Agenda

- Introduction to the lecture 3min.
- Introduction to decision-making system （Miyake） 5min.
- Luminous AI Technical design （Miyake） 5min.
- AI Graph Editor Implementation （Shirakami） 15min.
- Case study in-game （Namiki, Shirakami） 25min.
- Session summary 2min.

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CASE STUDY IN-GAME

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Case study in game

- NPC
- Buddies
- Nifl soldiers
- Monsters

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Case study in game

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Requirement for NPC

- Perform daily life tasks such as conversations, having a meal, and social behavior.
- Must have a large number of NPCs simultaneously acting.



Both light script system specialized for social behavior and AI Graph Editor can be processed simultaneously.

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NPC



Light script system selects one action which triggers a tray through external execution mode.

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Requirement for Buddies

1. While AI acts a part in an event scene, AI continues parallel thinking.
2. Cooperation with each other

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Requirement for Buddies 1

1. While AI acts a part in an event scene, AI continues parallel thinking.

Preset AI logic for acting is prepared. It can always replace by regular AI logic when triggered by a message.

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Buddies



This shows a preset AI logic (prepared) is triggered by message, and the character (green highlight) acts a part in an event scene.

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Requirement for Buddies 2

2. Cooperation with each other

AI which manages all buddies (Meta AI) gives orders to change buddies' actions.

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Requirement for Buddies 3



This shows the cooperation of buddies by a series of orders by the Meta AI.

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Nifl Soldiers

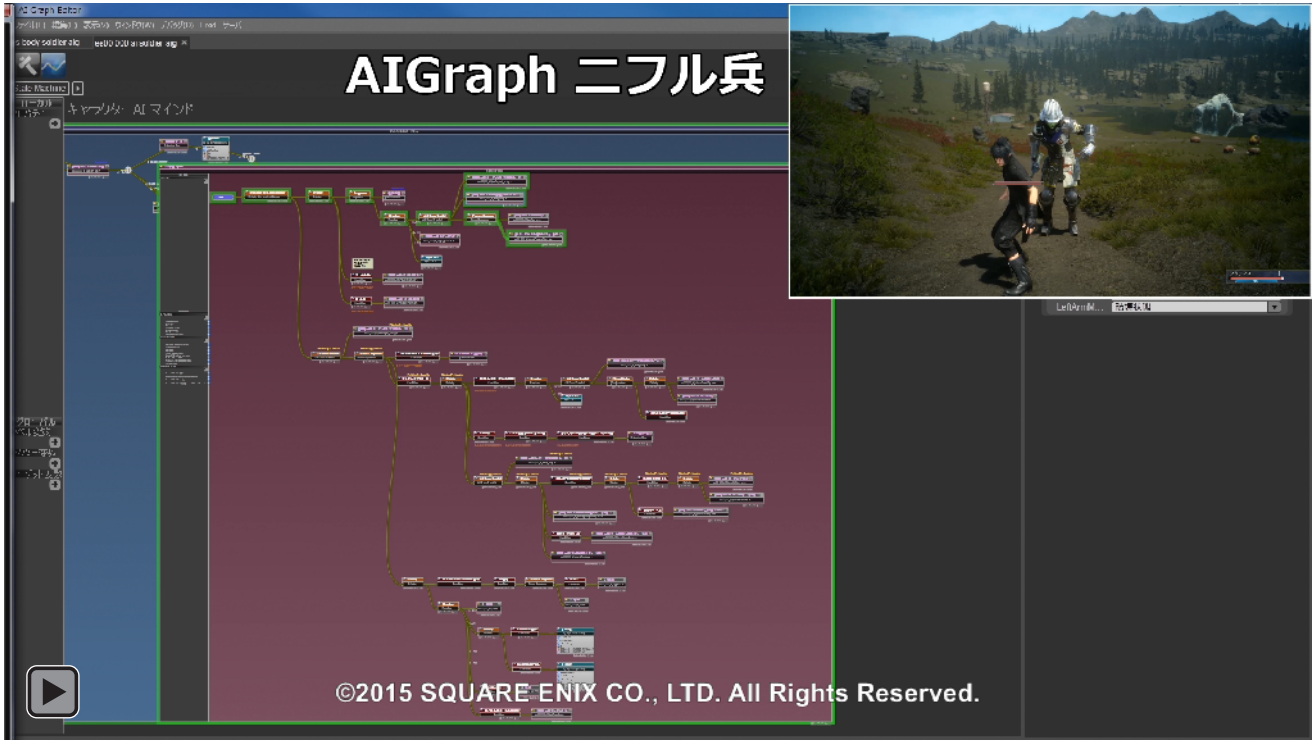


- Mechanical and rational behavior
  - What is possible now ?
  - What is the best rational behavior ?
  - Linkage of AI and body control

