

IGDA日本 GDC2013 報告会

「アクションゲームにおける学習」

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2013.4.13

今日の目次

(1) マキネーション・ツール (10min.)

INTRODUCING MACHINATIONS: A NEW WAY TO DESIGN GAME MECHANICS

SPEAKER/S: [Ernest Adams \(Independent\)](#) and [Joris Dormans \(Amsterdam University of Applied Sciences\)](#)

DAY / TIME / LOCATION: Thursday 4:00- 5:00 Room 3005, West Hall

TRACK / DURATION / FORMAT / AUDIENCE LEVEL: Design / 60-Minute / Lecture / All

(2) SimCity のゲームデザイン (10min.)

SIMULATING A CITY, ONE PAGE AT A TIME

SPEAKER/S: [Stone Librande \(EA/Maxis\)](#)

DAY / TIME / LOCATION: Friday 2:30- 3:30 Room 3005, West Hall

TRACK / DURATION / FORMAT / AUDIENCE LEVEL: Design / 60-Minute / Lecture / All

EXPLORING SIMCITY: A CONSCIOUS PROCESS OF DISCOVERY

SPEAKER/S: [Dan Moskowitz \(Maxis / Electronic Arts\)](#)

DAY / TIME / LOCATION: Wednesday 5:00- 6:00 Room 304, South Hall

TRACK / DURATION / FORMAT / AUDIENCE LEVEL: Programming / 60-Minute / Lecture / All

(3) Hitman : Absolution のAI (10min.)

Reinforcement Learning Based Character Locomotion in Hitman: Absolution

SPEAKER/S: [Michael Buttner \(IO / Square Enix\)](#)

DAY / TIME / LOCATION: Friday 10:00-11:00 **Interactive** :00 Room 304, South Hall

TRACK / DURATION / FORMAT / AUDIENCE LEVEL: Programming / 60-Minute / Lecture / Intermediate

Creating the AI for the Living, Breathing World of Hitman: Absolution

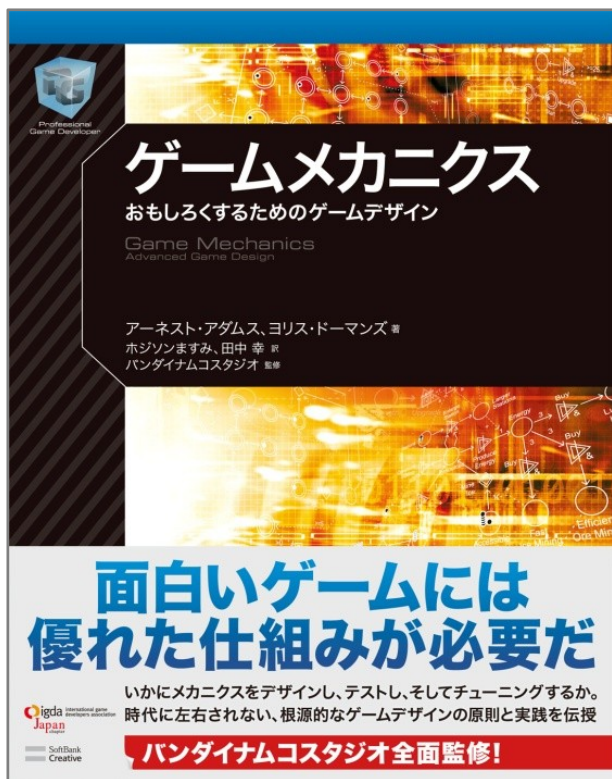
Maurizio De Pascale | Senior Software Engineer, IO Interactive A/S

Mika Vehkala | Senior AI Programmer, IO Interactive A/S

Location: Room 3005, West Hall **Date:** March 28 **Time:** 10:00AM - 11:00AM

第一部 マキネーション・ツール

アダムのマキネーション・ツール



•IGDA創設者の一人 アーネスト・アダムス 執筆

•バンダイナムコスタジオ

湊和久氏 / 當間知明氏 監修

•IGDA Japan公認本

アダムズのマキネーション・ツール

ゲームの仕組みを図式化 マキネーション

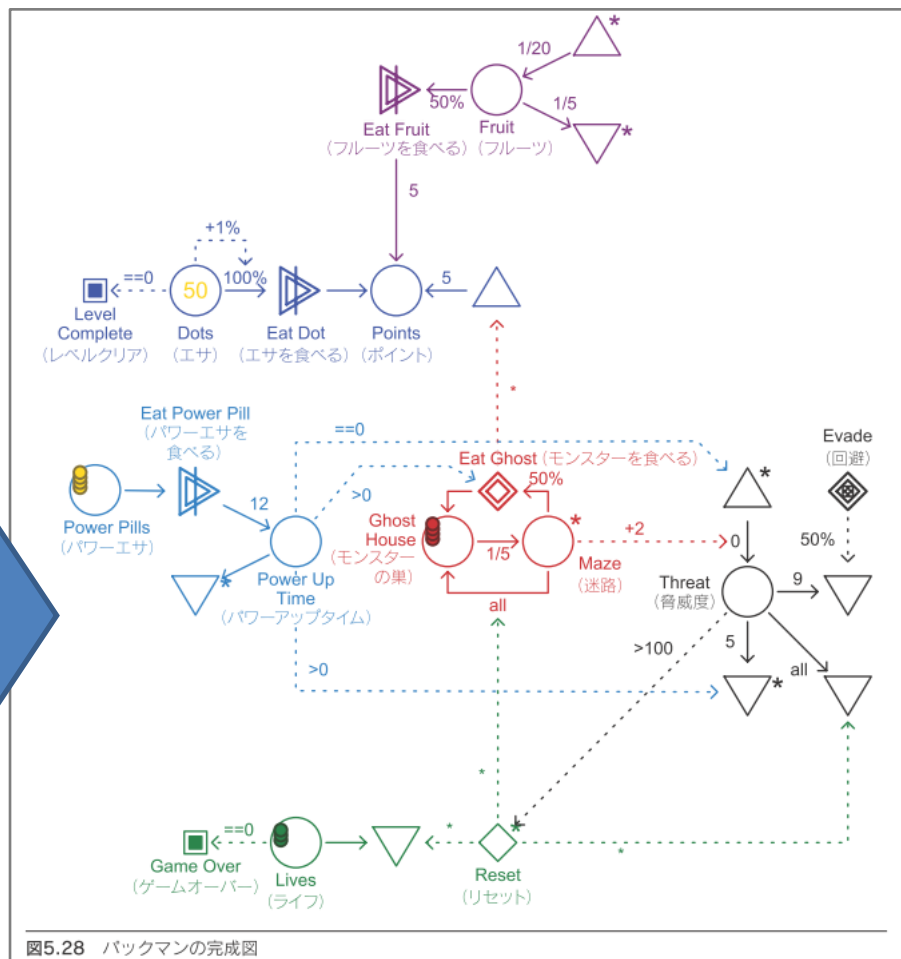
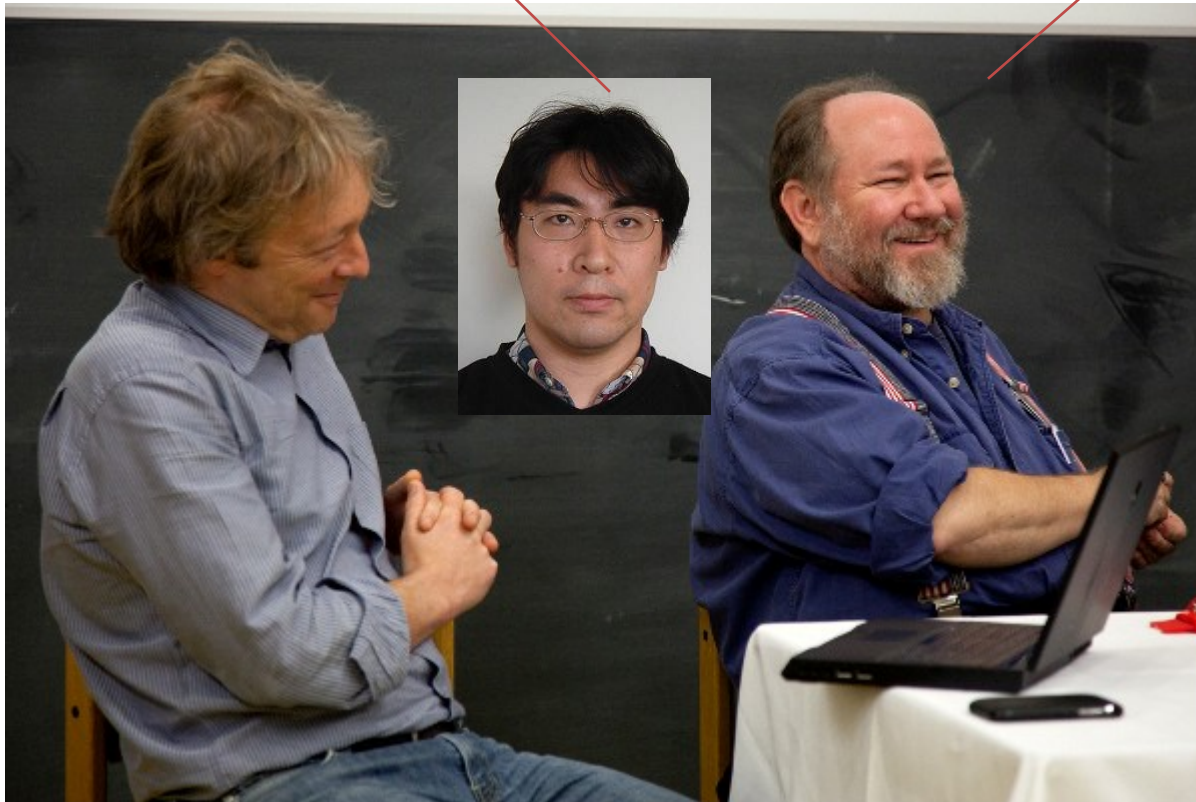


図5.28 パックマンの完成図

アダムのマキネーション・ツール

<http://www.facebook.com/youichiro.miyake>

<http://www.facebook.com/ewadams>



Ernest Adams さんからのメッセージ

Joris Dormans and I are very excited that our book Game Mechanics has been translated into Japanese. The Japanese game industry is very famous and powerful, so it is an honor for us to be represented there. We think that our ideas will be helpful to all game developers, and we hope that you will find the Machinations tool useful to design and prototype your core mechanics. We wish you good luck and great success when you create your games!

- Ernest Adams

Joris Dormans と私は、我々の著作「Game Mechanics」が日本語に訳されたことについて、とても感動しています。日本のゲーム産業は、力強く、世界中に名が通っており、本書を日本の皆さんにお届けできることを誇りに思います。マキネーション・ツールはゲームをデザインし、中心となる動作のプロトタイプを作るのに適しています。我々のアイデアがゲーム開発者の皆さんのお役に立てることを願います。日本の皆さんが、これからのゲーム開発で素晴らしい運と成功をつかまれることを願ってやみません。

- Ernest Adams

**アダムズさんの資料による
マキネーションの説明・実演**

アルテピアッツァ株式会社 永木映彦

マキネーションまとめ

- (1) 最初の導入に時間がかかってしまう。
- (2) 人に見せるときに、相手がマキネーションの原理を知らなくても理解して貰える。
- (3) マキネーションを使うことで、メカニクスに強くなることができる。

第二部

SIM CITY のゲームデザイン

Stone Librande さん

- 「Diablo III」リードデザイナー
- 「Spore」リードデザイナー
- 「SimCity 5」リードデザイナー

<http://stonetronix.com/>

Note: Please turn on the notes view to see the spoken portion of this presentation.

One-Page Designs

Stone Librande

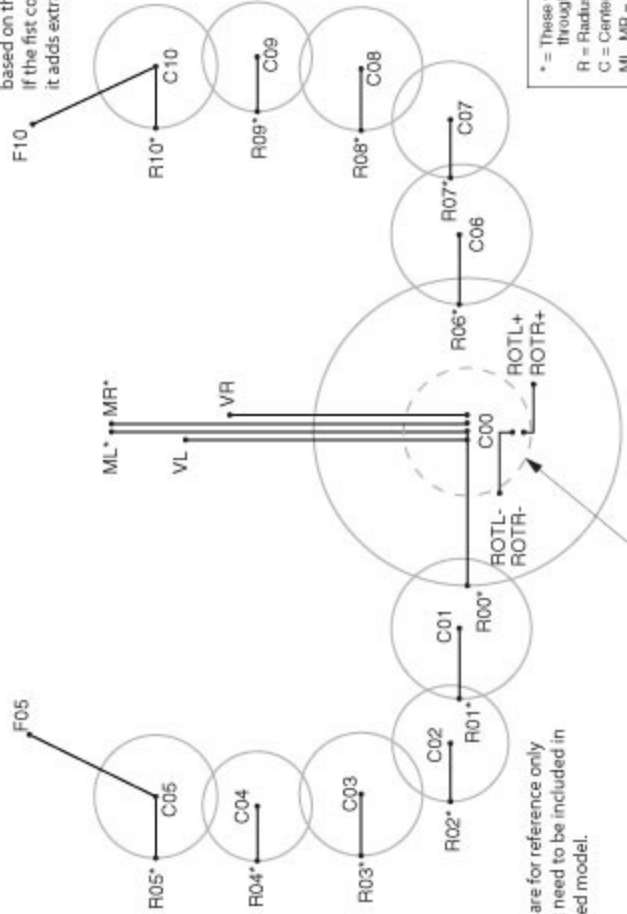
Creative Director, EA/Maxis

<http://stonetronix.com/>

Anatomy of a Creature

0 Time Estimates

The fists need force vectors based on the arm's strength. If the fist connects with an object it adds extra force to the collision.



The circles are for reference only and do not need to be included in the compiled model.

Table of Contents	
Overview	400
Off-Line	450
The Game	500
Spending	550
Marketing	600
Scene-By-Scene	700
0's, Misc	700
1000	700
2000	700
3000	700
5000	700
7000	700
100's, Op	700
110	700
150	700
200's, Ho	700
210	700
220	700
230	700
270	700
300's, C	700
300	700
310	700
320	700
340	700
350	700
360	700
370	700
380	700
390	700
391	700
400-600	700
400	700
450	700
500	700
550	700
600	700
700's, Si	700
700	700
710	700
720	700
730	700
740	700
800's, Pa	700
800	700
810	700
820	700
830	700
Sound	800
Miscellaneous	800

History

Eight years ago birth of INN. After s dropped. Three year adult on-line chat, b

Today

Using the existi cludes all the *Hoyle* access, but is more f titulation.

