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 / Al

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

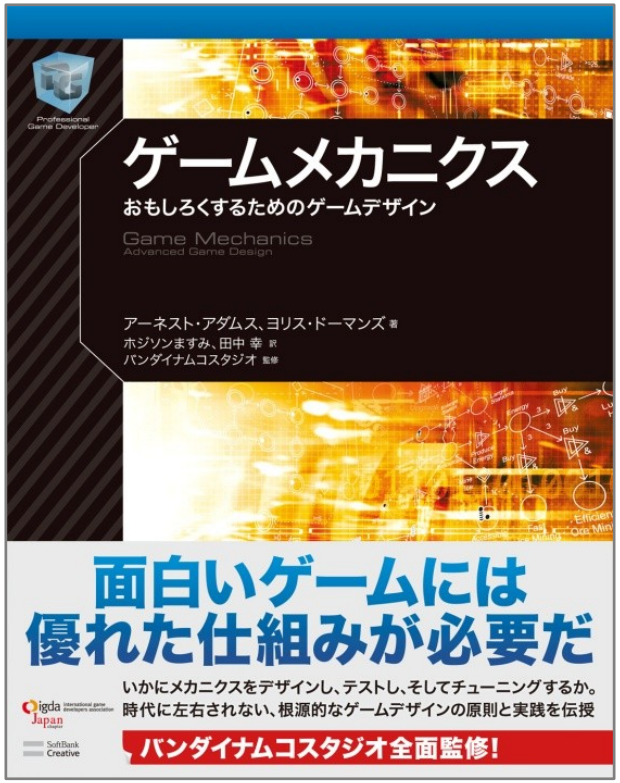
(3) Hitman : Absolution のAI (10min.)

Reinforcement Learning Based Character Locomotion in Hitman: Absolution
SPEAKER/S: Michael Buttner (IO / Square Enix)
DAY / TIME / LOCATION: Friday 10:00-11Interactive :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