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Rational Action Selection

- Decision making by behavior tree



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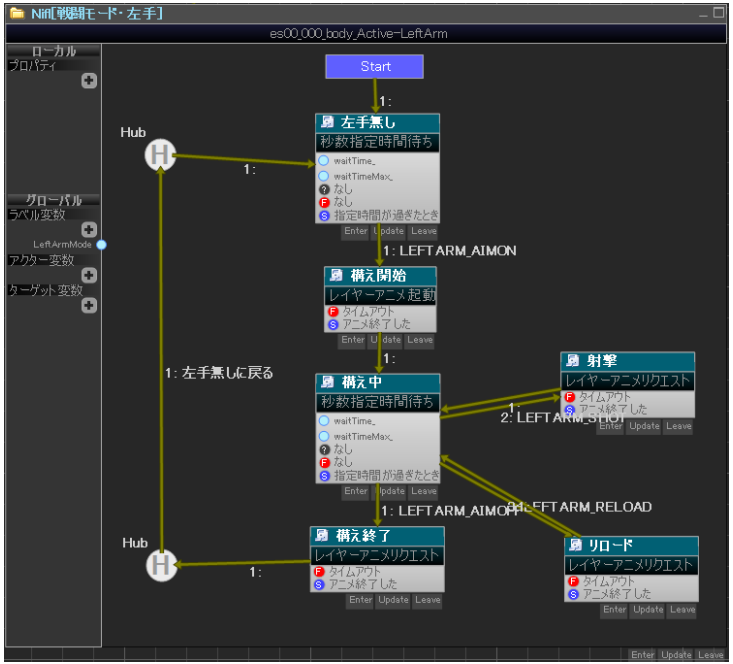
Linkage of AI and body control

- Body State machine and AI Graph

AI does not directly replay animation data.
AI connects to the animation layer via body state machine.

Especially for shooting and damage behavior, AI calls the control prepared in body state.

The architecture separates the roles between thinking and body to avoid increasing the size of the AI logic.



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Linkage of AI and body control

- Link of Body State machine and AI Graph



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Case study in game

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Monster



- Realistic behavior
  1. Vision sensor and target search
  2. PQS move and Steering
- Mass production
  3. Rule-based AI system
  4. AI Graph override
  5. Motion analysis

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1. Vison sensor and target search

Mechanism to make AI take an action on a target AI recognizes

- Vision sensor

  Simulation of character's vision AI
  Calculate what AI can see

- Target search

  Selecting the highest priority target from targets AI recognizes now

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1. Vison sensor and target search

- Vision sensor



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1. Vison sensor and target search