Gamble in a safe tasies, and play the r people, gamble, chat slapstick, good-natur

The key concep third-person virtual v ing, swimming, hot- viable economically

Hoyle games and ad

Financial Mo

Larry's Casino Berkeley's Jack gam four additional "part national advertisers challenge, etc.

Theme

Once again, Lei "from" a casino. He dollars to spend? He line Larry will playe sino for its mob own

One running ga counter, sells every scurries into every s

Goals

Our goals are f on-line and off-line p additional funds; pro line the method of m

own message file. In M center out (from left-to

The following cha renthe sis.

Women

5000—Passionate
Patti-is-not-young
only-plays-famous-cups

Our-next-selection
5-Passionate-Patti-Do
Expect-traveling-salesm
you'll-probably-just-en
lines-over-and-over-ju
MIKE IS LIVE (ENT
nino—Just select Passi
winnings

5100 Drew Barin
Beautiful, young, much time as possible

Next up is the be Drew Baringmore! As her time as possible n really loved how Drew lucky, before... Oh, w you choose Drew, you

5200 Cavaricchi
Beautiful young b sense girl with well-de

Well now, who ha ing hit on by men? He little number right here poor Larry found out, s beautiful young bisexu ricchi is one tough, no Cav tonight!

5300 Annette B
A mysterious, dar realizing his name refe hat. She wanted someo

Moving now to a film noire woman in " girl...actually she was her. She never realized mit murder for her, but she lovely? Well, of co a classic 1940's black People are dying to me

Scene-By-Scene Description

0's, Miscellaneous Animation

1000. User Interface

The 1000 numbers include everything that is shared globally: menus, cursors, icons, etc.

Rock Hard
Map
Internet play
My Stuff...
Options...
Help
Exit

Menus

The right-click menu will contain at least the following items (more will probably follow as we discover what I've forgotten!).

Title Bar

This only says "Rock Hard" if that's the player's chosen persona.

Map

Takes you to the Map without leaving the current scene so in case you cancel while on the Map, you'll still be exactly where you were. While in the Map, this menu item changes to "Return from Map."

Internet play

Takes you to SIGS. If you are not in a game, lets you select the game in SIGS, then takes you there. If you are already gambling, you remain in your chosen game. When you return, your on-line sign-up mates are there with you.

Stuff	
Money	\$5000.00
Cigars	3
Condoms	2
Disinfectant	1
Roses	12

Stuff...

Opens a hierarchical menu off the side listing all the "stuff" you have in Inventory, which at the very least includes money and probably other things you've bought or been given. Left-clicking on one of the items expands another layer of menu of verbs that includes "give" if the item is "giftable." Give then has a sub-menu that lists all the people in your immediate "chat area."

Options...

Goes to a tabbed dialog with all the choices in *Hoyle's* "Controls" dialog, except "Attitude." Added to the *Hoyle's* collection will be individual tabs for each of the games, allowing players to customize everything we think may ever be annoying. (For examples, see Office '97's "Tools | Options" menu item.) Each game's specifics are under that game. Going to Options from within a game opens to that game's sheet. Going to Options from anywhere else opens to the General sheet. Here are just a few of the many items available to futz with:

- Text color (of text you send to others)
- Background color (of text you send to others)
- Reading speed (for others' cartoon bubbles)

Help

Takes you to the standard Windows Help system, and Al's rip-off of *Hoyle's* help system.

Exit

Sure, ask 'em to confirm, but if they do, don't display a commercial, just get the hell out!

Chat Bubble

Chat is displayed inside a rounded-corner rectangle, with one corner replaced with a comma shape leading from the persona's mouth. Bubbles scale to fit the text typed. The left personas' bubbles go to the right, while the right personas' bubbles go to the left; the inner personas' bubbles go above, while the outer personas' bubbles go below. Each bubble attempts to not cover other bubbles, although that seems impossible. Keep them gracefully shaped and proportionate (i.e., approximately 3x5 proportions), rather than rigid and within fixed boundaries.

GRIM



Grim Fandango

Puzzle Document

Puzzle



Grim Fandango

Puzzle Document

Cut-Scene: Choo-Choo Farewell

So it was Evaluna, after all, who stole the suitcase. After doing that, she rallied the L.S.A. reserves, now a hundred strong, and secured the train station with them. Manny finds a special ticket waiting there for him—first class for retired civil servants. He gets on the train with Meche and Glottis (Demons ride free! At least, to the border) and they wave good bye to Eva and her troops.

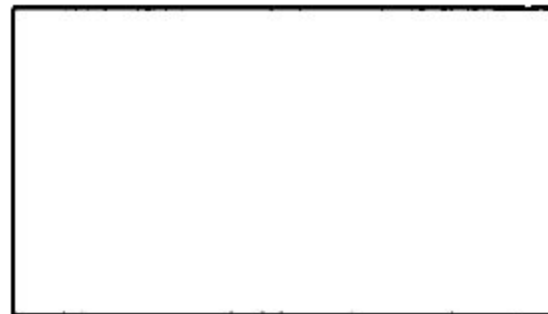
They speed across the world to the Mayan temple, where Glottis gets off. He can't leave the Land of the Dead, and there is a tearful farewell, but happy because Glottis has found a home with the little demon mechanics.

All the cheated souls finally get their tickets and board the train. The angelitos ride up front with Manny and Meche, singing "Chattanooga Choo Choo" and dancing in the isles until the train starts chugging out of the station and they all stick their heads out the windows to see the new world coming.

To protect this document,
please restrict your fallen
tears of joy to this box.
Thank you!



To protect this document,
please restrict your fallen
tears of joy to this box.
Thank you!



Eric Ingerson

"This report, by its very length"

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Page 72

April 30, 1996 1:52 PM
Tim Schafer

Pros

- Definitive source of information
- Entire design is in one place
- The act of creating the document is the act of designing the game

Cons

- Doesn't scale up
- Hard to manage updates
- Difficult to search

<http://stonetronix.com/>

Diablo

Direct

Shot does not travel along path, but hits target instantaneously.

0



Parameters:
delay

Melee

A type of direct damage that can only be delivered by the source being within close range of a target.



Parameters:
same as Direct
min-max range
move in and attack (on/off)

Instant

Near instantaneous delivery that cannot be dodged, but can be blocked by other objects.

0



Parameters:
min-max range
pierce (on/off)

Propelled

Shoots out an object (actor) that can be dodged or blocked by other objects.

0



Parameters:
min-max range
distance trigger
time trigger
velocity
pierce (on/off)

Lobbed

A type of propelled delivery that arcs up and passes over objects.



Parameters:
same as Propelled
launch angle

Pathing (Homing)

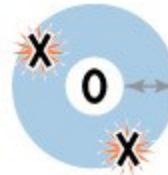
A type of propelled delivery that follows an arbitrary set of rules (AI) and attempts to reach a target, despite obstacles.



Parameters:
same as Propelled
pathing rules

Area - Circle

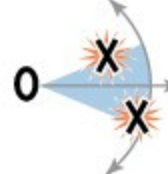
Payloads delivered to all targets within area at a set rate.



Parameters:
frequency of payloads
distribution
dissipation
min-max range
min-max height
spherical or cylindrical

Area - Cone

Similar to a circle, but in a specified arc.



Parameters:
same as Circle
min-max arc width

Area - Beam

Similar to a cone, but in a rectangular shape.



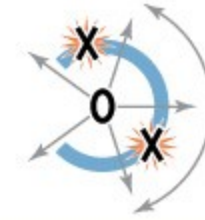
Parameters:
frequency of payloads
distribution
dissipation
min-max x,y,z

Nova (Wave)

Attack radiates out from central point.

Target takes one hit as wave passes through it.

(Note: novas are typically a full circle, but do not have to be).



Parameters:
min-max range
min-max arc
velocity
2D or 3D
ground hugging (on/off)
dissipation

Demonic Mage

Fire Chain

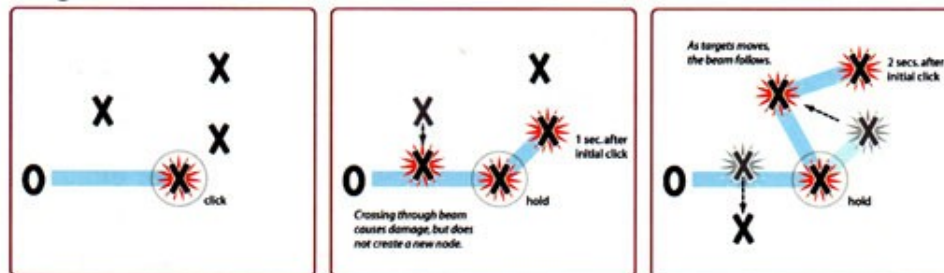
Skill Category

Fire

Description

Fire streams from the Mage's fingertips and spreads in chains to nearby monsters, burning them over time. The Mage must remain still while this happens. If the Mage gets hit, moves or releases the mouse button, the effect is broken.

Diagram



Details

Target a single monster.

Medium range.

Click to create a flame rope that connects the Mage to the target.

Attack continues as long as you hold down the mouse button, or until you get hit.

After 1 second the flame will leap from the target monster and connect to a nearby monster (if one is in range).

If the skill is leveled up, the flame will leap to additional monsters, in 1 second intervals, creating a connected chain. A monster already connected to the chain will not be reconnected again.

Line of sight: Yes, for initial target. Additional targets need to be in LOS from previous monster, not from the caster.

Auto-hit: yes.

Blockable: no.

Mana usage: up front cost paid on click, smaller cost paid over time (while mouse button is held down).

UI

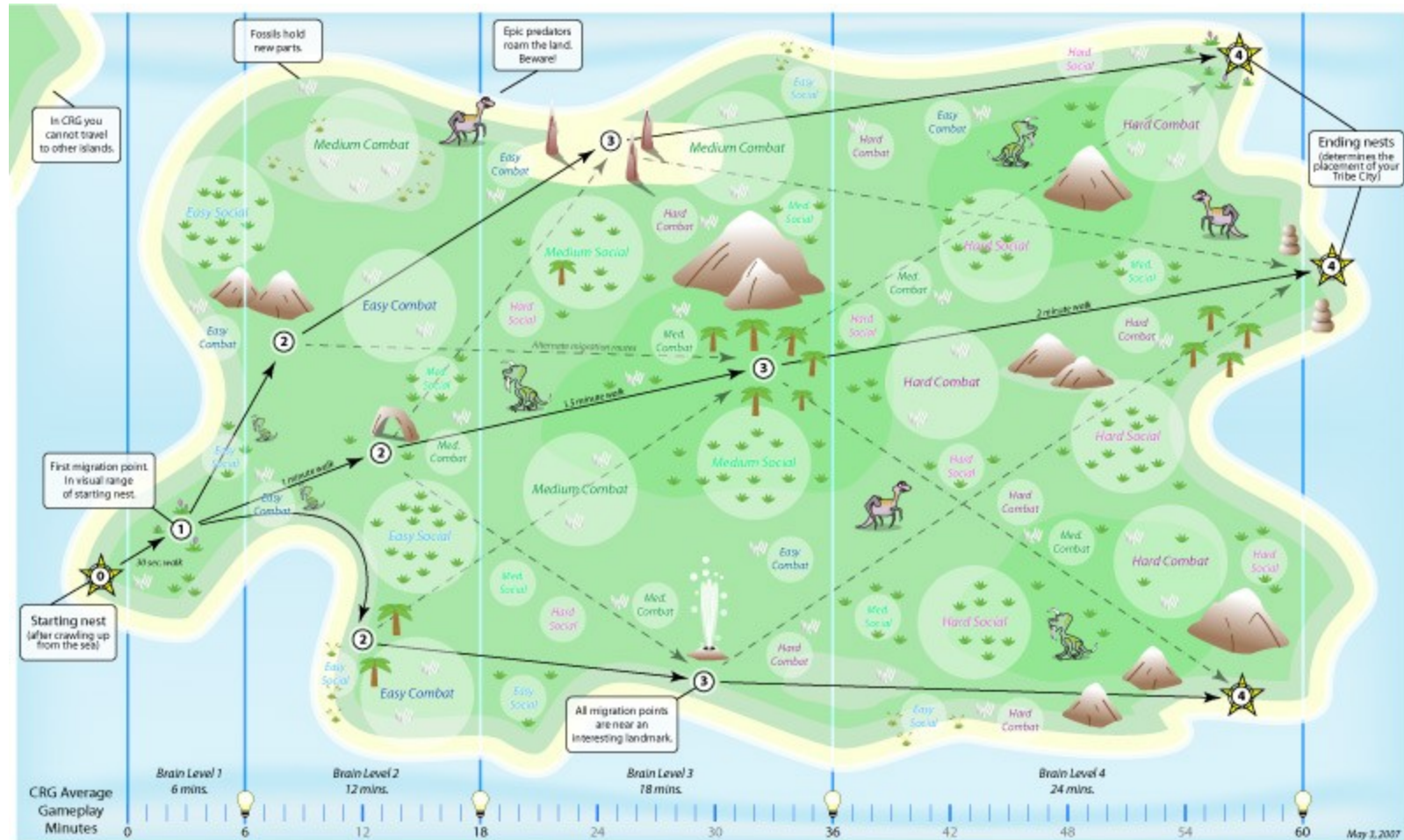
Set up the Fire Chain skill on either the Left or Right slot.

Click and hold on a monster.

If the Mage is not within range, he will walk within range and then start the attack.

