative generation system should offer the following
    - Temporal and spatial consistency
    - High freedom to the user
    - Flexible granularity
    - Significant level of creative control
    - Pacing control
    - Domain independence

However, to date, no such narrative generation architecture satisfies all evaluation metrics (Schudlo,2014)

Research Purpose: Implement a narrative generation system which satisfies all the evaluation metrics

Introduction: Results attained

- The existing research in the supervisor's groups proposes a design for a robust architecture for generating emergent narratives to use in video games.

- In this project, this architecture is further developed and implemented in unity.

- In order to demonstrate efficacy for the architecture, the system is used to create a prototype video game, for which the graphics and gameplay will demonstrate the narrative architecture.

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Background & Related Work: Dynamic Narrative Generation Systems
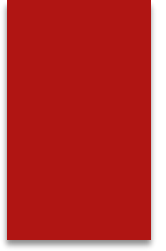
A number of Narrative Generation Systems have been produced in academic and commercial settings, such as:

- **Oz project:**
  - accepts pre-authored points, input to the system by the author, that make up the major transitioning points of the story. The order of plot points are evaluated by system functions.
- ***Facade's architecture:***
  - Uses simple graphics and natural language processing, to create an interactive drama, where the user experiences a dinner party with friends.
- ***The Virtual Storyteller:***
  - aims to create virtual environments inhabited by autonomous agents with which a user can interact.
  - Characters can set their own goals, and act based on their internal goals and personalities.
- ***The Interactive Drama Architecture(IDA):***
  - allow a human author to design a plot, while giving a user as much freedom in their choices as possible. The system builds a predictive model of user behavior in order to deal with the random actions that an interactive user may take.
- ***Generator of Adaptive Dilemma-Based Interactive Narratives(GADIN):***
  - A system based on the premise of presenting characters with dilemmas for which they have to make choices. The dilemmas chosen to be presented are based on a player model developed for the individual characters.

Background & Related Work: Evaluation metrics

The following <u>evaluation criteria</u> for an ideal emergent narrative generation system was identified

- ***Temporal and Spatial Consistency:*** Temporal consistency guarantees the plot occurs in the correct order. Spatial consistency requires that all locations of characters and objects are accounted for and realistic.

- ***Granularity of Story Control:*** the amount of control the system has over the story. A highly granular system has less control. For a system with low granularity, such as linear narratives, each aspect is micromanaged.

- ***Freedom to the User:*** the degree to which the user can impact the story through their actions.

- ***Ease of Authoring the Story/Creative Control:*** the amount of creative control given to a human author, for the story direction.

- ***Pacing Control:*** A system with good pacing control assures that events do not occur too fast or too slowly.

- ***Domain Dependency:*** Systems that are domain independent allows that the story can be told using a variety of media, e.g. text based game or a 3d interactive worldc

Background & Related Work: Evaluation metrics

An ideal narrative generation system should offer: temporal and spatial consistency, flexible granularity, high freedom to the user, a significant level of creative control to the author, appropriate story pacing, and domain independence
Currently no such architecture exists, for which all the evaluation metrics for an ideal narrative generation system is satisfied

Evaluation Metric						
System	Temporal & Spatial Consistency	Granularity	User Freedom	Creative Control	Pacing Control	Domain Dependency
Oz Project	None described. Dependant on the author.	Large grain	High	Medium	No pacing control.	Domain independent.
Façade	Yes. Dependant on the author.	Medium to small grain	Limited	High	Has pacing control	Domain dependant.
Virtual Storyteller	Yes Maintained through agent models and action supervision by Virtual Director.	Large grain	High	Medium	Has pacing control.	Both domain independent & dependant
IDA	Yes Dependant on the author.	Medium to small grain	High	High	Has pacing control.	Domain independent.
GADIN	Yes	Small grain	Limited	Limited	No pacing control.	Domain independent.