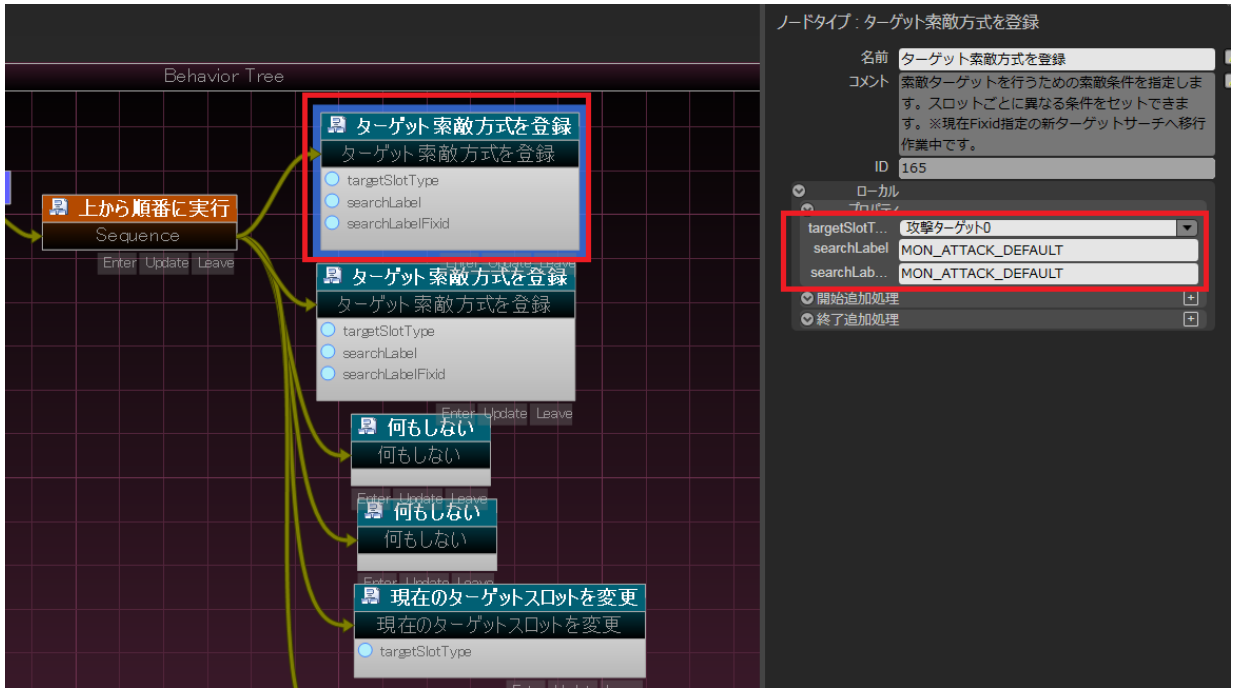
- Target search

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<DEFAULT>		NONE	2	DISTANCE_ASC	DEFAULT	SELF	SELF_BODY	OPPONEN	ONLY_CHA	LV3_IDENT	-1.0	-1.0	ANY	NO_USE	NO_USE	0.00	1.00	ALL	ALL
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ME07_TRIAL_BEHE_NORMAL_01	体験版ベヒ－仲間狙いモード	ME07_TRIAL_BEHE_NORMAL		DISTANCE_ASC	DEFAULT	SELF	SELF_BODY	OPPONENT			0.0		ALIVE						MIDDLE
ME07_TRIAL_BEHE_NORMAL_02		ME07_TRIAL_BEHE_NORMAL		DISTANCE_ASC	DEFAULT	SELF	SELF_BODY	OPPONENT			0.0		ALIVE						MIDDLE
ME07_TRIAL_BEHE_NORMAL_03		ME07_TRIAL_BEHE_NORMAL		DISTANCE_ASC	DEFAULT	SELF	SELF_BODY	OPPONENT			0.0		ALIVE						ALL
ME07_TRIAL_BEHE_NORMAL_04		ME07_TRIAL_BEHE_NORMAL		DISTANCE_ASC	DEFAULT	SELF	SELF_BODY	OPPONENT					ALIVE						ALL

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1. Vison sensor and target search

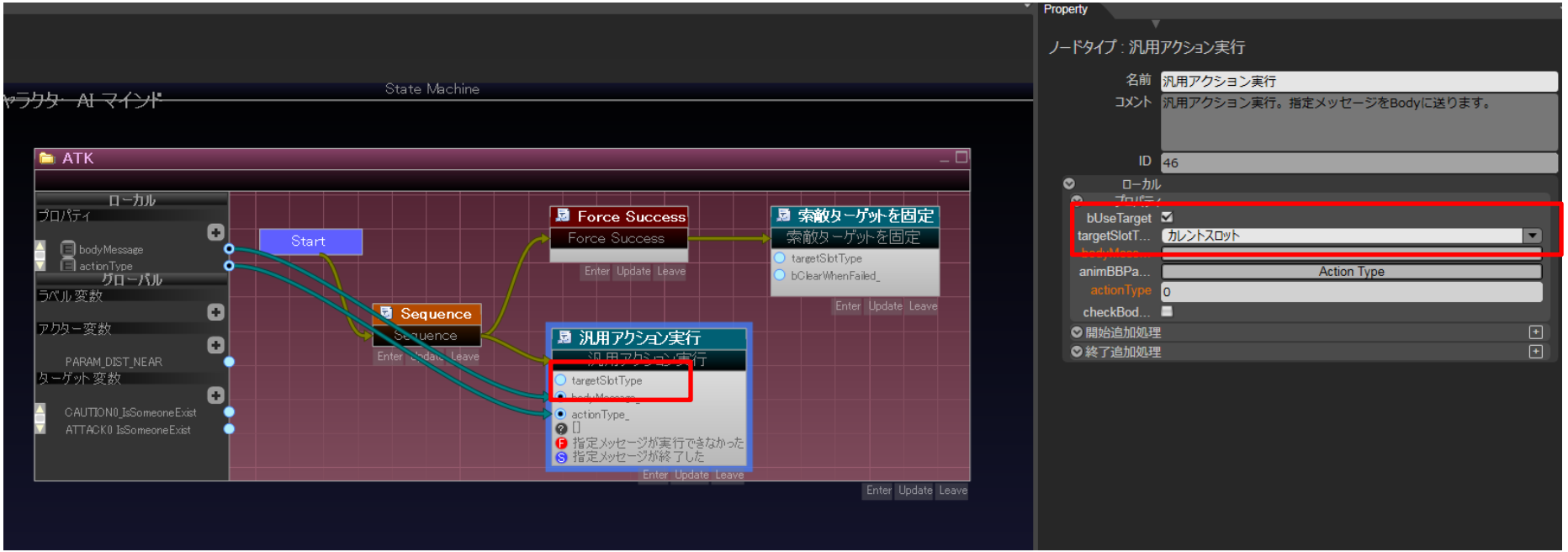
- This shows AI Graph executing a target search.