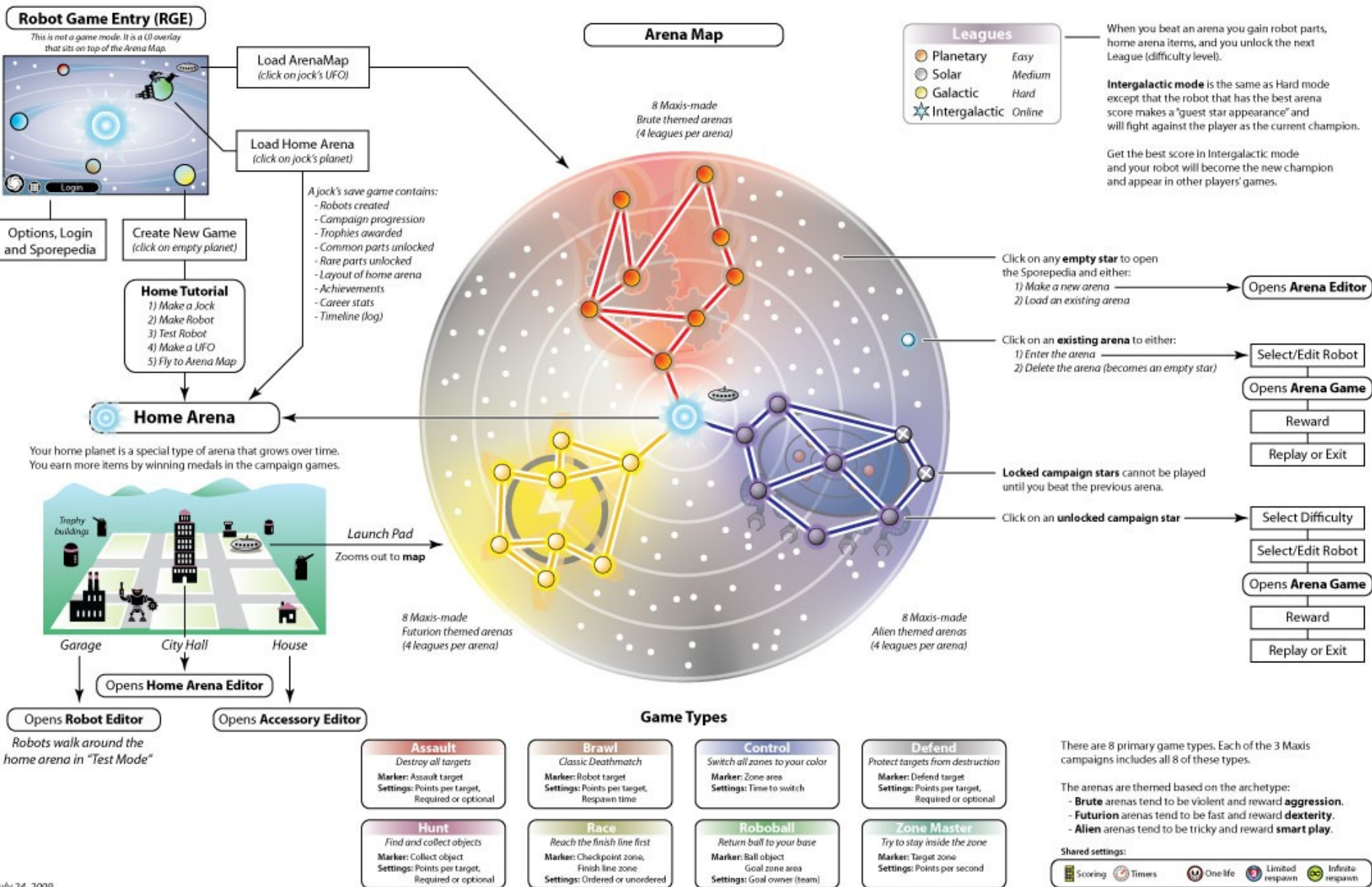
Release mouse button to stop attack.

Time + Space




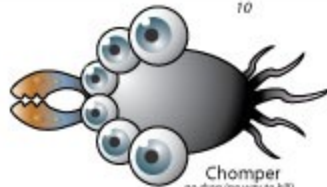









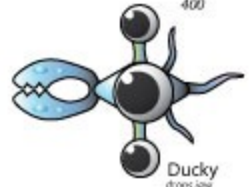








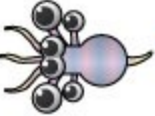

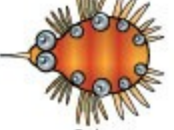
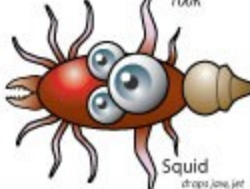


<http://stonetronix.com/>

Relationships Between Modules



Spore

1	world_ice	1	2	4	10
	ICE				
	Jaw (automatic) Jet (easy)	Player's Starting Cell <i>After mouth, Ejecta</i>	Goldy <i>drops jaw, jet</i>		Chomper <i>no drops (no way to kill)</i>
2	world_rock	10	20	40	100
	ROCK				
	Spike (easy) Poison (hard)	Shyster <i>no drops</i>	Alpha-Shyster <i>drops spike</i>	Poisoner <i>drops poison, jet</i>	Chomper <i>drops jaw</i>
3	world_plant	100	200	400	1K
	PLANT				
	Cilia (easy) Proboscis (hard)	Pinky <i>drops cilia</i>	Alpha-Pinky <i>drops jaw, cilia</i>	Nosey <i>drops proboscis, jet</i>	Ducky <i>drops jaw</i>
4	world_water	1K	2K	4K	10K
	WATER				
	Electric (hard)	Buzzy <i>drops electric</i>	Alpha-Buzzy <i>drops electric, spike</i>	Jawhead <i>drops jaw, spike</i>	Puffish <i>drops spikes, poison</i>
5	world_beach	10K	20K	40K	100K
	BEACH				
		Jetster <i>drops jet</i>	Eggkid <i>drops jaw</i>	Eggmom <i>drops eggs</i>	EggDad <i>drops jaw, jet</i>
					
				Poker <i>drops proboscis, cilia</i>	Squid <i>drops jaw, jet</i>



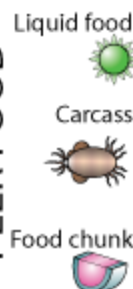
Base Interaction

Jaw	Proboscis	Spike	Poison	Electric
Each bite does 1 damage. 3 bites to kill. Leaves carcass.	Each sip does 1 damage. 3 sips to kill.	Each stab does 1 damage. 3 stabs to kill. Leaves food chunks and possibly liquid (no carcass).	Each second in cloud does 1 dmg. and temporarily slows. 3 seconds to kill. Leaves carcass.	Each zap does 1 damage and temporarily stuns. 3 zaps to kill. Leaves carcass.

CELL-B

	Jaw	Proboscis	CELL-A Spike	Poison	Electric
Jaw	Deflect. Both cells bounce off each other.	Jaw wins. Cell-A takes 1 damage.	Spike wins. Cell-B takes 1 damage.	vs. Cloud: Poison wins. vs. Part: Jaw wins.	vs. Bolt: Electric wins. vs. Part: Jaw wins.
Proboscis	Jaw wins. Cell-B takes 1 damage.	Deflect. Both cells bounce off each other.	Spike wins. Cell-B takes 1 damage.	vs. Cloud: Poison wins. vs. Part: Proboscis wins.	vs. Bolt: Electric wins. vs. Part: Proboscis wins.
Spike	Spike wins. Cell-A takes 1 damage.	Spike wins. Cell-A takes 1 damage.	Deflect. Both cells bounce off each other.	vs. Cloud: Poison wins. vs. Part: Spike wins.	vs. Bolt: Electric wins. vs. Part: Spike wins.
Poison	vs. Cloud: Poison wins. vs. Part: Jaw wins.	vs. Cloud: Poison wins. vs. Part: Proboscis wins.	vs. Cloud: Poison wins. vs. Part: Spike wins.	Cells with Poison Parts are immune to poison.	vs. Bolt: Electric wins. vs. Part: Poison wins. Doesn't target poison clouds.
Electric	vs. Bolt: Electric wins. vs. Part: Jaw wins.	vs. Bolt: Electric wins. vs. Part: Proboscis wins.	vs. Bolt: Electric wins. vs. Part: Spike wins.	vs. Cloud: Poison wins. vs. Part: Electric wins.	Electric cell won't target other electric cells.

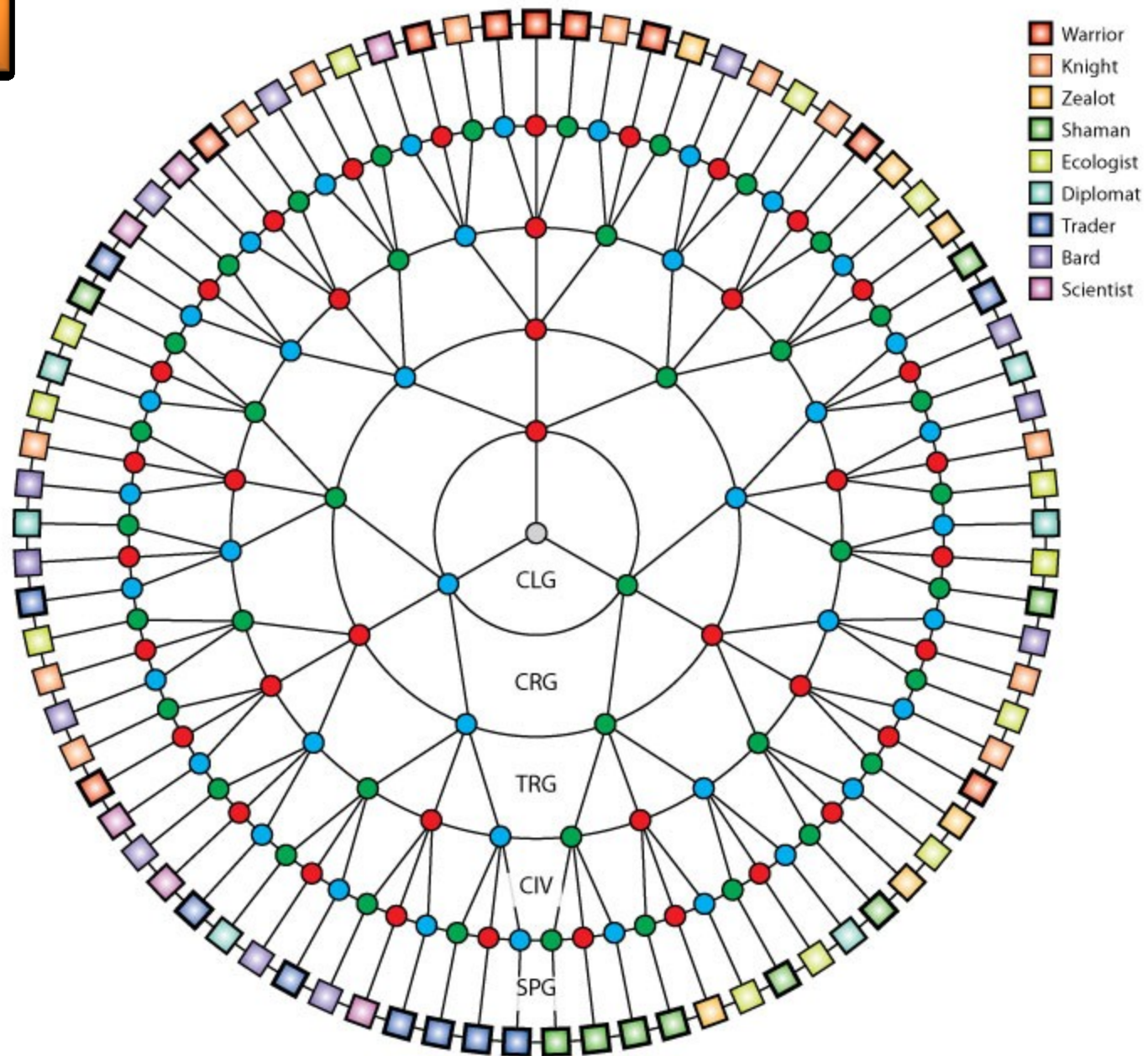
PEER FOOD



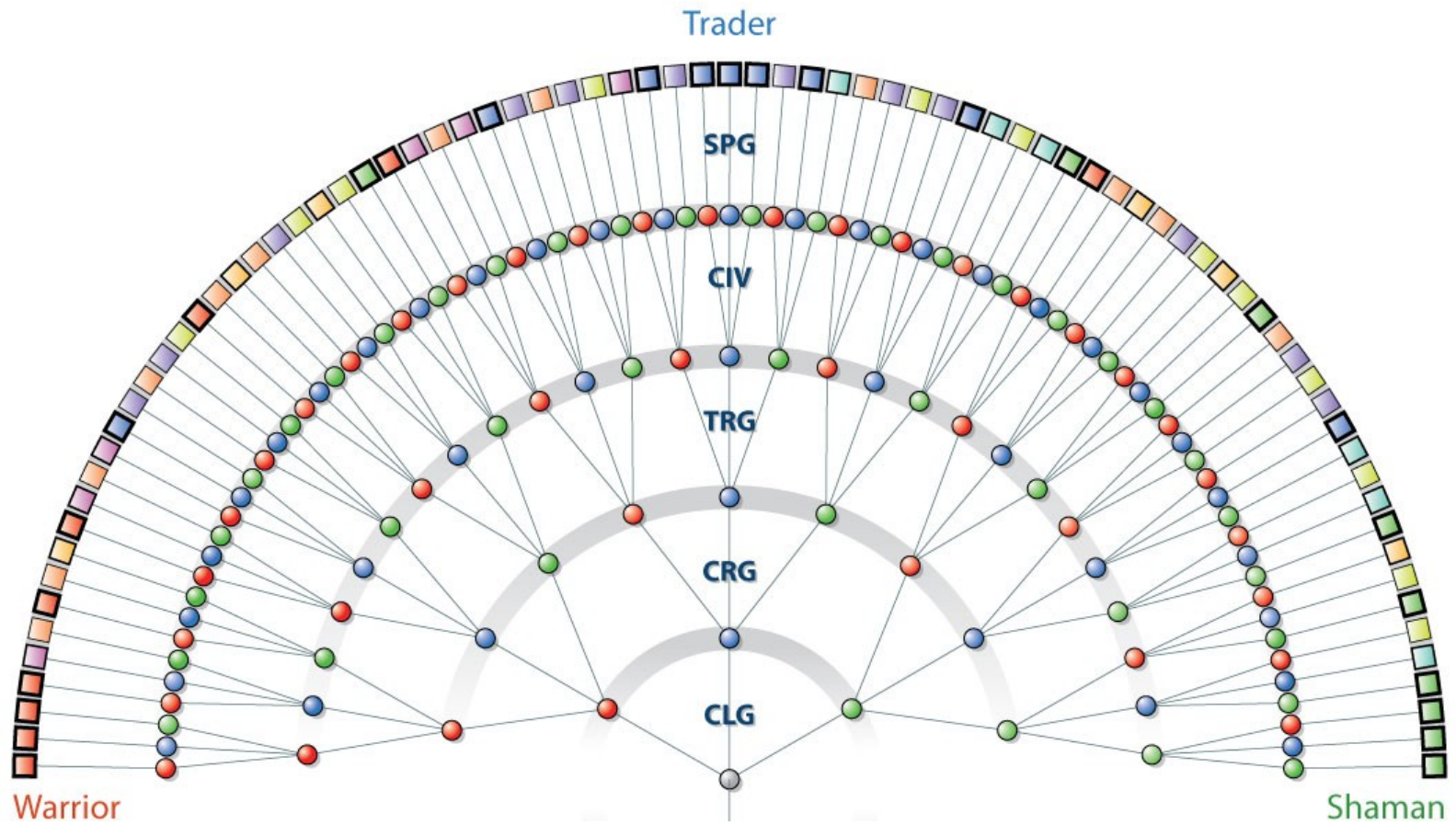
	Jaw	Proboscis	Spike	Poison	Electric	Filter Mouth
Liquid food	Ignores liquid food.	Sip for 1 DNA point. Shrinks to -1 size.	Stabbed food leaks two -1 size liquid food and then disappears. New food fades quickly.	Poison cloud doesn't hurt food.	Electric doesn't target liquid food.	Too big to eat. Ignores peer food.
Carcass	Bite carcass once to split it into three -1 size chunks.	Deflect.	Splits carcass into three -1 size chunks.	Poison cloud doesn't hurt carcass.	Electric doesn't target carcasses.	Ignores it.
Food chunk	Bite chunk once to split it into three -1 size chunks.	Deflect.	Splits chunk into three -1 size chunks.	Poison cloud doesn't hurt food chunks.	Electric doesn't target food chunks.	Ignores it.