Figure 1: Summary of Evaluation Criteria for Narrative Generation Systems

Background & Related Work: Vladimir Propp's Morphology of Folktales

- Based on the analysis of 100 folktales, Propp identified 31 basic structural elements that typically occurred in narratives(V. J. Propp, 1968)
- These functions occurred in a specific, ascending order (1-31) within each story
- The first 5 functions are used to generate the narrative for the prototype developed for the emergent narrative system

Vladimir Propp's First Five Story Functions	
Function	**Function Sub-Types**
ABSENTATION(β) Def: one of the members of a family absents himself from home.	β^1 : The person absenting himself can be a member of the older generation(like parents) β^2 : An intensified form of absentation is represented by the death of parents β^3 : Sometimes members of the younger generation absent themselves(they go visiting, fishing, for a walk, out to gather berries, etc.)
INTERDICTION(γ) Def: an interdiction(the action of prohibiting or forbidding something) is addressed to the hero. A forbidding edict or command is passed upon the hero ('don't go there', 'don't do this'). The hero is warned against some action.	γ^1 : Interdiction **not to go out** may be strengthened or replaced by putting children in a stronghold. Can show up as a weaker form, such as a *request* or *advice* γ^2 : An *inverted* form of interdiction(an order/suggestion). e.g. "*Bring breakfast out into the field*", "*Take your brother with you to the woods*"
VIOLATION(δ) Def: the interdiction is violated	The forms of violation correspond to the forms of interdiction. Functions 2 and 3 form a paired element. However, The 3 can sometimes exist without 2.
RECONNAISSANCE(ε) Def:the villain makes an attempt at reconnaissance(attain knowledge needed to fulfill their plot.). The villain actively probes for information, perhaps for a valuable item.	ε^1 : Reconnaissance. The reconnaissance has the aim of finding out the location of children, precious objects, etc. ε^2 : Inverted reconnaissance. The intended victim questions the villain. Examples: ""What a swift steed you have! Could one get another one somewhere that could outrun yours?" ε^3 : In separate instances, reconnaissance is carried out by non-villains
DELIVERY(ζ) Def: the villain learns information about their victim.	ζ^1 : Direct Delivery: The villain directly receives an answer to their question. ζ^2 : Inverted Delivery: An inverted or other form of information-gathering evokes a corresponding answer.

Figure 2 : Outline of Vladimir Propp's Story Functions

Research Methodology

DESIGN

- The design of the narrative generation system was obtained from a previously published paper by the supervisor's group (Schudlo,2014)
- With the use of this design, a software architecture diagram was created for its implementation.

IMPLEMENTATION

- The Narrative Generation System was built in unity with custom C# scripts

PROTOTYPES FOR EFFICACY

- The first prototype created with the architecture was a text-based simulation, which consisted of a number of buttons that would allow the user to have control over the story world values. The story written for the prototype was derived from the first 5 functions of Vladimir Propp's Morphology of the Folktale.
- The second prototype implemented using the architecture was a 2D RPG style game, where the player is able to interact with the game world by moving the player with arrow keys and interacting with the characters through a dialogue system.

Results: Summary

The Results can be subdivided into four sections:

- Architecture Implementation
  - The design and implementation of the proposed emergent narrative generation system

- Prototype Implementation – Story
  - The first 5 functions from the work of Vladimir Propp is used to construct Author level plot fragments within the story

- Prototype Implementation – Game World
  - In order to prove efficacy for the system, 2 prototypes are developed

- System Validation
  - The emergent narrative generation is evaluated based on the 6 evaluation criteria

Results: Architecture Implementation

Plot Fragments, Preconditions

- The **Preconditions** class for this implementation contains a Boolean value and an ID. Each instance of a precondition represents the evaluation of a specific story world value within the narrative and can only be set to true or false.

- The **Plot Fragment** class represents events that occur in the story. Each plot fragment has precondition members, which must be true in order to be presented to the player. The Fixed Precondition List contains preconditions that cannot be changed through player actions, but rather are decided at the instantiation of a new game. The Mutable Preconditions and Trigger Preconditions lists are changeable through player action. All Fixed preconditions and Mutable preconditions must be true for the system to consider the plot fragment.

- Once true, the system waits until at least one trigger Precondition is true. At this point, the plot fragment is presented to the player, with the use of the Action member. The Action Member is an Interface, for which every plot fragment is assigned a specific implementation for its execute() method. Under this method, the system user can specify how to change the game world and present the plot fragment to the player.