アダムズのマキネーション・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

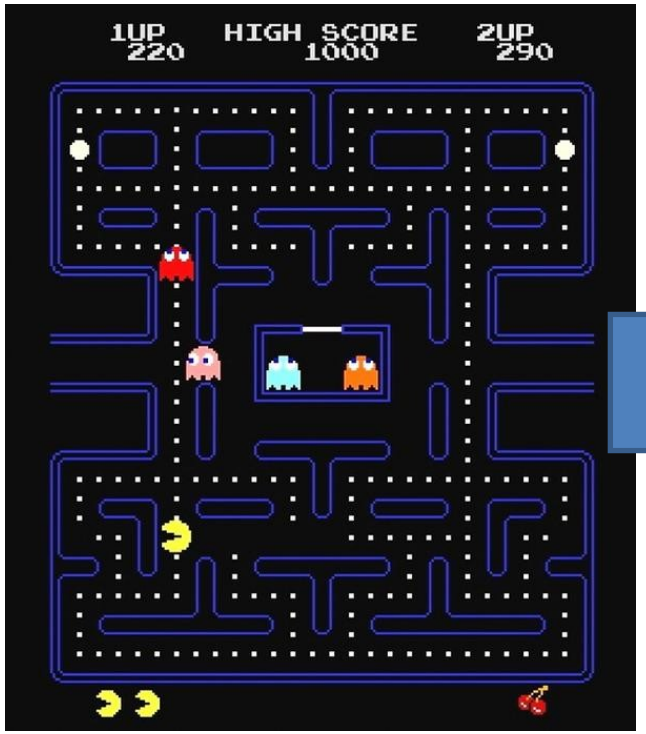
  湊和久氏 /當間知明氏　監修
- IGDA Japan公認本

SoftBank Creative

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



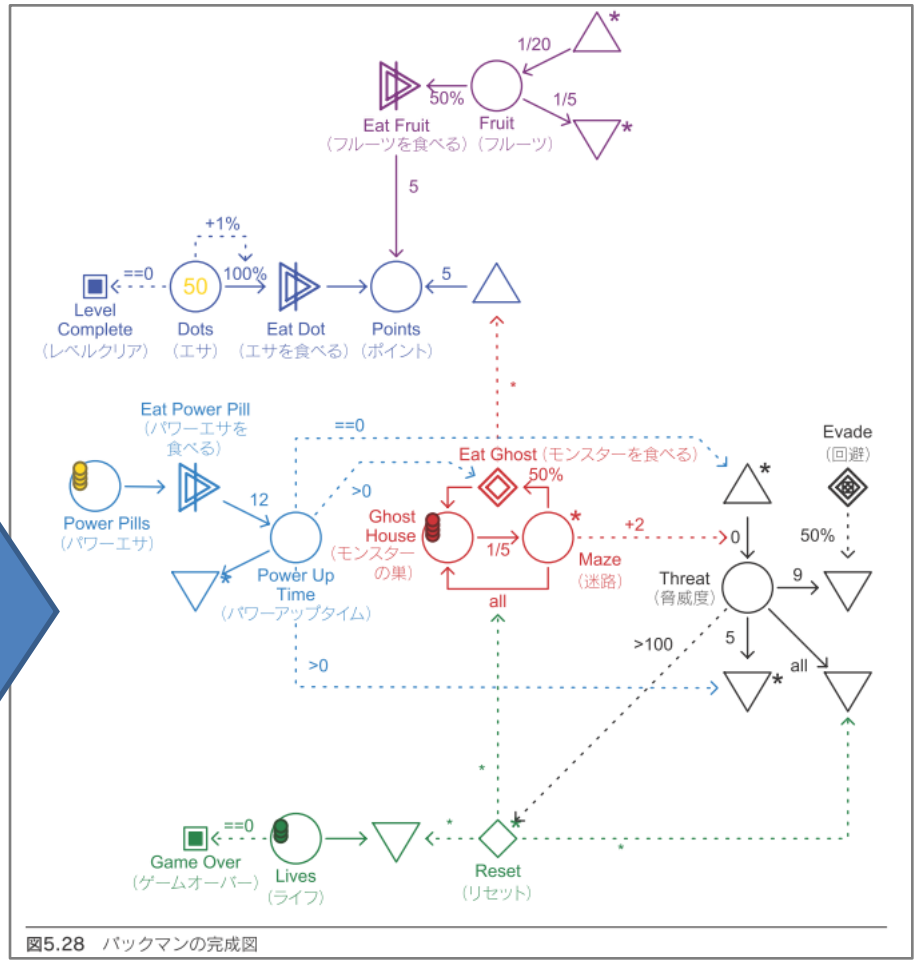
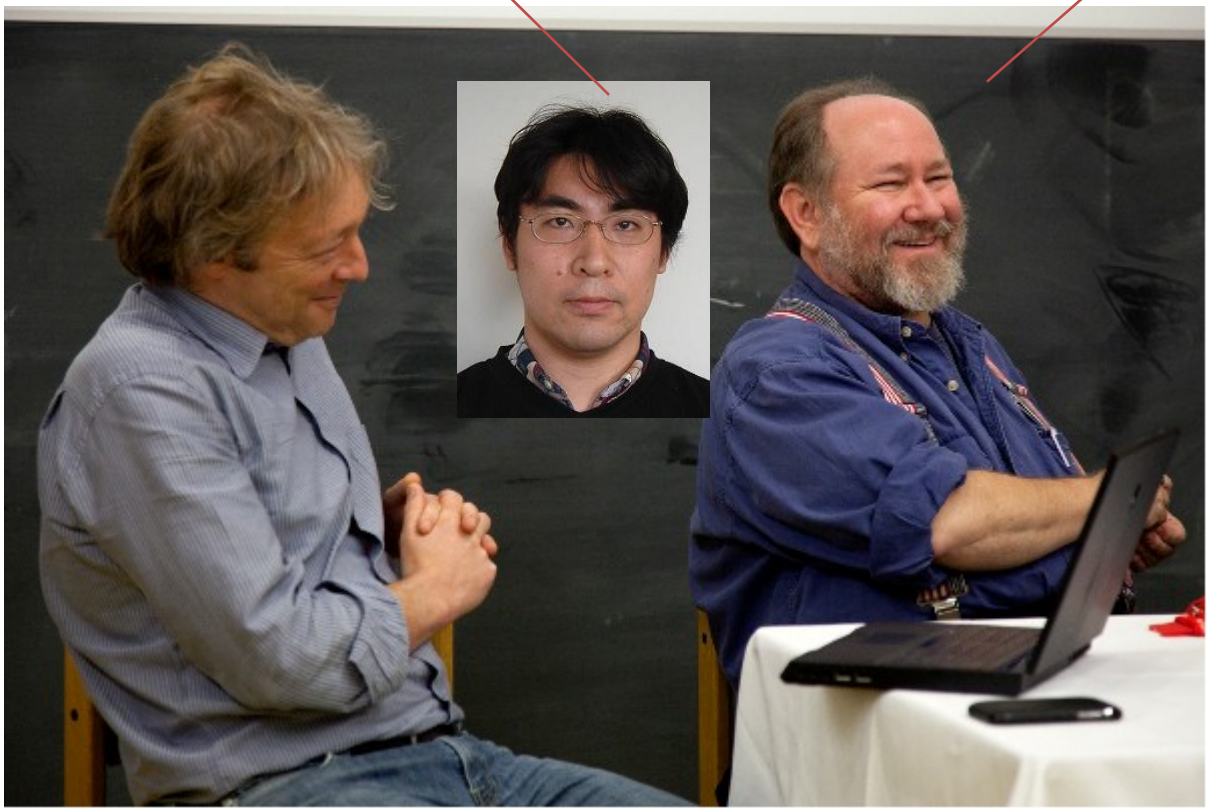