Profession	Count
Vandrerr	25
Warrior	23
Trader	23
Shaman	23
Scientist	42
Zealot	42
Diplomat	42
Ecologist	12
Knight	12
Bard	12

Spore



Spore



<http://stonetronix.com/>

Calculating Space Game Archetypes

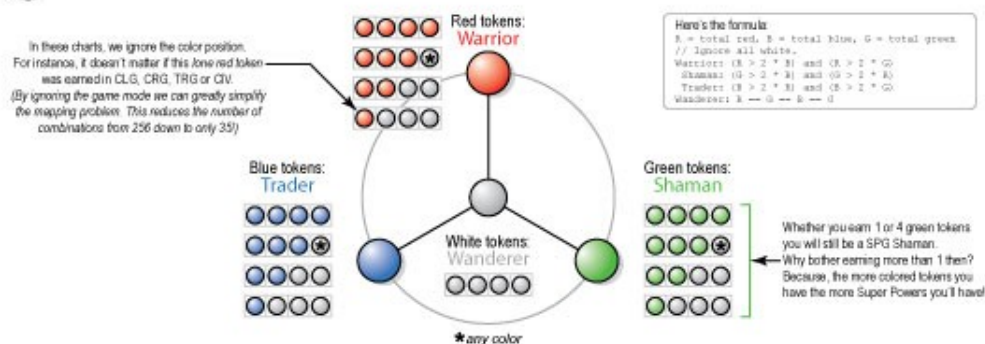
- When you complete a game mode you earn a "token". (These tokens will show up on your Sporepedia card.) Your tokens will determine your SPG Archetype when you enter into SPG. Tokens come in 4 colorful flavors:



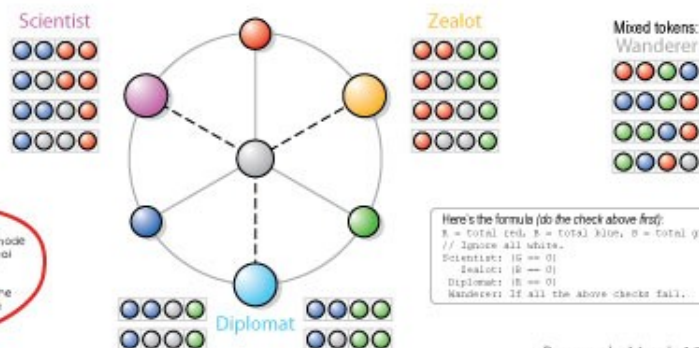
- When you start a new creature it has 4 white tokens by default. As you play through CLG, CRG, TRG and CIV you will replace your default white tokens with red, blue and/or green tokens. You can only earn 1 token per game mode.



- As you collect tokens you start to define your species. Collect 1 dominant color to move towards a primary archetype.



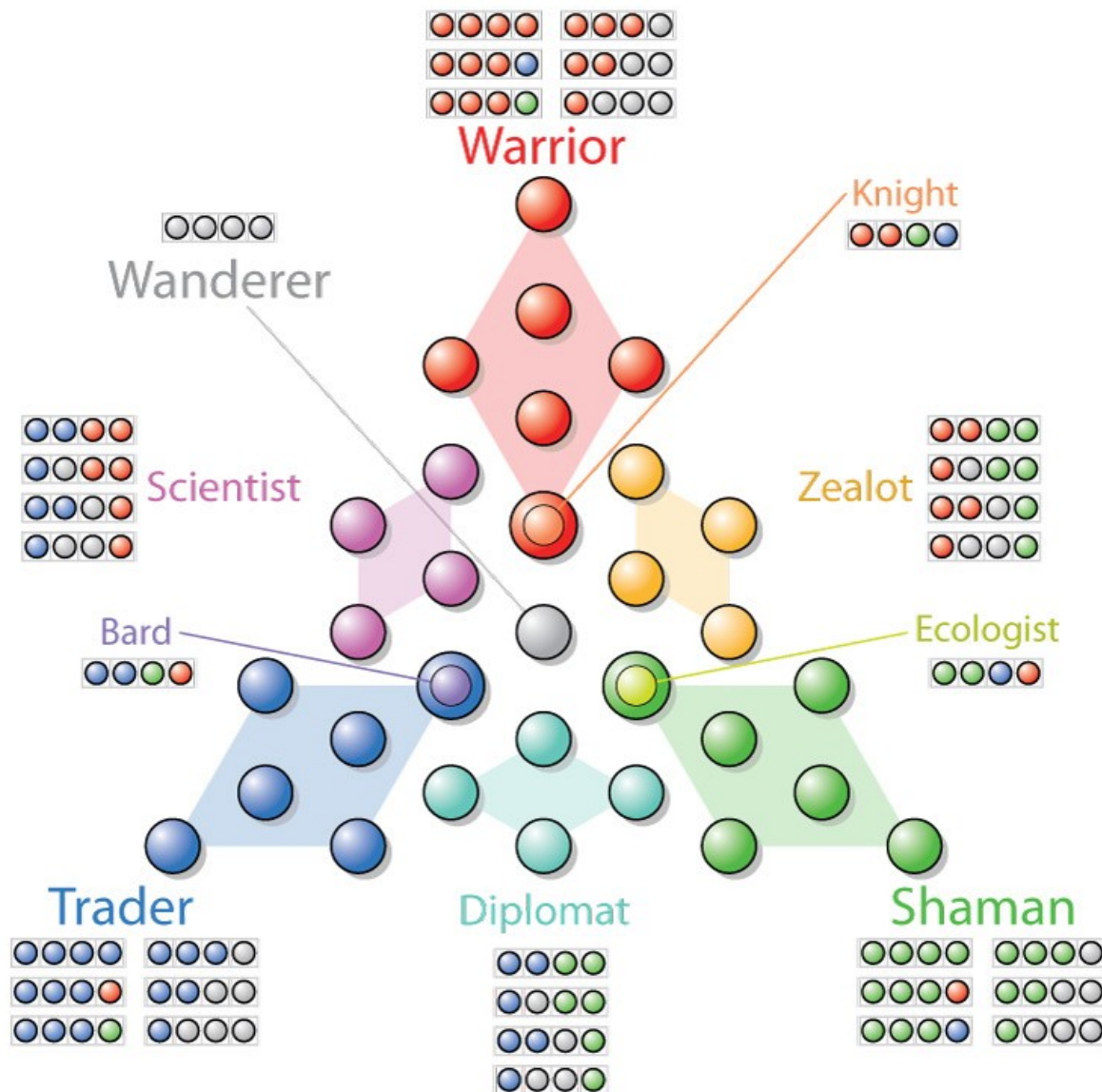
- Collect 2 colors to move towards a secondary trait. If you have a mixture of all 3 colors you will become a Wanderer.









FUN FACTS!

If we try to keep track of which game mode contributes which token we have to deal with 256 combinations. By ignoring the game mode and only focusing on the color we can simplify the problem down to just 35 combinations.

Spore



 This pattern is special. If the player ends up with one of each color then look at the only the last color to determine the archetype.
 For instance:
 or  or  equals Trader. Ending with  = Warrior and ending with  = Shaman.

The SimCity logo is displayed in a bold, stylized font. The word "SIM" is in white with an orange outline, and "CITY" is in orange with a white outline. The entire logo is set against a black rectangular background.

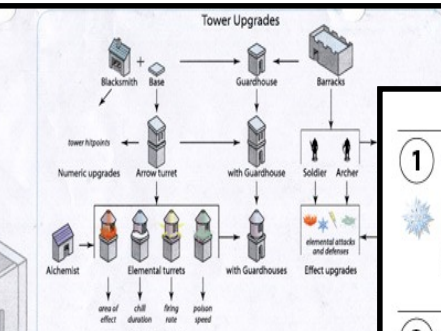
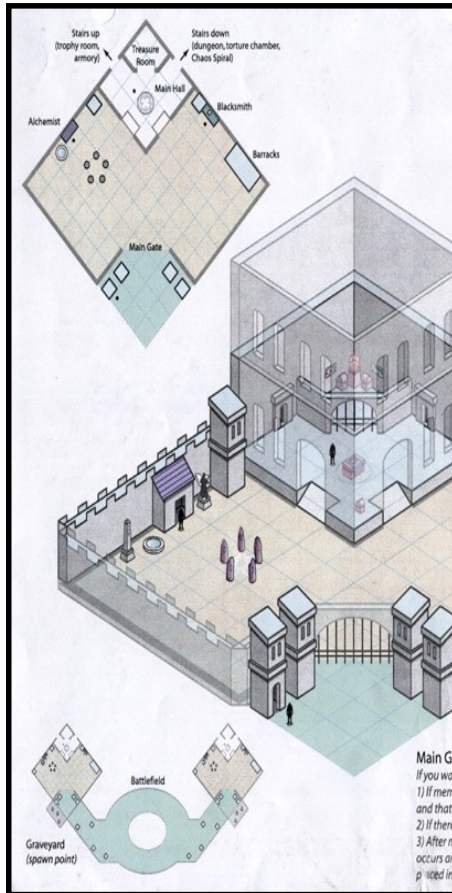
SIMCITY

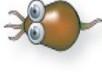

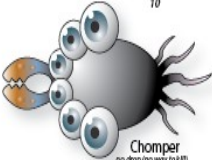











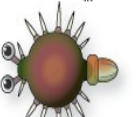




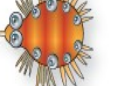

Simulating a City,
One Page at a Time

Stone Librande
Lead Designer, *SimCity*

<http://stonetronix.com/>

@StoneLibrande



	Small	Medium	Big	Large
1 world_ice	1	2	4	10
ICE Jaw (automatic) Jet (easy)	 Player's Starting Cell after mouth, flange	 Goldy drops jaw, jet		 Chomper no drop (no way to kill)
2 world_rock	10	20	40	100
ROCK Spike (easy) Poison (hard)	 Shyster no drop	 Alpha-Shyster drops spike	 Poisoner drops poison, jet	 Chomper drops jaw
3 world_plant	100	200	400	1K
PLANT Cilia (easy) Proboscis (hard)	 Pinky drops cilia	 Alpha-Pinky drops jaw, cilia	 Nosey drops proboscis, jet	 Ducky drops jaw
4 world_water	1K	2K	4K	10K
WATER Electric (hard)	 Buzzy drops electric	 Alpha-Buzzy drops electric, spike	 Jawhead drops jaw, spike	 Puffish drops jaw, poison
5 world_beach	10K	20K	40K	100K
BEACH	 Jetster drops jet	 Eggkid drops jaw	 Eggmom drops eggs	 EggDad drops jaw, jet
			 Poker drops proboscis, cilia	 Squid drops jaw, jet