Results: Architecture Implementation

Gameworld Generator

- The **Gameworld Generator** class is responsible for instantiating the game. All elements defined in this class define the story, such as Preconditions, Plot fragments, Actions, Characters and Roles.

- Plot Fragments are grouped under **Author level Plot fragments**, which are story plot points meant to guide the story, based on the author's intent. The order of the author-level fragments are defined in this class. This order is maintained by the system, as each author-level plot fragment uses the completion of the previous fragment as a precondition.

Director, Controller, Evaluator

- The **Director** is the core component of the architecture, responsible for managing plot fragments and system goals. The Director decides which plot fragments to present to the player with the use of the **Evaluator**.

- The Evaluator class interacts directly with the game world and communicates to the director, once a precondition changes states. Once the Director has chosen a plot fragment to present to the player, it provides the Controller with the Action member. The **Controller** can directly change the Game World based on the Action instructions.

Results: Architecture Implementation
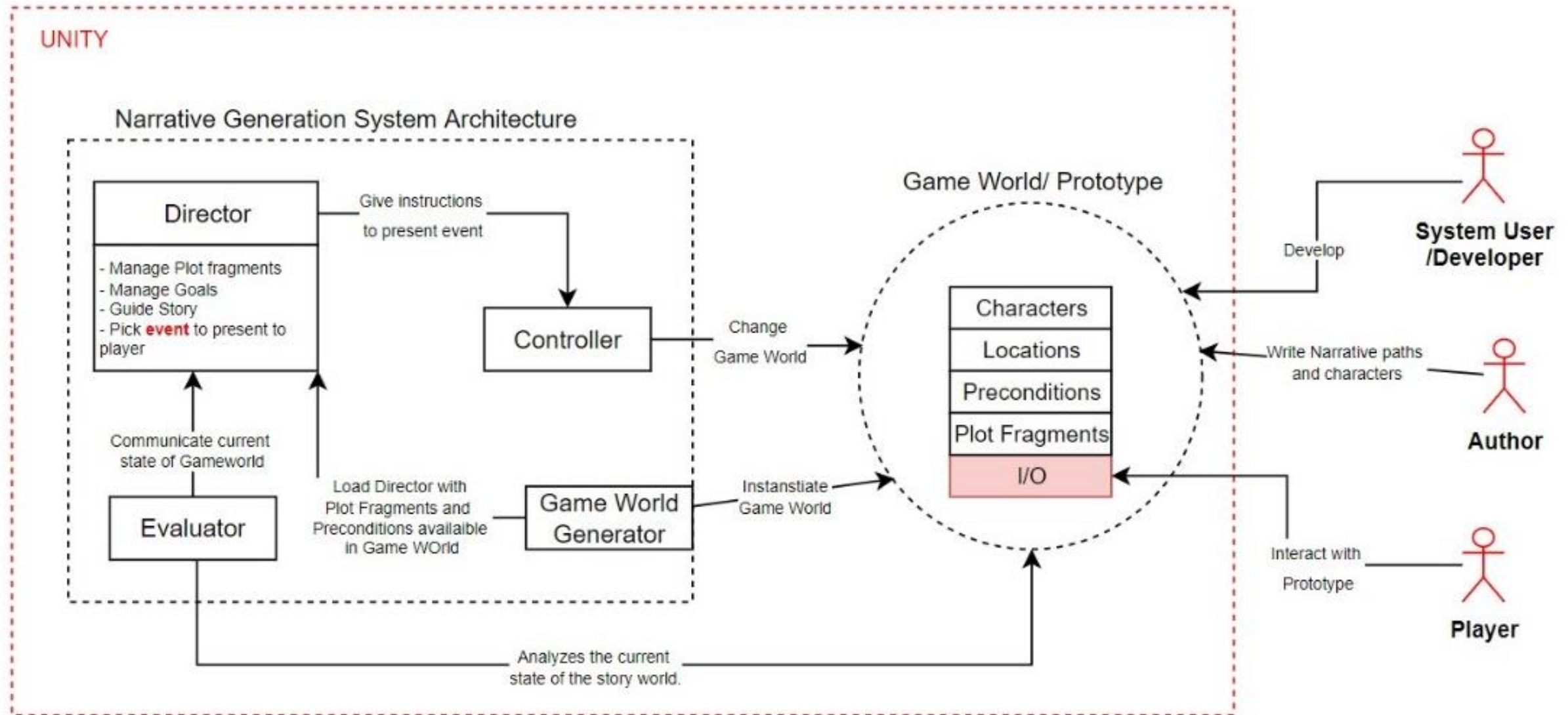
Figure 3: Contextual schematic system diagram