図5.28　パックマンの完成図

SoftBank Creative

アダムズのマキネーション・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します。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/

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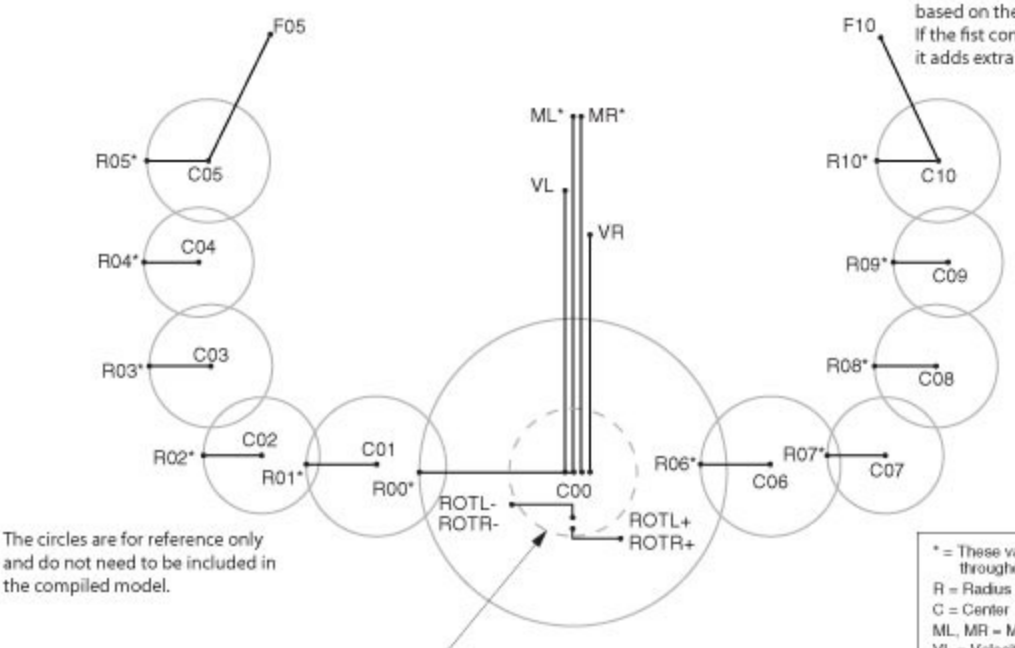
Anatomy of a Creature