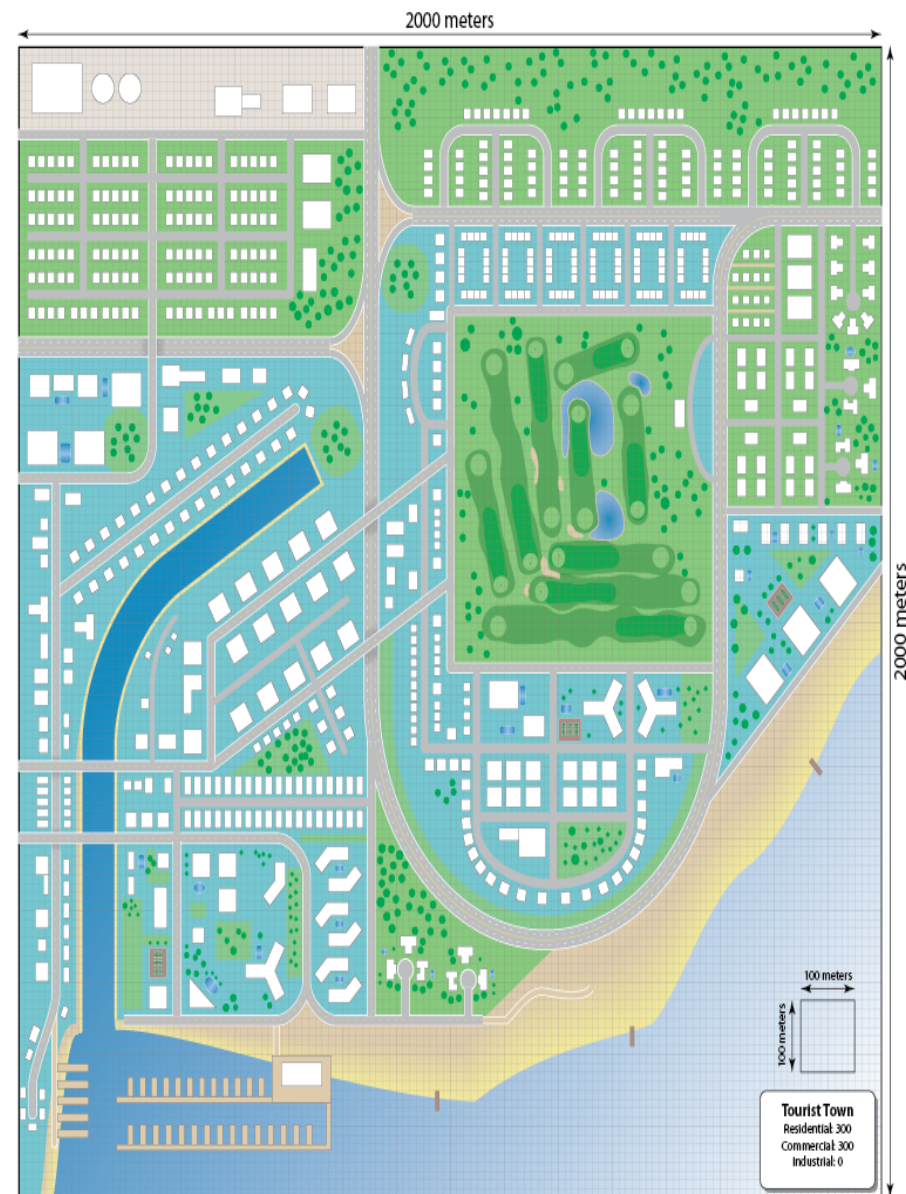
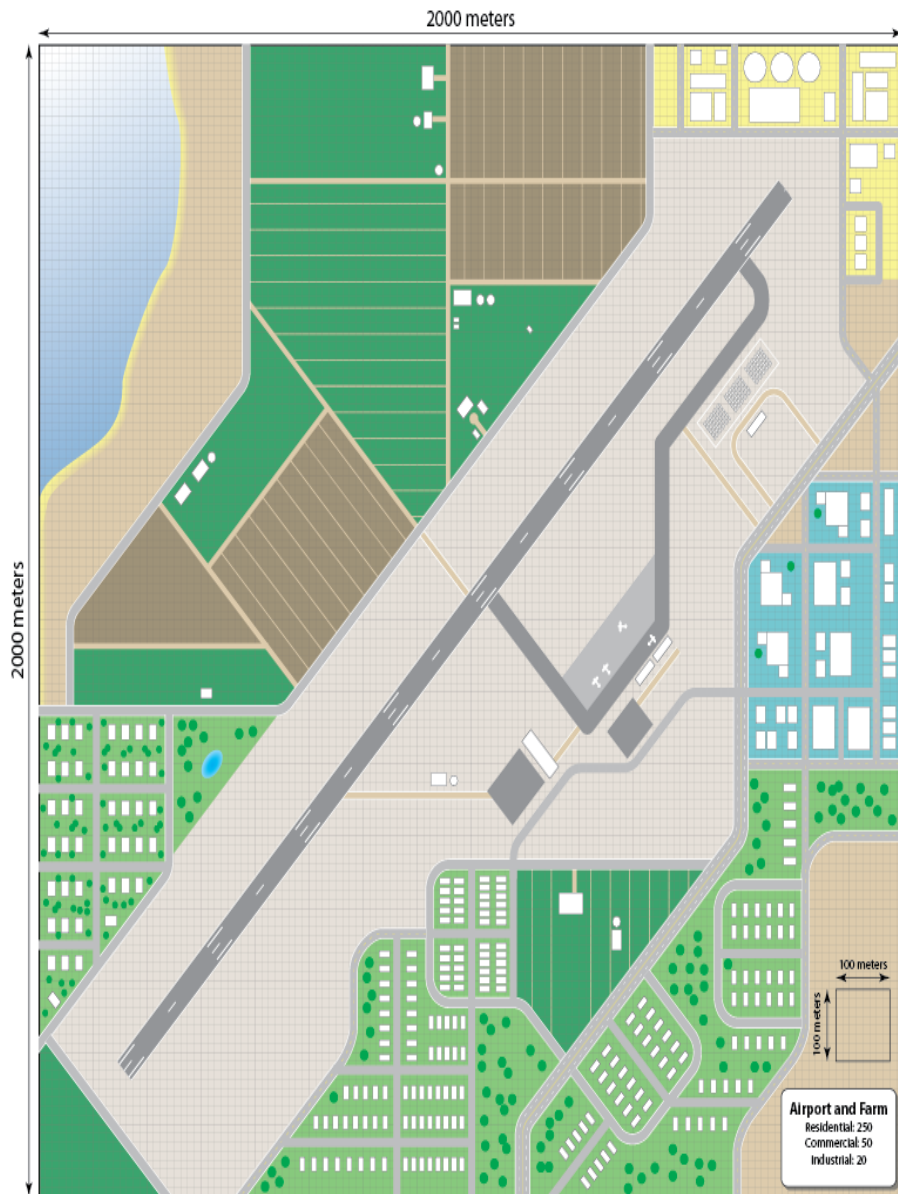
Spore

<http://stonetronix.com/>



SimCity 5

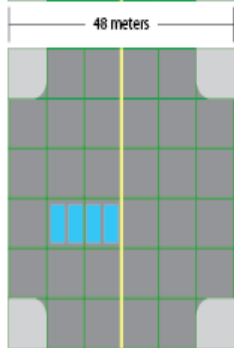
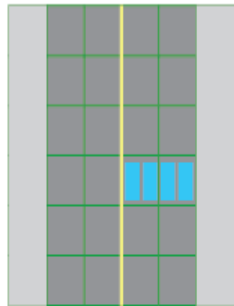
<http://stonetronix.com/>



Road Widths

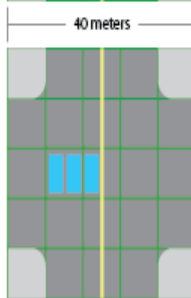
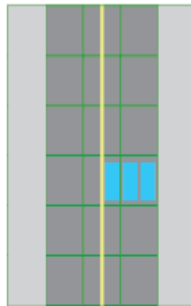
Highway

4 Lane
Low - High Density



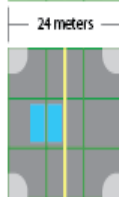
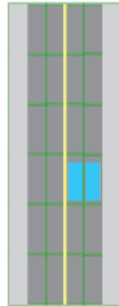
Avenue

3 Lane
Low - High Density



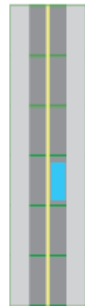
Road

2 Lane
Low - High Density



Street

1 Lane
Low Density Only



Region Flow

Start a New Game

New Region

The player selects a region map from a small set of shipping maps. New region maps will be added over time.

Join Region

The player selects a particular city slot by clicking on an open city slot.

Accept Invite

Automatically loads the region map associated with the invitation.

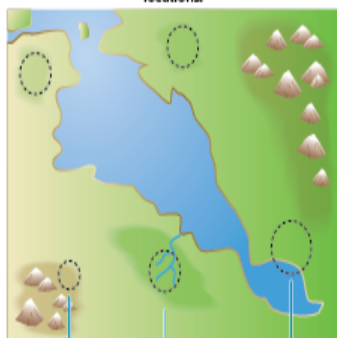
Continue

Load Region

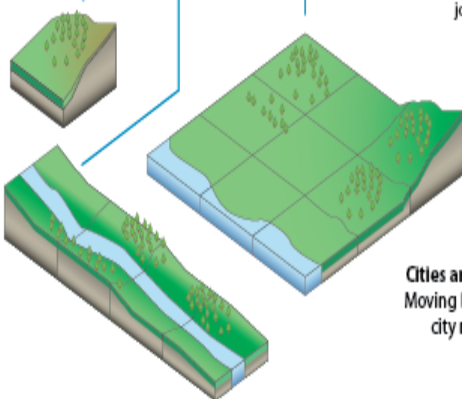
Select a region map where you already own a city.

Empty region

The player selects a starting city slot from a set of locations.



Different city slots contain different configurations of tiles.



Existing region

Over time the maps fills up with more cities and extra city slots unlock.



Regions can be single player or multiplayer. Each time you unlock a new city slot you can invite a friend to join or open it to any player.

Claim for Yourself
Invite Friend
Open to All

Cities are single player only. Moving between tiles within a city needs to be quick!

Region Level Gameplay

Epic Arc

Start out with a pristine landscape and build up a custom megapolis.

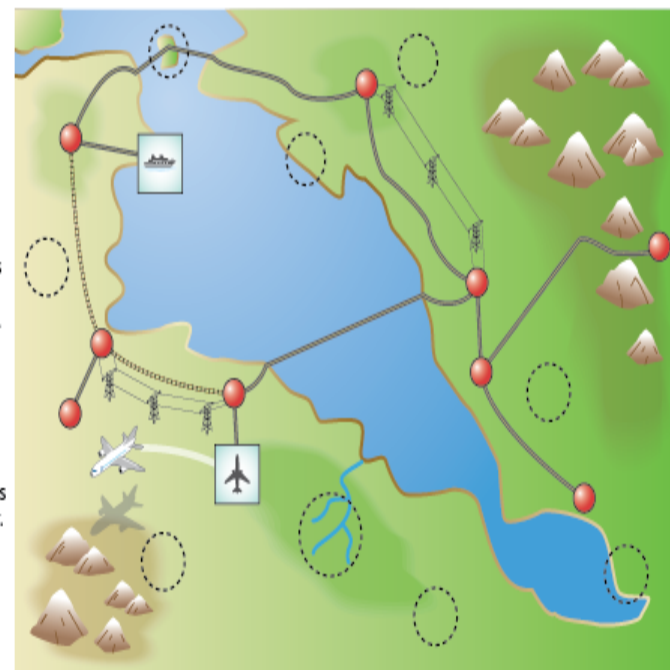
Free Play or Scenario

Each region can be played as a sandbox or as a challenge customized to the map type.

Regional Projects

Work together to build an airport and everyone in the region can buy and sell goods quickly on the Global Market.

Think big! Build a spaceport and reach for the stars!



Megacorps

Join your big business together with your neighbors' and rule the markets.

Specialization

Should this city be a mining town or vacation resort? The choices you make at the city level impact the region as a whole.

Connect and Prosper

Join cities together with roads, train tracks, and electric wires. Share commuters, resources, universities, and police depts.

Many Cities, One Region

No city is an island. Workers, shoppers and students commute in and out. Pollution and crime spread to neighboring cities if left unchecked.