Results: Prototype Implementation - Story

- The story for the prototype was based on the first five functions of Vladimir's Propp's morphology of folktales.

- These functions are represented as an author level plot fragment in the prototype. Within each author level fragment, subtypes are defined as basic level plot fragments.

- The Prototype defines five roles; Hero, Villain, Absentee, Interdiction Messenger, and Guardian. On instantiation of the Game, the Gameworld Generator creates a noble family with seven members, containing the hero, the mother, father, and 4 siblings.

- The genders and ages of the characters are chosen randomly within given ranges.

- Fixed precondition values of the world are assigned either true or false at instantiation.

Results: Prototype Implementation - Story

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INTRODUCTION

The game begins in a castle hallway, with all family members gathered around a dining table. The exit to the castle is near by. The player is able roam through the dining room. The player cannot leave the dining room until enough time has passed. Player is iniyially unable to leave home area(blocked)

Author Level Plot Fragment 1: ABSENTATION
A randomly assigned family member absents themselves(randomly chosen + based on fixed precondition)

Name of plot:
a1: Absentee leaves home for business
Fixed Preconditions:
1) *Absentee* is an older generation relation
Mutable Preconditions:
1) Enough time has passed by
Trigger:
1) Too much time has passed by
2) Player tries to leave the area
Event
Absentee announces to family they will be leaving home for a business deal. The player is transported outside the castle, where all family members say good bye

Name of plot:
a2: Absentee leaves home to fight in war
Fixed Preconditions:
1)Absentee is male
2) *Absentee* is an older generation relation
Mutable Preconditions:
1) Enough time has passed by
Trigger:
1) Too much time has passed by
2) Player tries to leave the area
Event
Absentee announces to family they will be leaving home to fight in the war. The player is transported outside the castle, where all family members say good bye

Name of plot:
a3) Absentee dies
Fixed Preconditions:
1) *Absentee* is an older generation relation
Mutable Preconditions:
1) Enough time has passed by
Trigger:
1) Too much time has passed by
2) Player tries to leave the area
Event
Absentee has a heart attack, the rest of the characters gather. The player is transported to outside the castle, where all members are gathered around a gravestone.

Name of plot:
a4) Absentee goes for a walk
Fixed Preconditions:
1) Absentee is a younger generation
Mutable Preconditions:
1) Enough time has passed by
Trigger:
1) Too much time has passed by
2) Player tries to leave the area
3) Player speaks to absentee
Event
Absentee walks up to player and tells them they are going for a walk.The player and absenttee are transported outside the castle, where player says gooodbye to absentee.

Name of plot:
a5) Absentee goes out to gather berries
Fixed Preconditions:
1) Absentee is a younger generation
Mutable Preconditions:
1) Enough time has passed by
Trigger:
1) Too much time has passed by
2) Player tries to leave the area
3) Player speaks to absentee
Event
->*Absentee* walks up to player and tells them they are going out to gather berries. The player and absenttee are transported outside the castle, where player says gooodbye to absentee.

Name of plot:
a6) Absentee goes fishing
Fixed Preconditions:
1) Absentee is a younger generation
2) *Absentee* can go fishing/there is a river nearby
Mutable Preconditions:
1) Enough time has passed by
Trigger:
1) Player speaks to absentee
2) Too much time has passed by
Event
->*Absentee* walks up to player and tells them they are going fishing
->The player and absenttee are transported outside the castle, where player says gooodbye to absentee.
->Transport absentee to river where they fish

Author Level Plot Fragment 2: INTERDICTION
The hero is warned against some action.