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1. Vison sensor and target search

- This shows AI Graph using a selected target.



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Monster



- Realistic behavior
  1. Vision sensor and target search
  2. PQS move and Steering
- Mass production
  3. Rule-based AI system
  4. AI Graph override
  5. Motion analysis

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2. PQS movement and Steering

- Position searching system PQS(Point Query System)
  Finds a point to move to by position query data
  PQS makes various kinds of movement possible.

- Steering
  Path following system with dynamic avoidance
  Animal-like avoidance behavior

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2. PQS movement and Steering

- PQS move

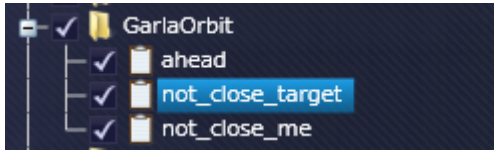


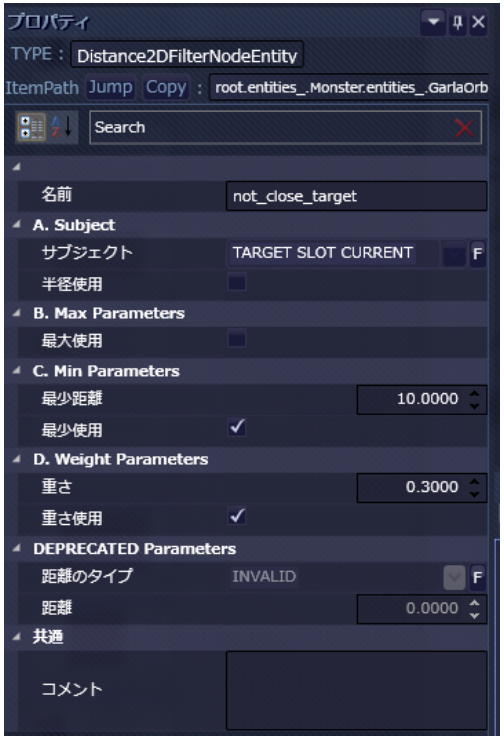
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2. PQS movement and Steering

- PQS data

Ex. PQS length filter and property





PQS data consists of a combination of multiple filters
Ex.
Angle filter = 30 degree region in front of subject
Length filter = Region over 10m far from an object
⇒ By using this data, a character can go around an enemy in any situation.