Starting City

Early Game

Mid-Game

Late Game

End Game

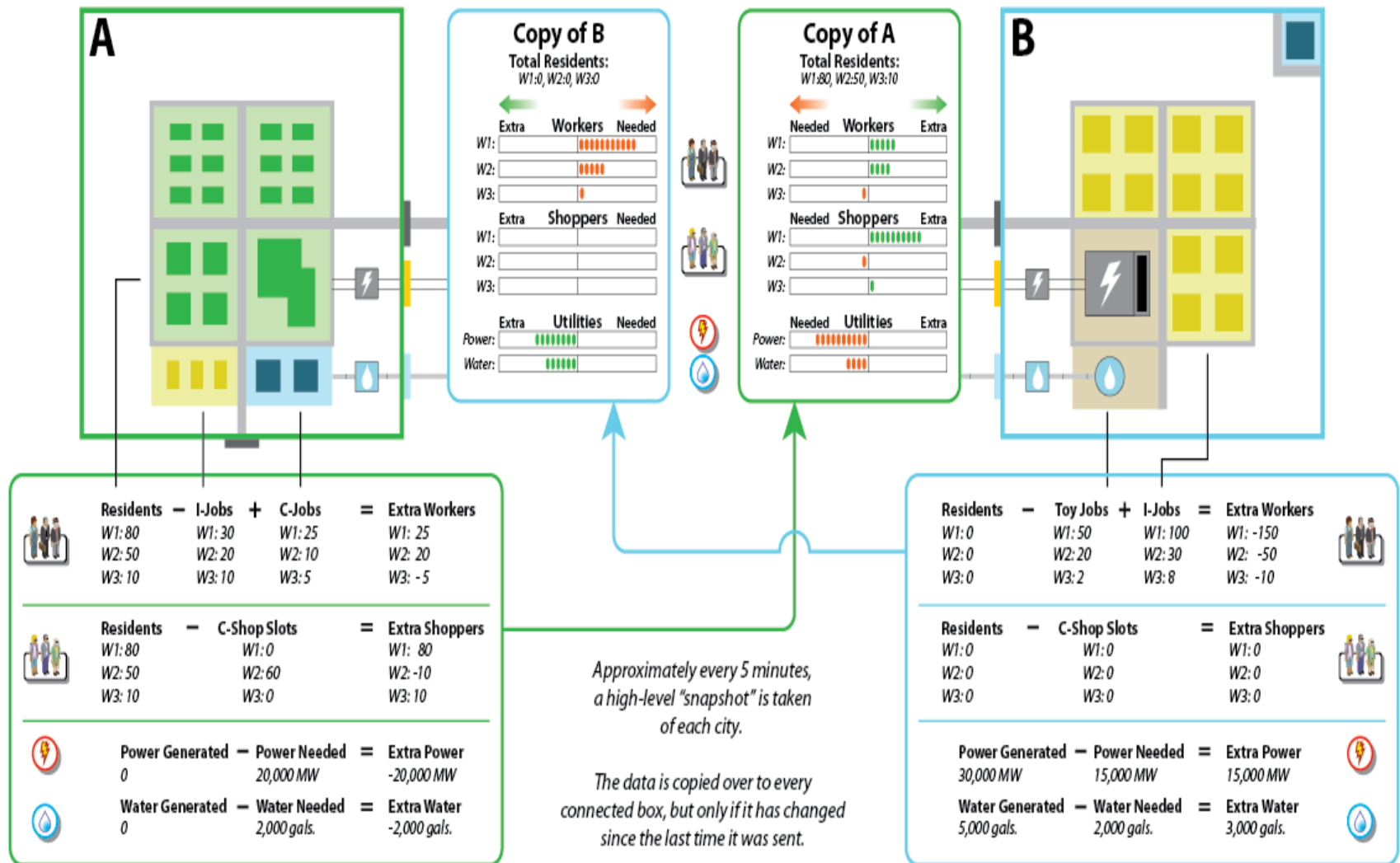


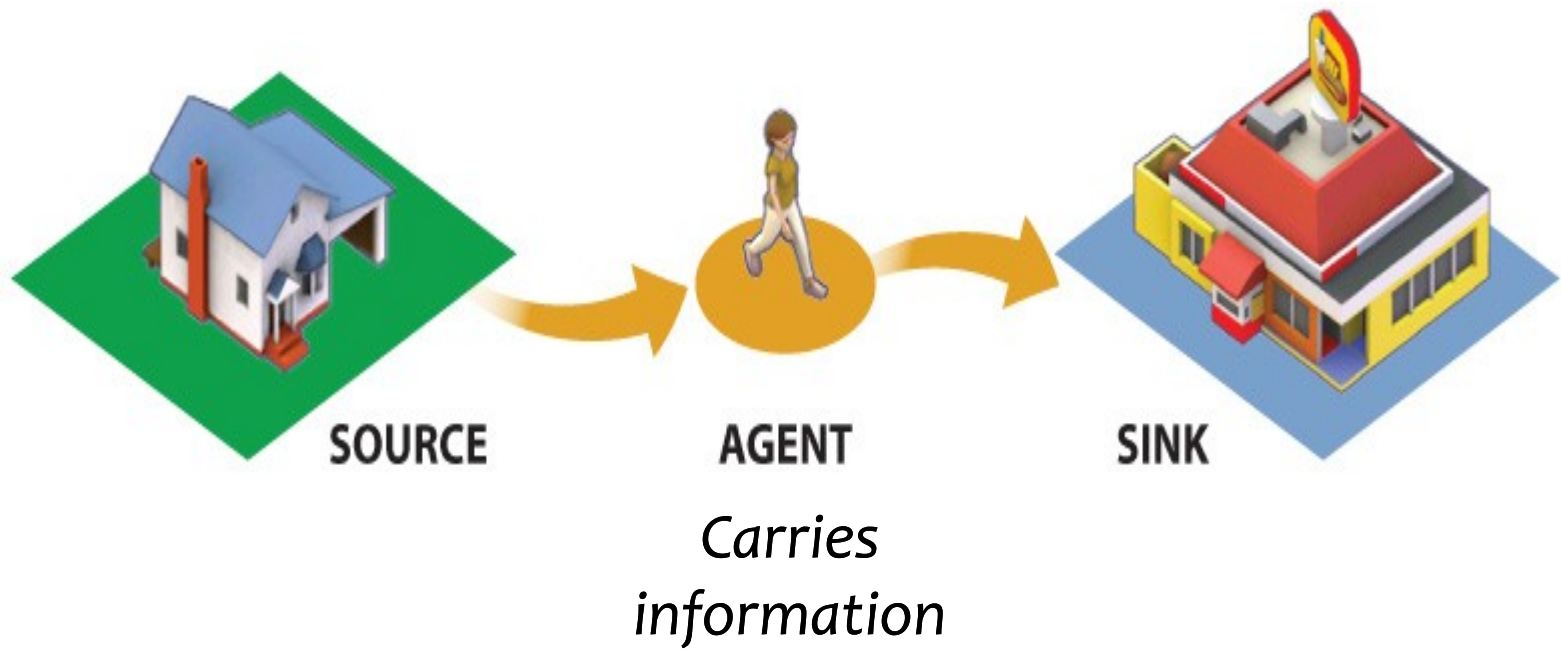
Transferring Citizens and Utilities

The copy is treated as if it were actually a part of the main city, although it is invisible to the player.

The total number of Workers + Shoppers entering the box cannot be > Total Residents

Non-connected buildings are not counted.





<http://stonetronix.com/>

RESOURCES

are the simulation variables that flow between units and are carried by agents.



Citizen



Happiness



Money



Goods



Sickness



Taxes



Water



Trash



Electricity

AGENTS

transport resources between units.



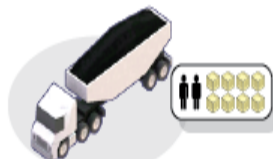
Walking



Driving



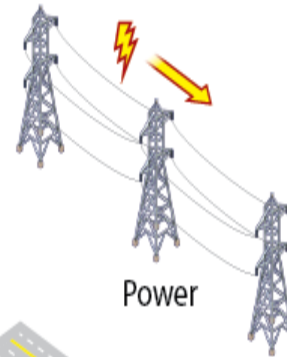
Shuttling



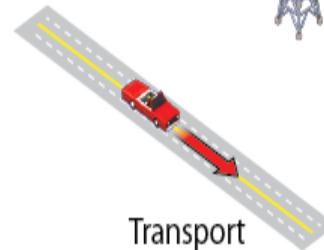
Working

PATHS

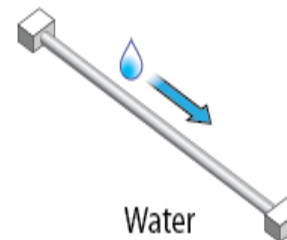
connect units.



Power



Transport



Water



UNITS

run simulation rules to create, destroy and transform resources and agents. The basic building blocks of the simulation.



Housing



Shops



Workplaces



GlassBox

A New Simulation
Architecture

Andrew Willmott (Maxis)

"GlassBox

A New Simulation Architecture"

<http://www.andrewwillmott.com/talks/inside-glassbox>

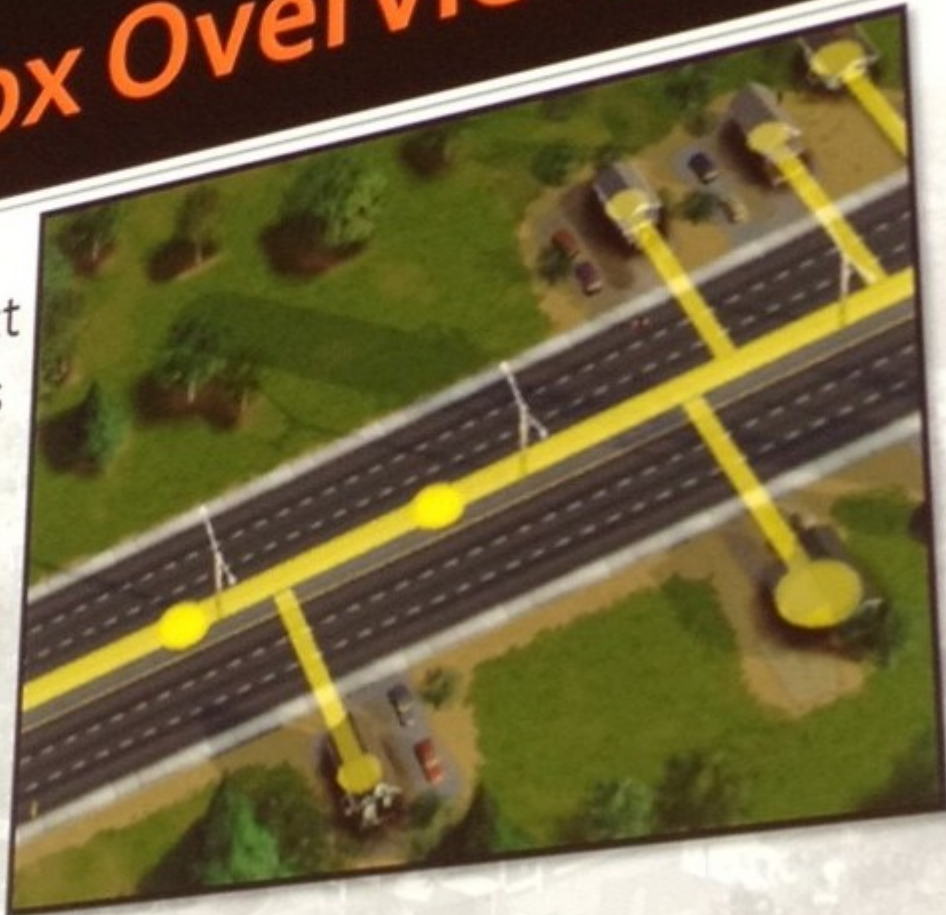
DAY / TIME / LOCATION: Wednesday 5:00- 6:00 Room 304, South Hall
TRACK / DURATION / FORMAT / AUDIENCE LEVEL: Programming / 60-
Minute / Lecture / All

EXPLORING SIMCITY: A CONSCIOUS PROCESS OF DISCOVERY

SPEAKER: [DAN MOSKOWITZ](#)

GlassBox Overview: Agents

- Also more abstract transport handlers
 - Pipe



GlassBox Overview: Agents

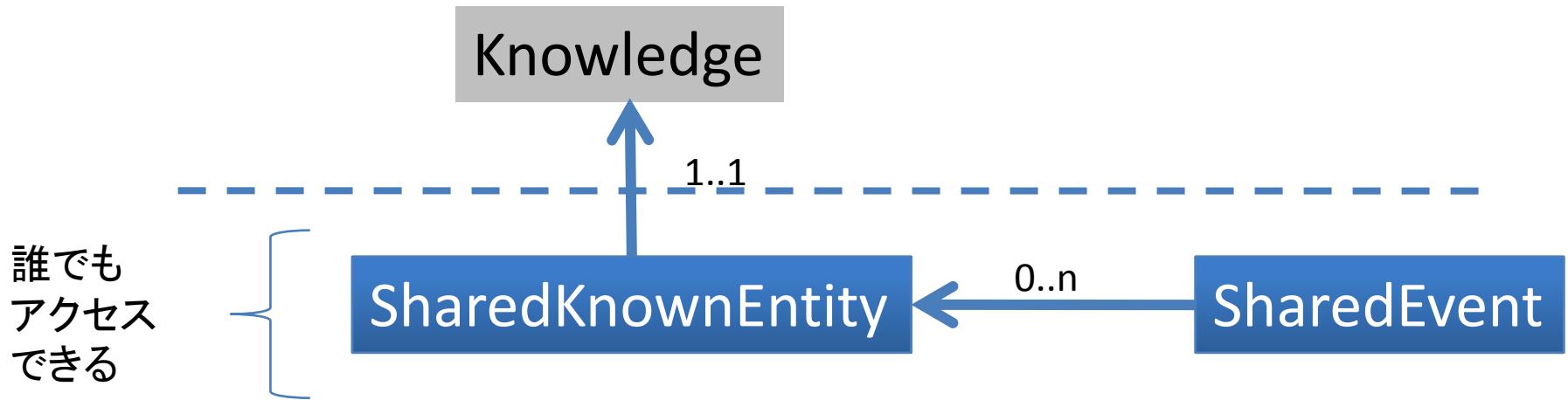
- Agents controlled by "Transport Handlers"
 - Vehicles
 - Pedestrians



第三部

HITMAN : ABSOLUTION の AI/ANIMATION

Knowledge



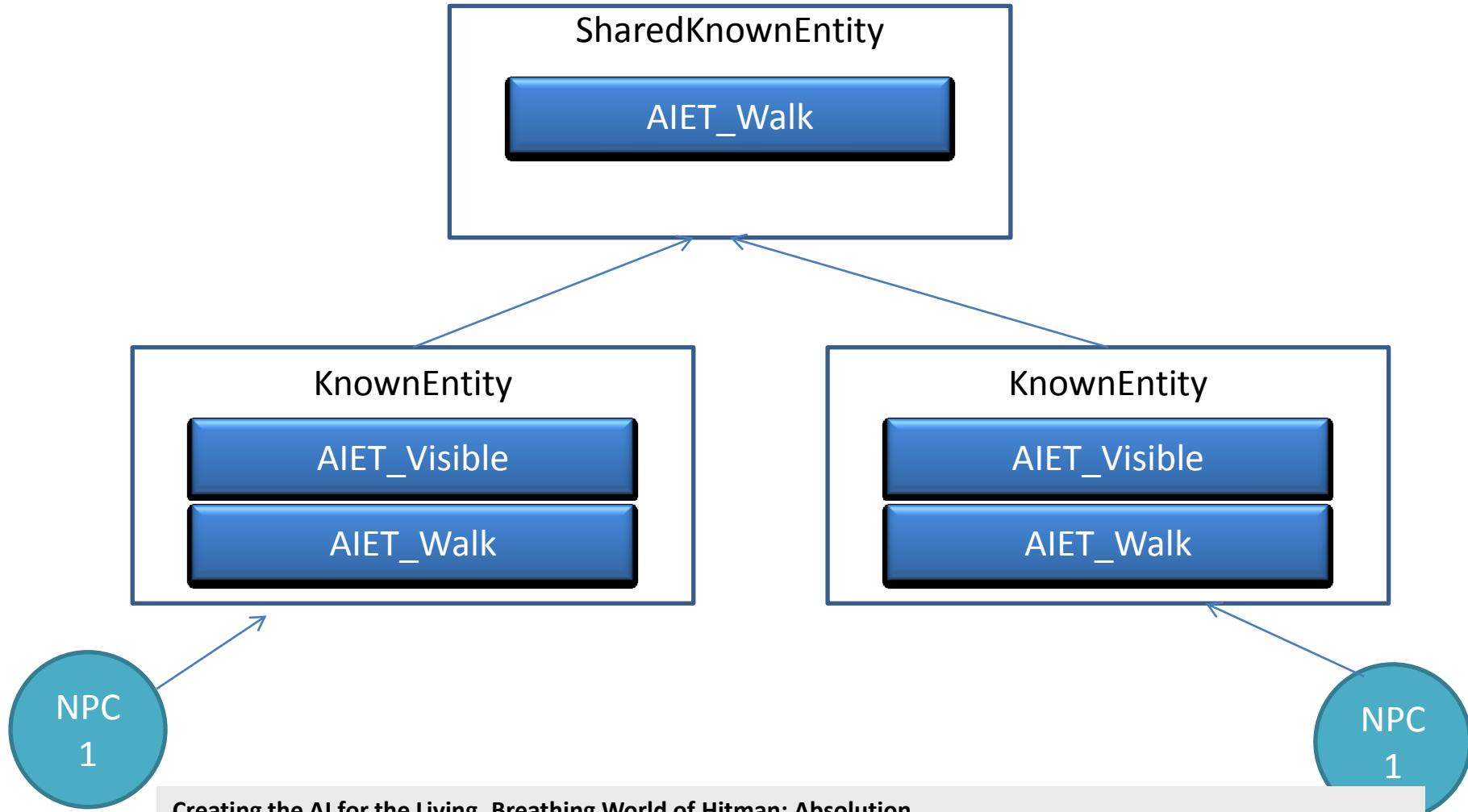
Creating the AI for the Living, Breathing World of Hitman: Absolution