Name of plot:
b1: Hero is warned to not visit a location by a messenger
Fixed Preconditions:
1) Interdiction *Location* exists
2) Interdiction *Messenger* exists
3)One of the following Absentation plot fragment is complete(1.1, 1.2, 1.3)
Mutable Preconditions:
1) Enough time has passed
Trigger:
1) Player talks to interdiction Messenger
2) Too much time has passed by since the completion of mutable condition
Event
-> *Interdiction messenger finds player(if trigger 2)*
-> Messenger tells player thay should not go to a location
-> *At this point player is unable to leave home, as they are locked inside area(exiting results in popup)*

Name of plot:
b2: Hero is instructed that they are forbidden to leave home
Fixed Preconditions:
1) Hero is a child(age <18)
2) nterdiction *Location* exists
3) Interdiction *Messenger* exists
4)One of the following Absentation plot fragment is complete(1.1, 1.2, 1.3)
Mutable Preconditions:
1) Enough time has passed
Trigger:
1) Player tries to leave home/castle
2) Too much time has passed by since the completion of mutable condition
3) Player talks to guardian
Event
-> in this case, the guradian also takes the role of the interdictionmessenger
->Player is told by guardian character they cannot leave home
-> *At this point player is unable to leave home, as they are locked inside area(exiting results in popup)*

Name of plot:
b3: Hero is instructed to look for absentee
Fixed Preconditions:
1) Interdiction *Messenger* exists
2) one of the following Absentation plot fragment is complete(2.1, 3.1, 3.2)
Mutable Preconditions:
1) Enough time has passed
Trigger:
1) Player talks to interdiction Messenger
2) Too much time has passed by since the completion of mutable condition
Event
-> *Interdiction messenger finds player(if trigger 2)*
-> Messenger tells player to go find
-> *At this point player is unable to leave home, as they are locked inside area(exiting results in popup)*

Results: Prototype Implementation - Story

Author Level Plot Fragment 3: VIOLATION
The interdiction is violated

Name of plot:
c1: Hero leaves to look for absentee/hero leaves for interdiction
Fixed Preconditions:
1) Interdiction 1.1 or 2.1 completed
Mutable Preconditions:
1) Hero retrieves weapon from bedroom
Trigger:
1) Player leaves home
Event
-> give hints to player to find weapon
-> once weapon is retrieved, restrictions are lifted, player may now leave home
-> There is a single path that leads to the interdiction location, evaluator places enemies along the way
-> health potions are also availaible
-> player may die if health is too low
-> *instantiate villian and their motive*

Name of plot:
c2: Hero leaves home, by sneaking off
Fixed Preconditions:
1) Interdiction 1.2 is completed
Mutable Preconditions:
1) Hero finds sleeping potion
2) Hero makes tea with it
3) Hero gives tea to guards, and they fall asleep.
4) Hero retrieves weapon from guards
Trigger:
1) Player leaves home
Event
-> give hints to player to make guards sleep and find weapon
-> once weapon is retrieved, restrictions are lifted, player may now leave home
-> There is a single path that leads to the interdiction location, evaluator places enemies along the way
-> health potions are also availaible
-> player may die if health is too low
-> *instantiate villian and their motive*

Author Level Plot Fragment 5: DELIVERY:
the villain learns information about their victim.

Name of plot:
e1: Villian succeeds to gain information
Fixed Preconditions:
none
Mutable Preconditions:
1)Hero selects the dialogue to divulge information
Trigger:

Event
->Villian gains knowldege about hero

Name of plot:
e2: Villian fails to get information
Fixed Preconditions:
none
Mutable Preconditions:
1) Hero finishes talking to player, without revealing information
Trigger:

Event
->Villian does not knowledge about the hero

Author Level Plot Fragment 4: RECONNAISSANCE:
The villain makes an attempt at reconnaissance(attain knowledge needed to fulfill their plot.) with a disguise