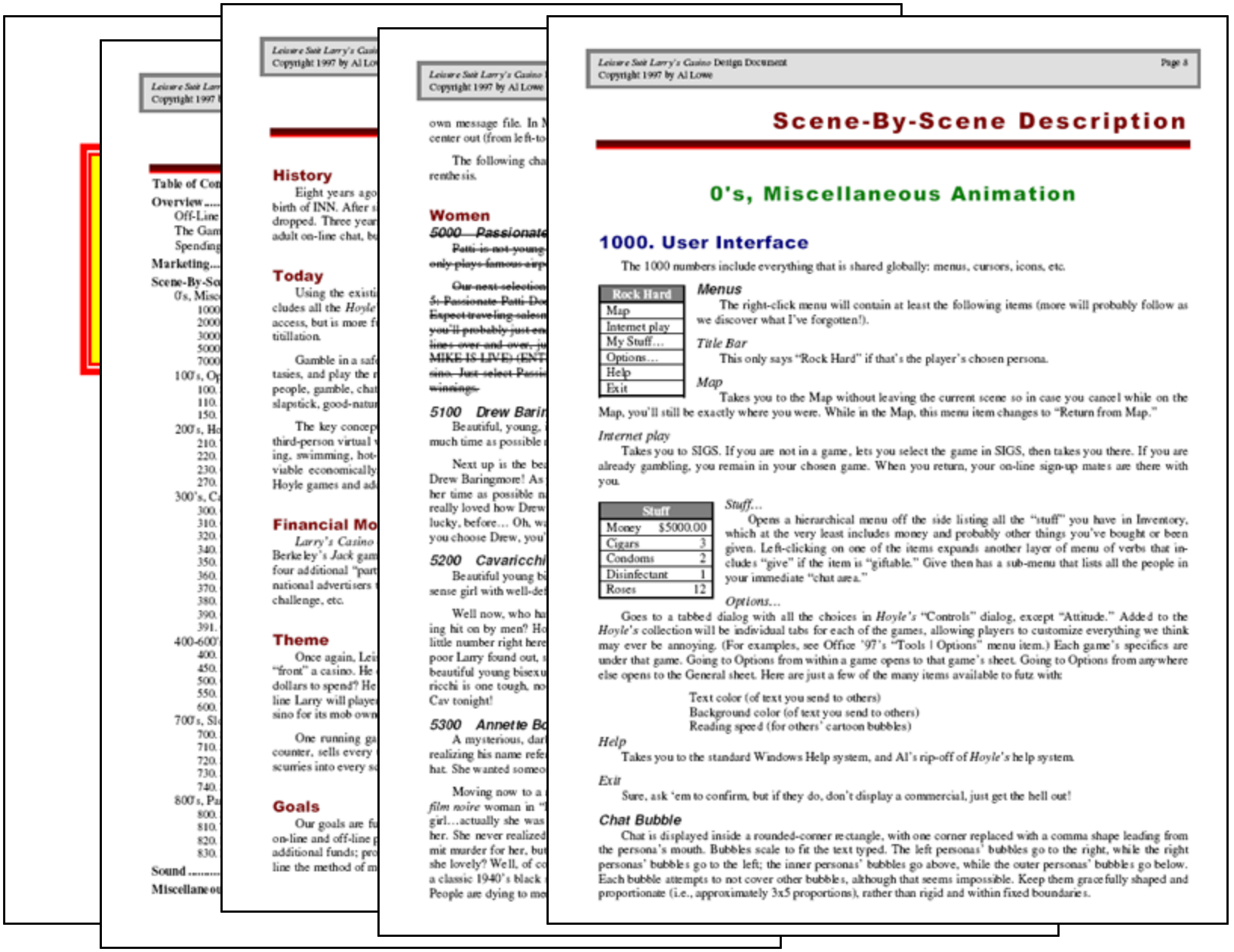


The fists need force vectors based on the arm's strength. If the fist connects with an object it adds extra force to the collision.

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

NOTE:
All of these points should originate from the same center point (C00).

* = These values stay constant throughout the round
R = Radius
C = Center
ML, MR = Mass left and right
VL = Velocity generated from the left arm
VR = Velocity from the right arm
F = Hitting force
ROTL- = Negative rotation generated from the left arm
ROTL+ = Positive rotation
ROTR+, ROTR- = Rotation generated from the right arm



Leisure Suit Larry's Casino Design Document
Copyright 1997 by Al Lowe

Page 8

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.