Maurizio De Pascale | Senior Software Engineer, IO Interactive A/S

Mika Vehkala | Senior AI Programmer, IO Interactive A/S

Location: Room 3005, West Hall **Date:** March 28 **Time:** 10:00AM - 11:00AM

Knowledge



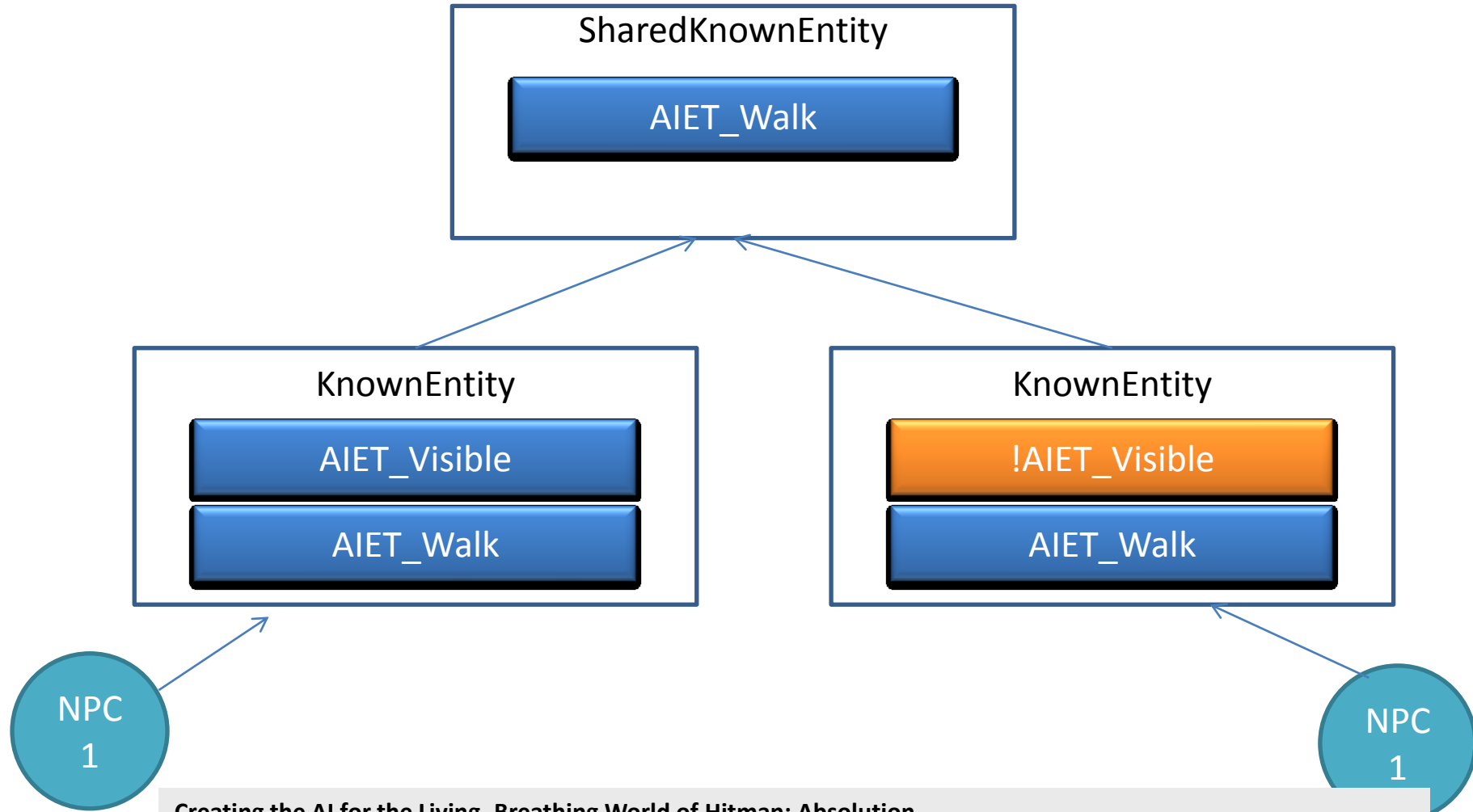
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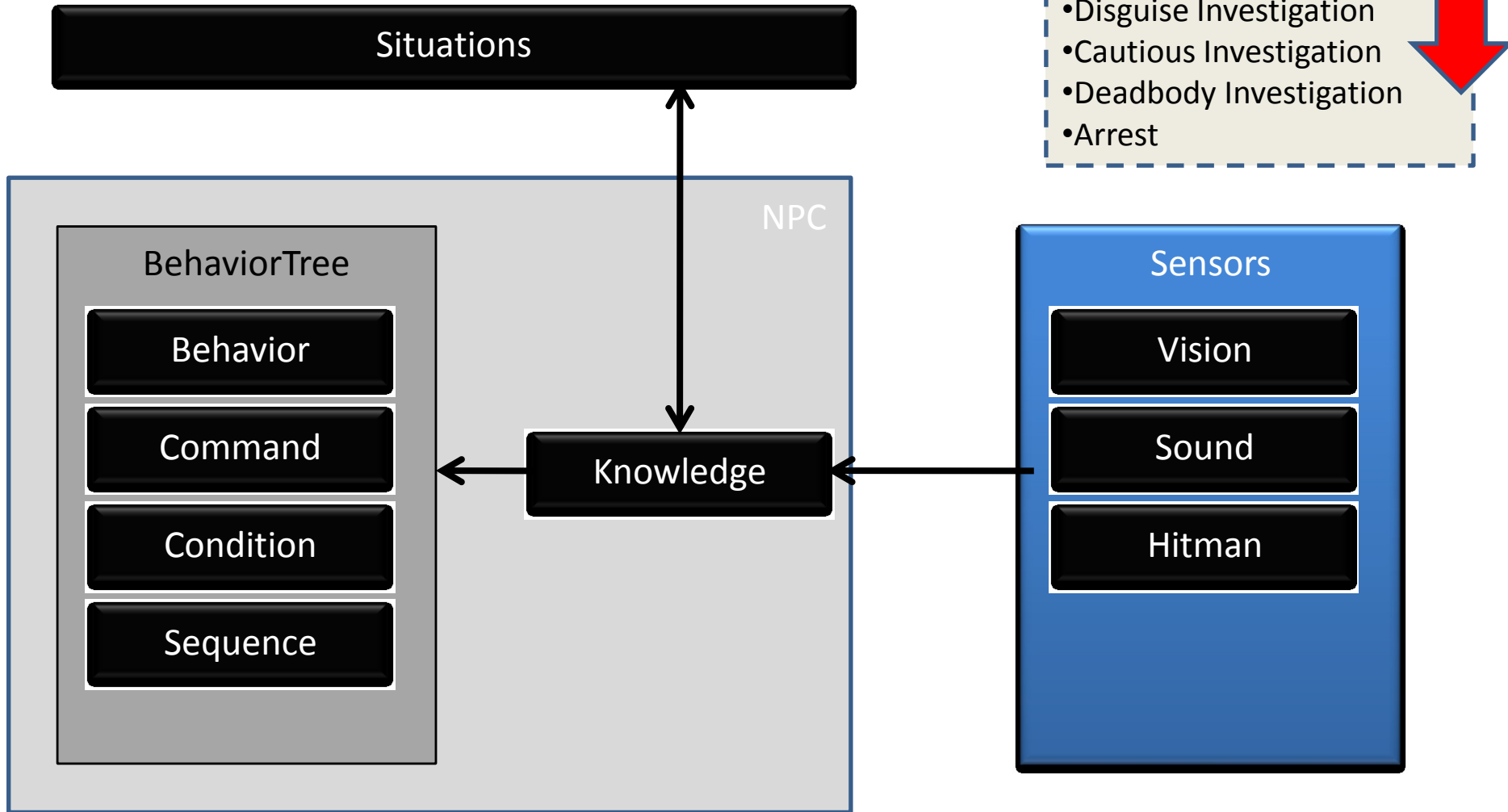
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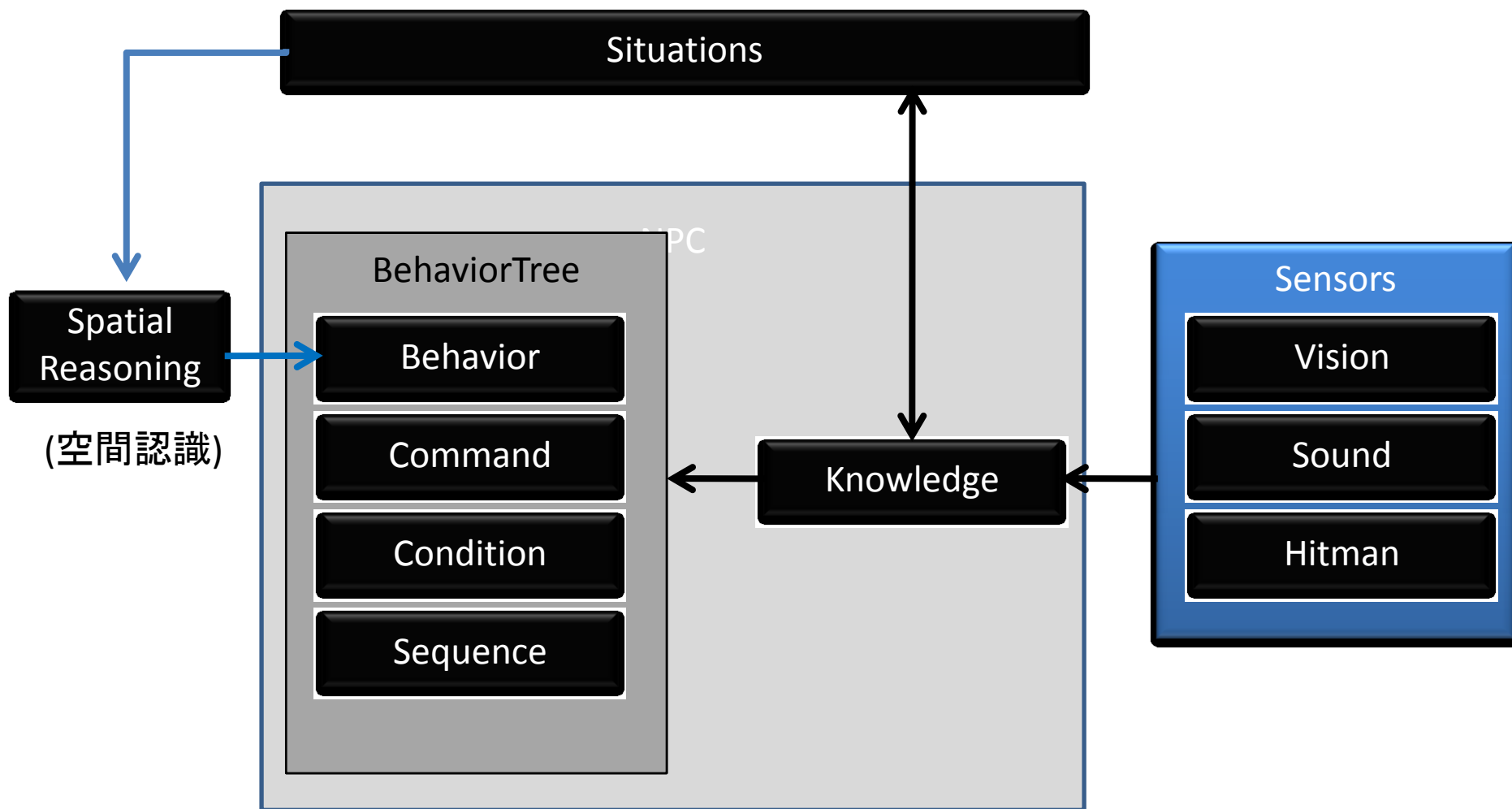
Mika Vehkala | Senior AI Programmer, IO Interactive A/S

Location: Room 3005, West Hall **Date:** March 28 **Time:** 10:00AM - 11:00AM

アーキテクチャ

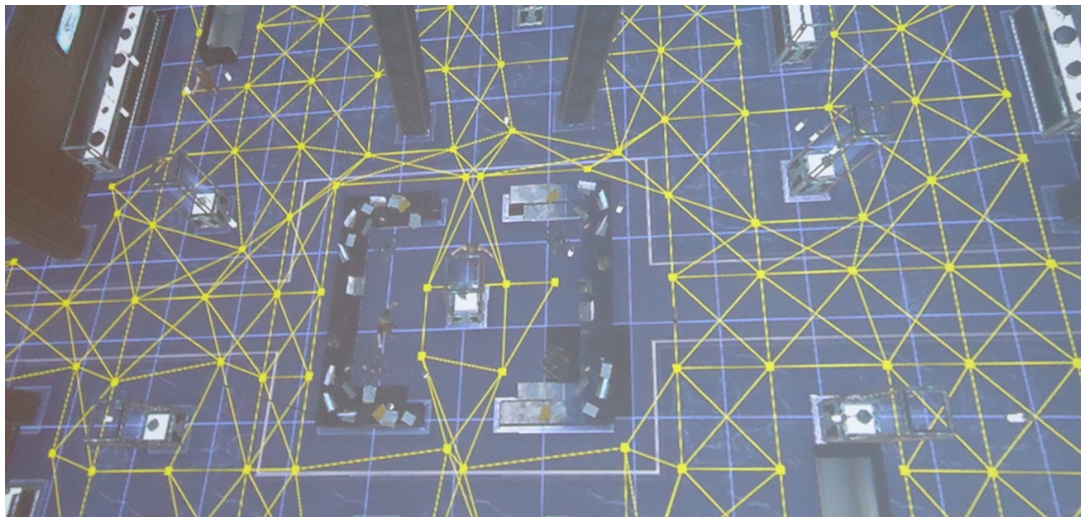


アーキテクチャ



Creating the AI for the Living, Breathing World of Hitman: Absolution
Maurizio De Pascale | *Senior Software Engineer, IO Interactive A/S*
Mika Vehkala | *Senior AI Programmer, IO Interactive A/S*
Location: Room 3005, West Hall **Date:** March 28 **Time:** 10:00AM - 11:00AM