Name of plot:
d1: Villian tries to attain knowledge on the absentee
Fixed Preconditions:
1) Any Absentation except 1.3 is completed
Mutable Preconditions:
1) Any interdiction has been violated
Trigger:
1) Hero runs into villian
Event
Conversation:
-> Villian engages in casual conversation to ask questions about absentee
-> the player can choose to tell them info or not tell them about absentee
Bribery:
villian may offer bribery in exchange for information

Name of plot:
d2: Villian tries to attain knowledge to gain an upperhand in war
Fixed Preconditions:
1) A war is surrently going on
Mutable Preconditions:
1) Any interdiction has been violated
Trigger:
1) Hero runs into villian
Event
Conversation:
-> Villian engages in casual conversation to ask questions about war plans
-> the player can choose to tell them info or not tell them about war
Bribery:
villian may offer bribery in exchange for information

Name of plot:
d3: Villian tries to attain knowledge about a family secret
Fixed Preconditions:
1) Family Secret exists
Mutable Preconditions:
1) Any interdiction has been violated
Trigger:
1) Hero runs into villian
Event
Conversation:
-> Villian engages in casual conversation to ask questions about Family Secrets
-> the player can choose to tell them info or not tell them about war
Bribery:
villian may offer bribery in exchange for information

Name of plot:
d4: Villian tries to attain knowledge about hero's strength
Fixed Preconditions:
1) Family Secret exists
Mutable Preconditions:
1)
Trigger:
1) Hero runs into villian
Event
Conversation:
-> Villian asks hero to save them from a monster
-> Villian gages te strength of the hero

Results: Prototype Implementation - Gameworld

Two Game Worlds were created for the prototype.
- The first prototype created was a text-based low fidelity prototype, where user input was given through buttons, which directly changed story world preconditions.

- The second prototype created is a 2D RPG style game. The character is able to navigate within a 2D castle and interact with items and other characters through a dialogue system.\.

Results: Prototype Implementation - CASESTUDY

Case study: Overview Of A Single Story Path Of The First 3 Author Level Plot Fragments

Results: Prototype Implementation - CASESTUDY

Interdiction

Text Based Narrative Generator

ABSENTATION

absentiadsOlderGeneration	False
absentiadsYoungerGeneration	True
absentiadsMale	True
RiverNearBY	False
MinTimePassed1	False
TooMuchTimePassed1	True
PlayerTimesLeaving	Status
PlayerSpeaksToAbsentee	Status

INTERDICTION

InterdictionLocationExists	True
InterdictionMessengerExists	True
AbsentationCompleted#123	Status
AbsentationCompleted#456	True
MinTimePassed2	True
TooMuchTimePassed2	True
HeroIsAChild	Status

VIOLATION

InterdictionCompleted13	Status
InterdictionCompleted2	Status
HeroGetsWeapon	Status
HeroFindsSleepingPotion	Status
HeroMakesSleepingTea	Status
HeroGivesBattleGuards	Status
HeroLeavesHome	Status

OUTPUT:

OUTPUT: Interdiction 3(inverse): Interdiction messenger finds player if not already with player.
Messenger tells player to look for absentee.
At this point player is unable to leave home, as they are locked inside area(exiting results in popup)
Place weapon in bedroom

Mother

Theo...Go look for Violet and bring her back right now! It's not safe!

Continue

Guard1

I can't let you leave home without protection my lord...

Continue

Author Level Plot Fragment 2: INTERDICTION
The hero is warned against some action.