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2. PQS movement and Steering

- Steering



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Monster



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3. Rule-based AI System

- Rules AI for the monster perform the action that matches the determined condition
- Luminous AI system that was used previously
- Refined in a way to coexist with AI Graph
- Although the degree of freedom is partly limited, simplicity of data and the ease of maintenance are clear benefits

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3. Rule-based AI System

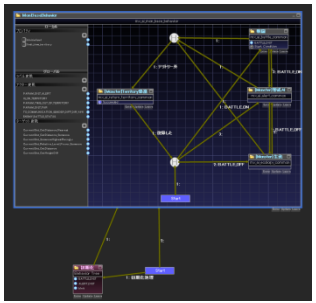
- Rule-based AI



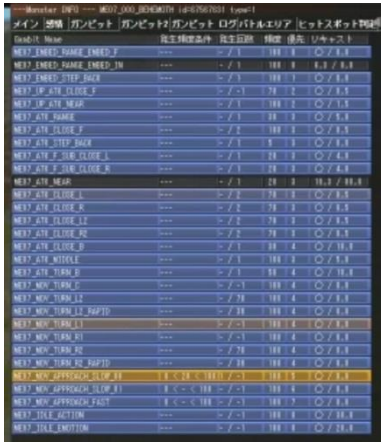
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3. Rule-based AI system

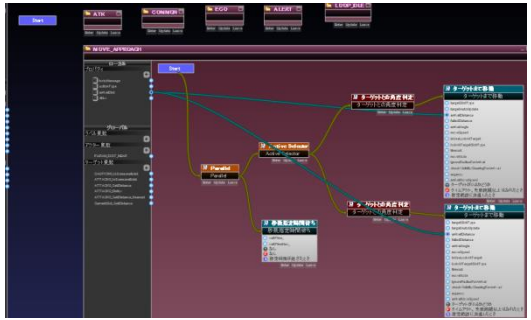
- Rule-based AI execution flow



AI Graph
Basic logic execution



Rule execution



AI Graph
Behavior template execution

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Monster



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4. AI Graph override

- Mechanism to override a part of the base AI graph data by an alternate AI graph
- It's like class inheritance.

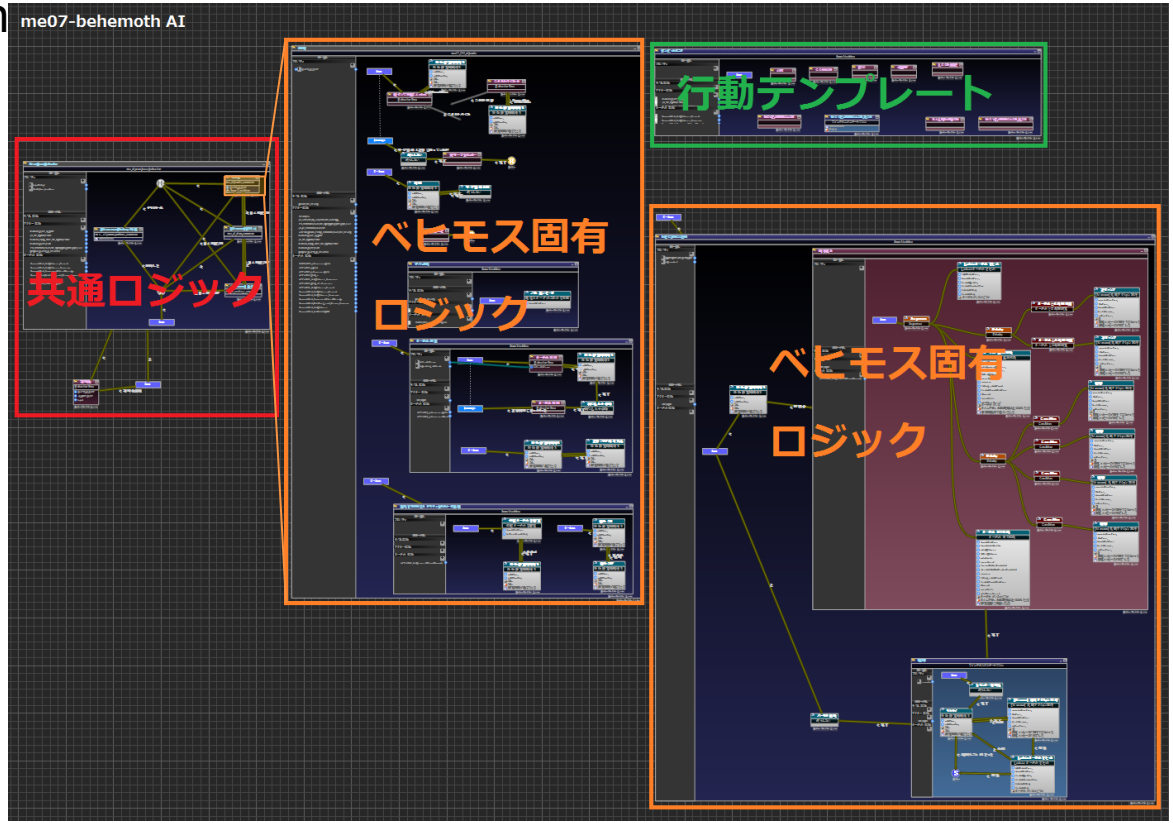
- While sharing a common logic base, the system can override any part of the AI logic

- Sharing common data can avoid doubling data and reduce redundancies.