空間認識

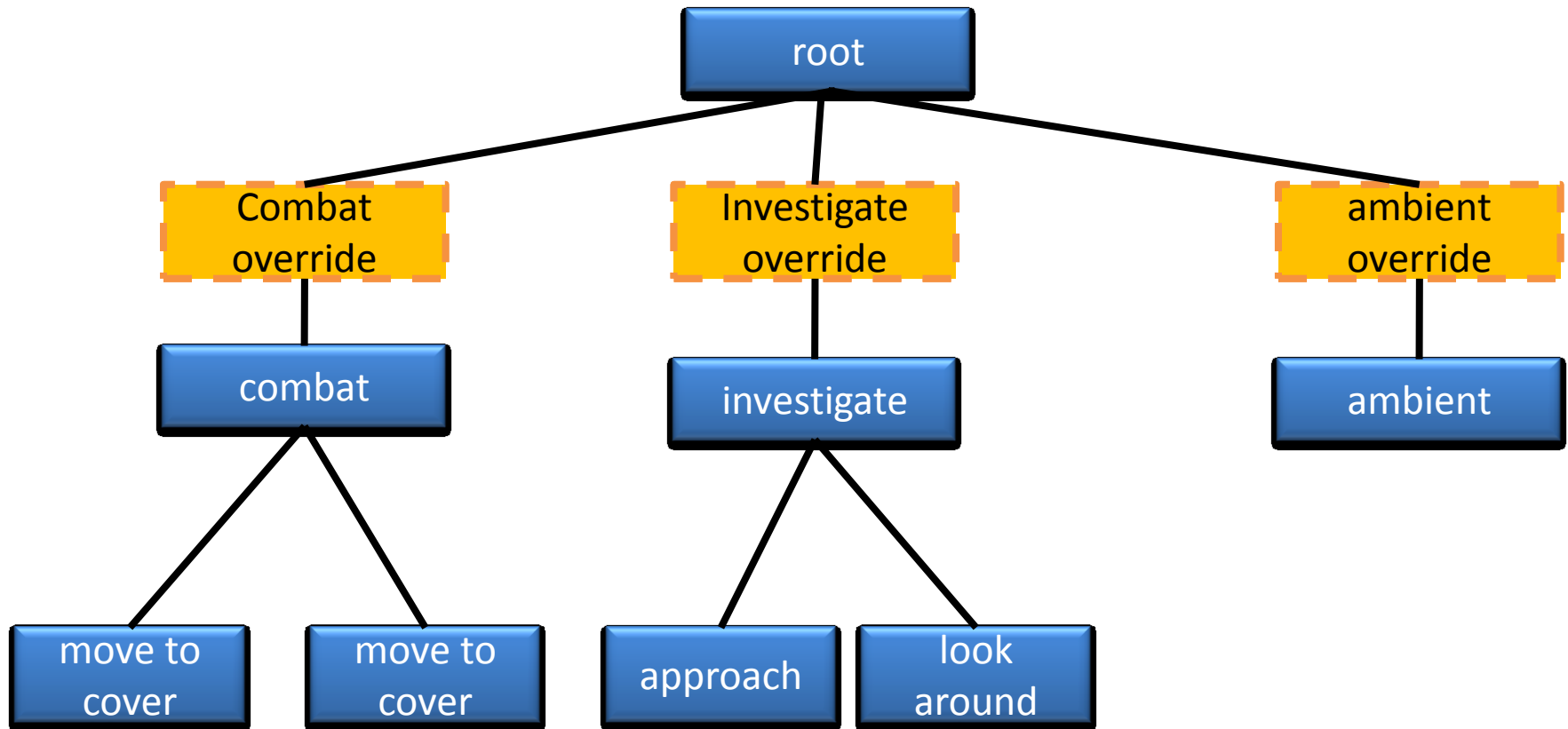


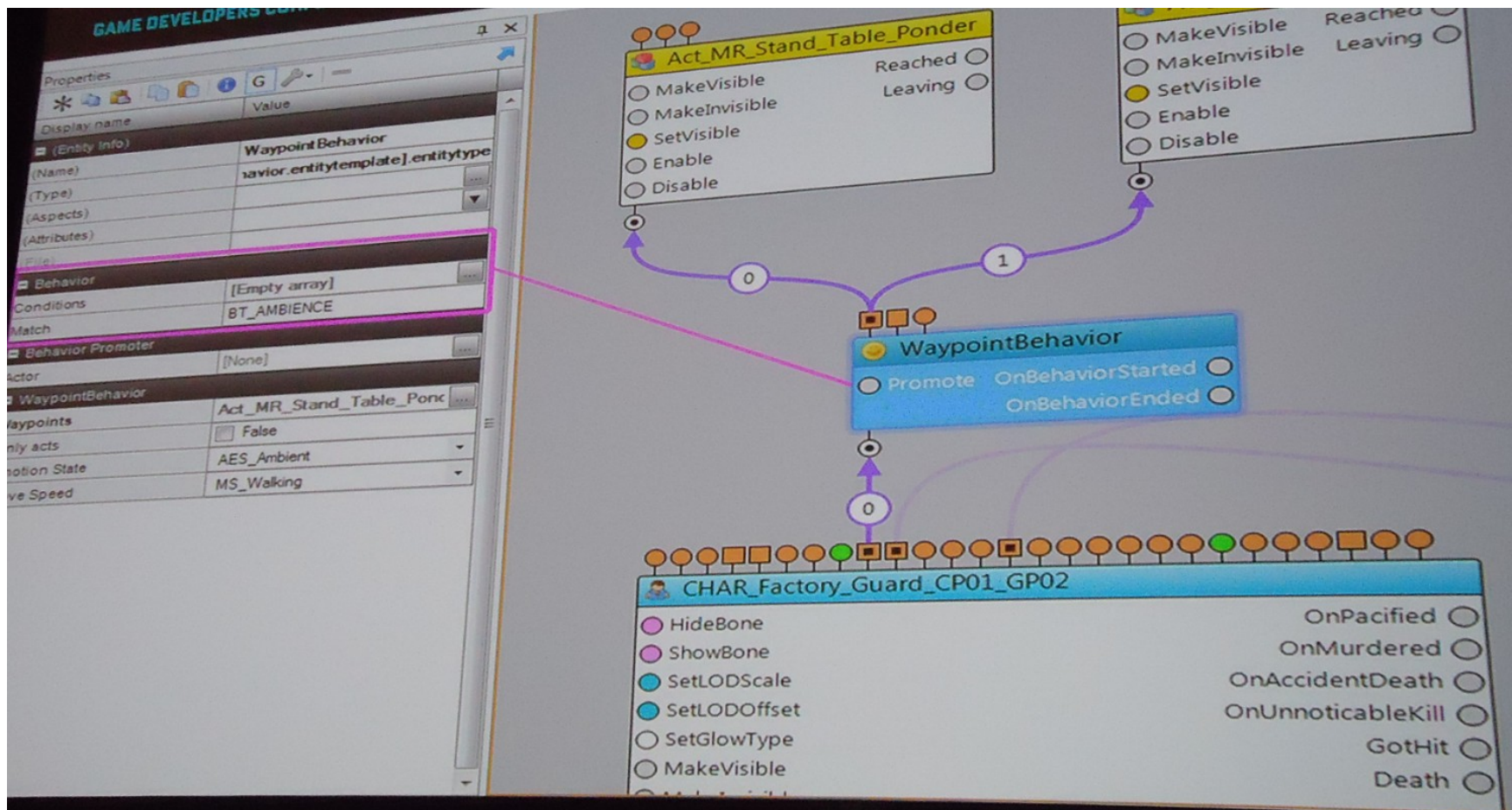
- ウェイポイントによる空間認識
- 空間分割による領域認識

各ウェイポイントでドライブする
行動をBehavior Tree の Behavior
に Override する。



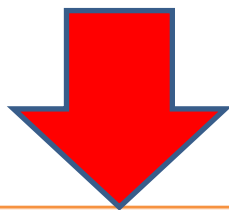
Behavior Tree for NPC (例)



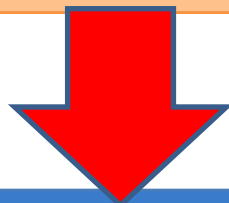


次世代AIの課題

AIとアニメーションの関係をどう構築するのか？

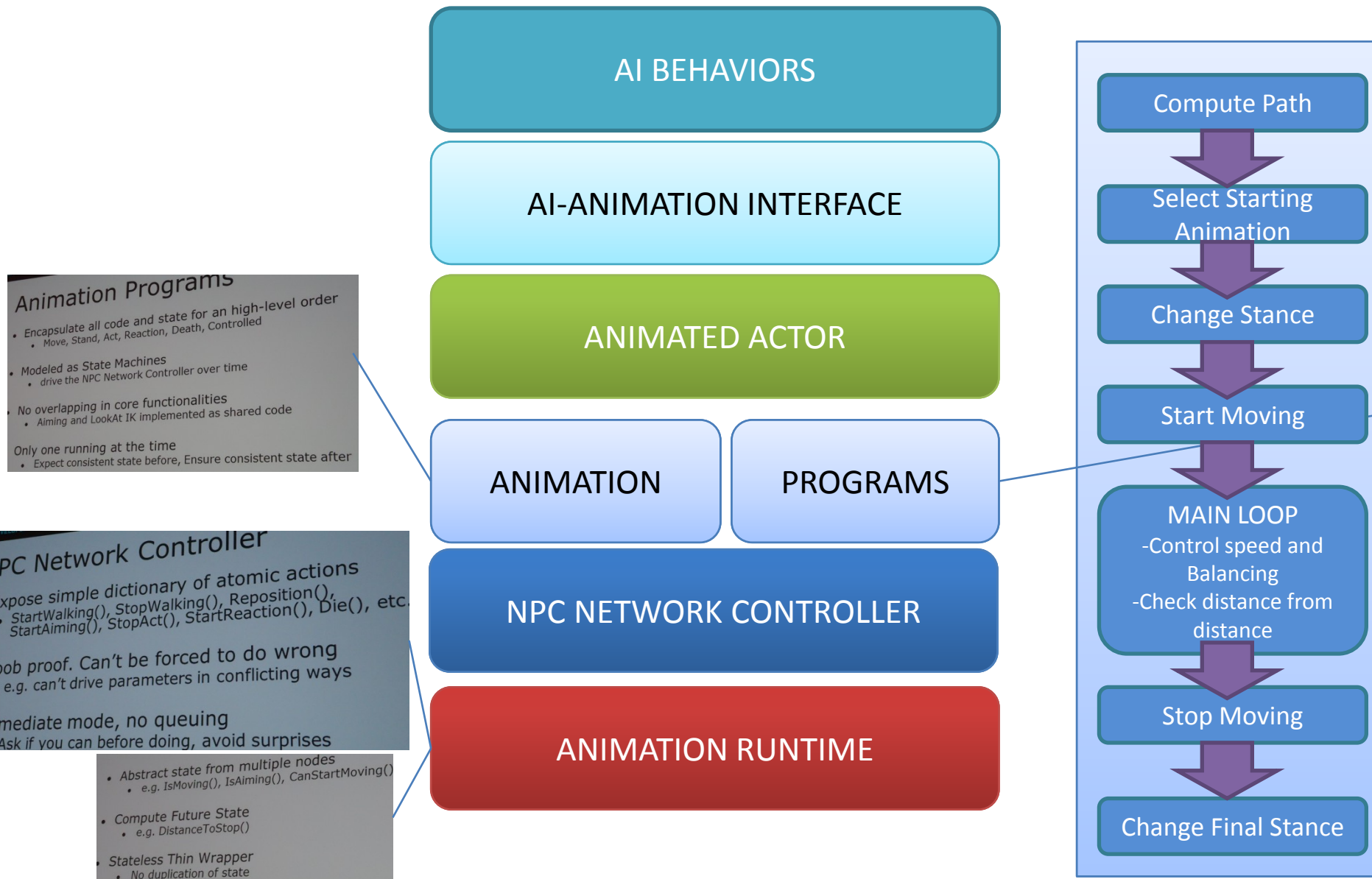


身体と知能の間をどうつなぐか？
(ロボティクス、ゲームAI共通のテーマ)



- レイヤー化構造を入れる = ゲーム)
- 入れ子(サブサンプション)構造 = ロボット

Hitman の AI/Animation Layer 構造



Hitman のAnimator の特徴

- Motion Graph による semi-procedural
- 強化学習による遷移調整

Motion Graph



Near-optimal Character Animation with Continuous Control
Treuille, A. Lee, Y. Popović, Z.
ACM Transactions on Graphics 26(3) (SIGGRAPH 2007)
<http://grail.cs.washington.edu/projects/graph-optimal-control/>

- アニメーションは各フレームに状態(姿勢、速度、... など)を持っている。
- いくつかのアニメーションを例えばモーションキャプチャーで取って、近い状態のフレームでつなげる。

ゲームAI展望

- AI Summit はこれまでの復習的な講演が2年続いている。
- 今世代の大型タイトルのAI技術を集合させたタイトルが発表された。
- その中から「学習」を使った新しいアプローチが出て来た。

学習について

「学習」は必ず次世代の中心的なアプローチになる。

- これまで使用されて来なかったが、ゲームAI技術の継続的向上は学習を使うレベルになりつつある。
- 学習を使う土台となるAIのフレームの基礎的な積み上げが終わりつつある(今年のGDCで終わり)。
- アカデミックのAIは学習がメインである。
- アカデミックのAIのゲーム産業のAIの垣根が壊れつつある。
- 次世代のスケールでは手動でデータを作るのが困難。AI技術の助けが必要だろう。
- AIはゲームコンテンツだけでなく、ゲームソフトウェア全体を完成させるだろう(メタAIなど)。
- AIはゲームコンテンツだけでなく、ゲーム製作の技術を完成させるだろう。

「学習」について