Name of plot:
b1: Hero is warned to not visit a location by a messenger
Fixed Preconditions:
1) Interdiction *Location* exists
2) Interdiction *Messenger* exists
3)One of the following Absentation plot fragment is complete(1.1, 1.2, 1.3)
Mutable Preconditions:
1) Enough time has passed
Trigger:
1) Player talks to interdiction Messenger
2) Too much time has passed by since the completion of mutable condition
Event
-> *Interdiction messenger finds player(if trigger 2)*
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Name of plot:
b2: Hero is instructed that they are forbidden to leave home
Fixed Preconditions:
1) Hero is a child(age <18)
2) nterdiction *Location* exists
3) Interdiction *Messenger* exists
4)One of the following Absentation plot fragment is complete(1.1, 1.2, 1.3)
Mutable Preconditions:
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2) one of the following Absentation plot fragment is complete(2.1, 3.1, 3.2)
Mutable Preconditions:
1) Enough time has passed
Trigger:
1) Player talks to interdiction Messenger
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Event
-> *Interdiction messenger finds player(if trigger 2)*
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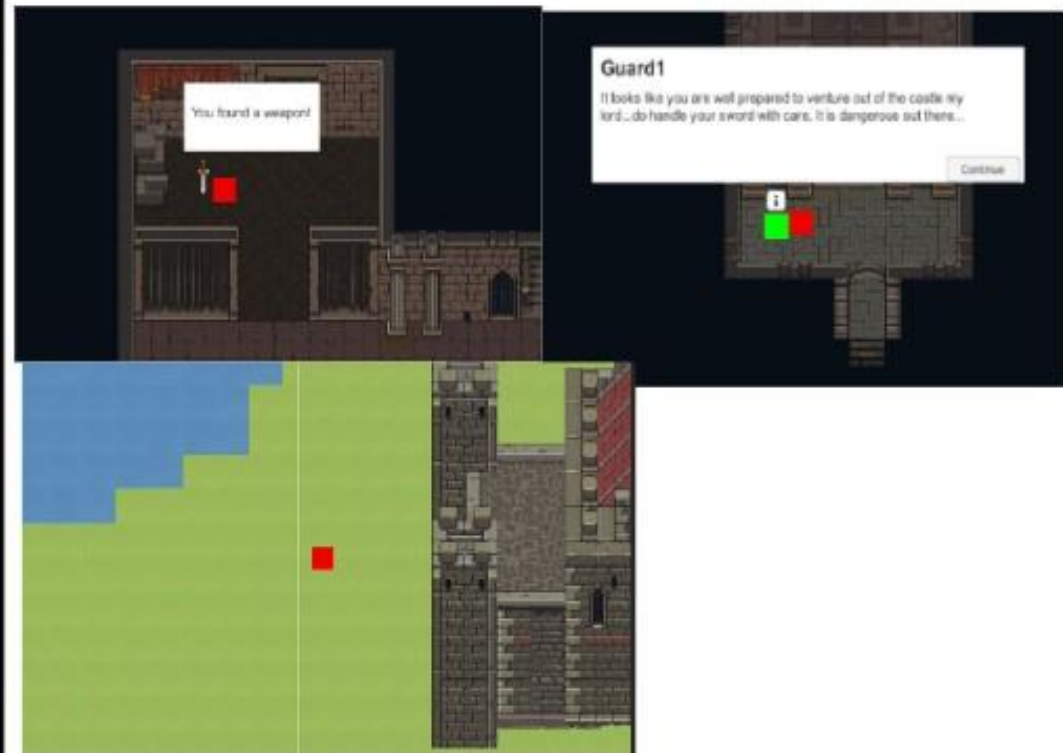# Results: Prototype Implementation - - CASESTUDY

Novelty

- The novelty of the results lies within the system validation, for which this architecture shows potential to satisfy all of the validation criteria.
- The implementation of the second prototype also showcases the efficacy of this architecture in commercial use.
- This acts as a demonstration for the effectiveness of the architecture and guides future research towards commercial use of the engine in creating games with dynamic narratives.

Evaluation Metric						
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Proposed Architecture Results	Yes. Can be maintained by the author with the use of Plot Fragments and Author Plot fragments.	Large grain	High to medium. Dependant on Author	High	Can be implemented through preconditions of plot fragments, such as coroutines.	Domain independent.

Critical analysis of the Results & VALIDATION

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Temporal and Spatial Consistency

Spatial and temporal consistency can be achieved through preconditions, which guarantee that certain conditions must be true or specific characters must be present in story locations before the fragment is presented to the user. This metric is satisfiable by the architecture but is ultimately the responsibility of the system user and author to maintain consistency through accurate preconditions.