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4. AI Graph override

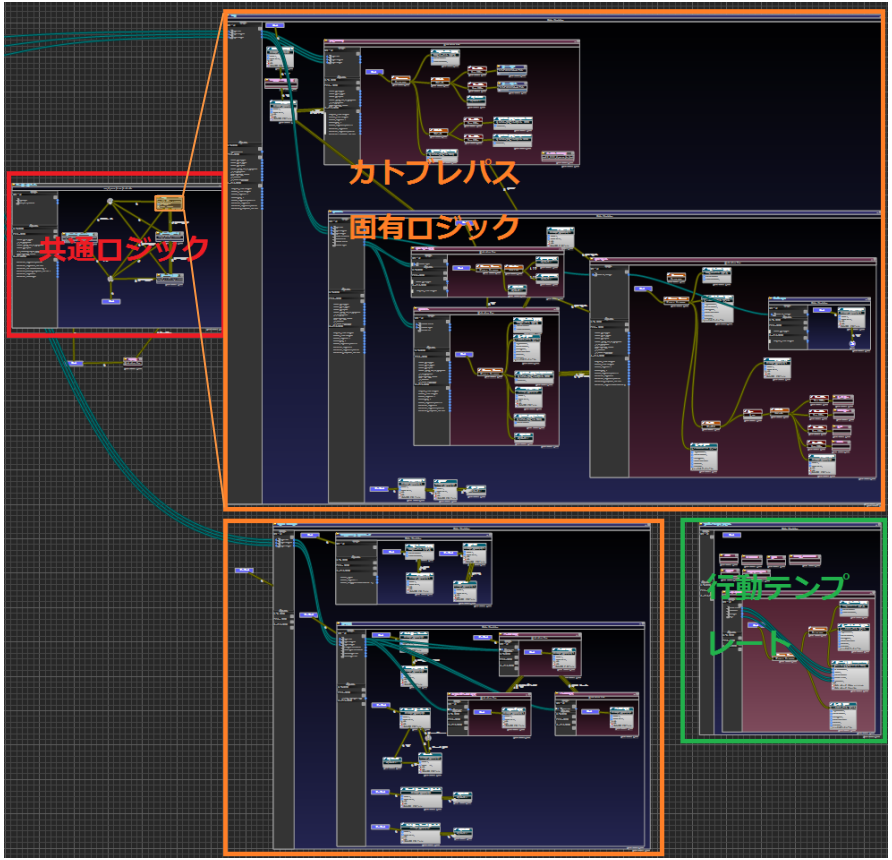
Me07 behemoth



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4. AI Graphオーバーライド

Me04 Catoblepas



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Monster



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5. Motion Analysis

- Attack Motion Analysis

Attack motion analysis system automatically calculates the maximum distance and angle of attack through a simulation of both animation and attack.

AI Graph then uses that distance and angle data in the actual motion.

This semi-automatic system can halve the amount of work for the game designers.