Granularity of Story Control

The proposed system's granularity is flexible and can be either low or high, based on the author's design. This is determined by the Author level plot fragments. To achieve a linear storyline, the author can decrease granularity with low level author plot fragments, with very few preconditions, easily achievable by the user. In contrast, the author may employ high level author plot fragments in order to give the user more freedom over the story.

Critical analysis of the Results & VALIDATION

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Proposed Architecture Results	Yes. Can be maintained by the author with the use of Plot Fragments and Author Plot fragments.	Large grain	High to medium. Dependant on Author	High	Can be implemented through preconditions of plot fragments, such as coroutines.	Domain independent.

Freedom to the User

The system is able to give the player a high amount of control, based on the complexity of the story world and the number of lot fragments and gameplay elements implemented in the game world generator. The prototype created for this architecture, however, does not offer a high amount of control as a small number of plot fragments were implemented due to time and resource constraints.

Ease of Authoring the Story/Creative Control

The system gives the author a high level of creative control, through the design of plot fragments and author level plot fragments. However, the design of the plot fragments and director can make it quite difficult to write good narratives, especially so as user freedom increases. In the case of the prototype created, although the stories generated are diverse, it did not always create an interesting story.

Critical analysis of the Results & VALIDATION

Evaluation Metric						
System	Temporal & Spatial Consistency	Granularity	User Freedom	Creative Control	Pacing Control	Domain Dependency
Proposed Architecture Results	Yes. Can be maintained by the author with the use of Plot Fragments and Author Plot fragments.	Large grain	High to medium. Dependant on Author	High	Can be implemented through preconditions of plot fragments, such as coroutines.	Domain independent.

Pacing Control
The architecture does not implement explicit pacing controls. However, the prototype created using the architecture implements functions such as coroutines, in order to keep track of time and push plot points on the player if the story is not moving forward.

Domain Dependency
The architecture is implemented in a way such that the Gameworld is abstracted from the story elements. This allowed the creation of two prototypes, without change in the plot fragments, director and other components in the architecture.

LIMITATIONS of RESULTS

- Although the architecture has the potential to satisfy all the evaluation criteria for an ideal narrative generation system, it does not guarantee it. Because this system gives a great deal of control to the Author and System user, it is the responsibility of those parties to write narratives and plot fragments in such a way that all the evaluation criteria are met.

- For example, the system can give a high degree of freedom to the user, with intricate plot fragments. However, the architecture can also be used to implement a very linear story.

- These conditions may be minimized through adding additional controls. However, in order to guarantee one evaluation criteria, another may be sacrificed.

- For example, the system can implement a feature to guarantee spatial and temporal consistency, however this may reduce author freedom as the system can prevent the author from exploring stories related to time travel or teleportation.

Impact on Theory & Practice

- The implementation of this narrative generation system extends the current research in the field of dynamic storytelling in videogames.

- It proposes a design for an architecture that is able to satisfy all of the evaluation criteria for an ideal narrative generation system.

- This research implementation is the prototype in order to prove the efficacy of this architecture.

- With additional resources, this architecture has potential to be extended to be used in commercial games, providing an immersive, and dynamic narrative experience

Conclusions

- The proposed architecture combines the favorable attributes of each narrative generation system and fulfills all six criteria for an ideal narrative system.

- The goal of this thesis was to extend and implement this design by building a prototype in Unity to prove its efficacy and Usability. The development of this project may lead to the development of an improved architecture for creating dynamic, Emergent narratives for video games.

- When the architecture implementation was judged based on the 6 evaluation criteria discussed, it was found that the architecture can indeed satisfy all six criteria.

- However, the architecture does not guarantee that all six criteria are always met, but rather enables the Author and user of the system to achieve the six defined criteria.

- Thus, we can conclude that the narrative generation system implemented can offer a very dynamic story within games in order to create more immersive experiences, however, it must be coupled with Authors who are able to make use of the narrative system.

Future Work & Lessons Learnt

- Extend the prototype to include more complex plot fragments. This will result in a more dynamic story

- Incorporate procedurally generated characters, locations and areas at instantiation of the game.

- Enable a memory system for each character, and enable AI behavior to implement more believable characters

- Incorporate gameplay within actions in order to create a more enjoyable experience

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Thank you!