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5. Motion Analysis

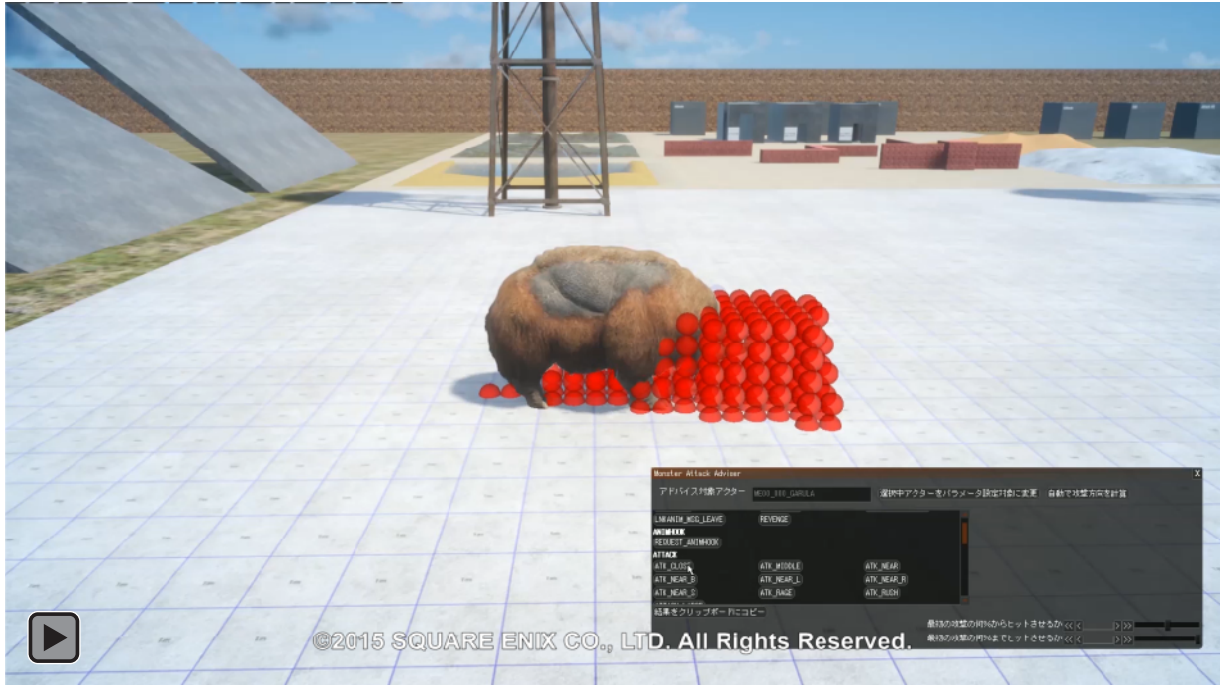
- Attack Motion Analysis



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5. Motion Analysis

- Attack Motion Analysis



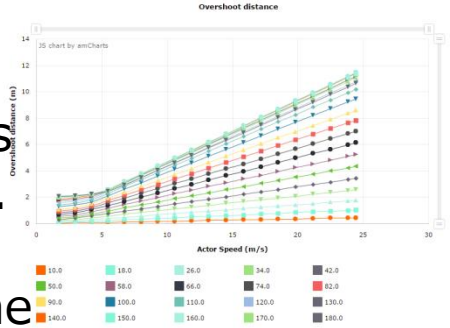
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5. Motion Analysis

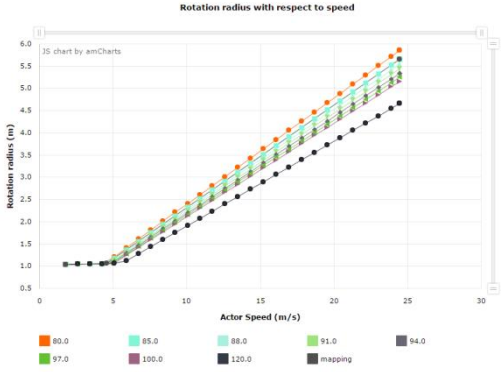
- Travelling Motion Analysis

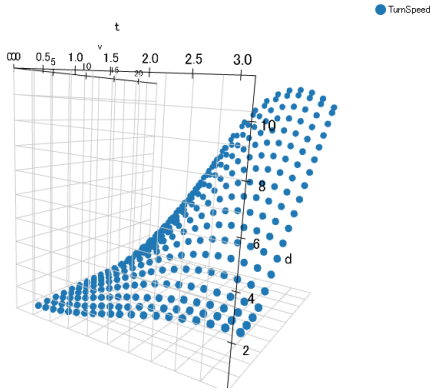
Using an automatic analysis system, we can view the performance of a character's turning and stopping ability in chart form.

From the chart, if there is a problem in the animation data, we can adjust the data.









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SESSION SUMMARY

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Session Summary

- In the introduction, we gave an over view of the state of the art in decision making technologies
- In order to meet the diverse requirements of our design team, we introduced the concept of our original decision-making system.
- We then introduced the ideas regarding specifications and implementations in the graph-based AI logic creation tools.
- We then demonstrated how the above AI technology have been applied in the game.

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Finale

Thank you for Viewing this Presentation ！



LUMINOUS STUDIO

Business Division 2

Advanced
Technology
Division

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