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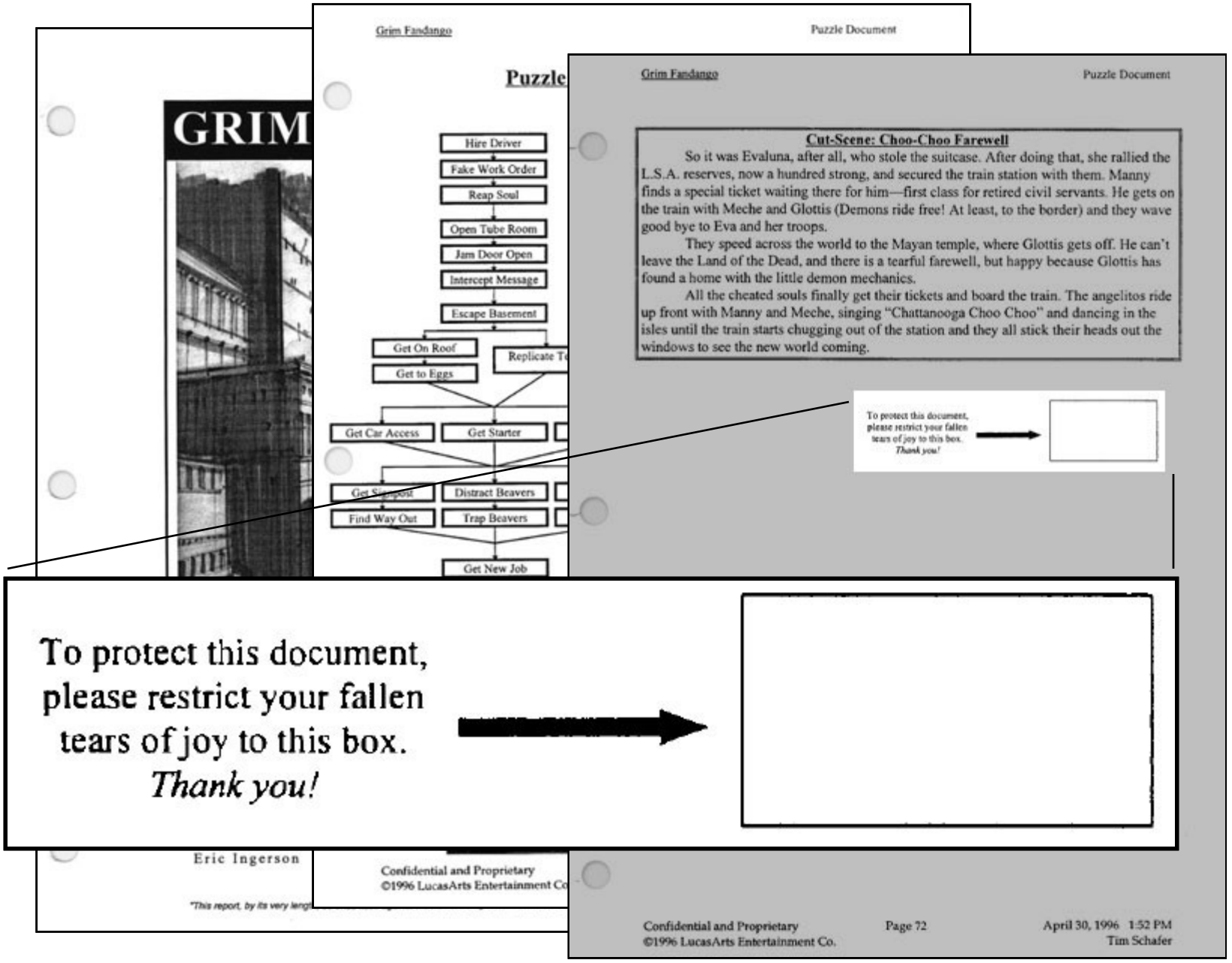

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Pros

- 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

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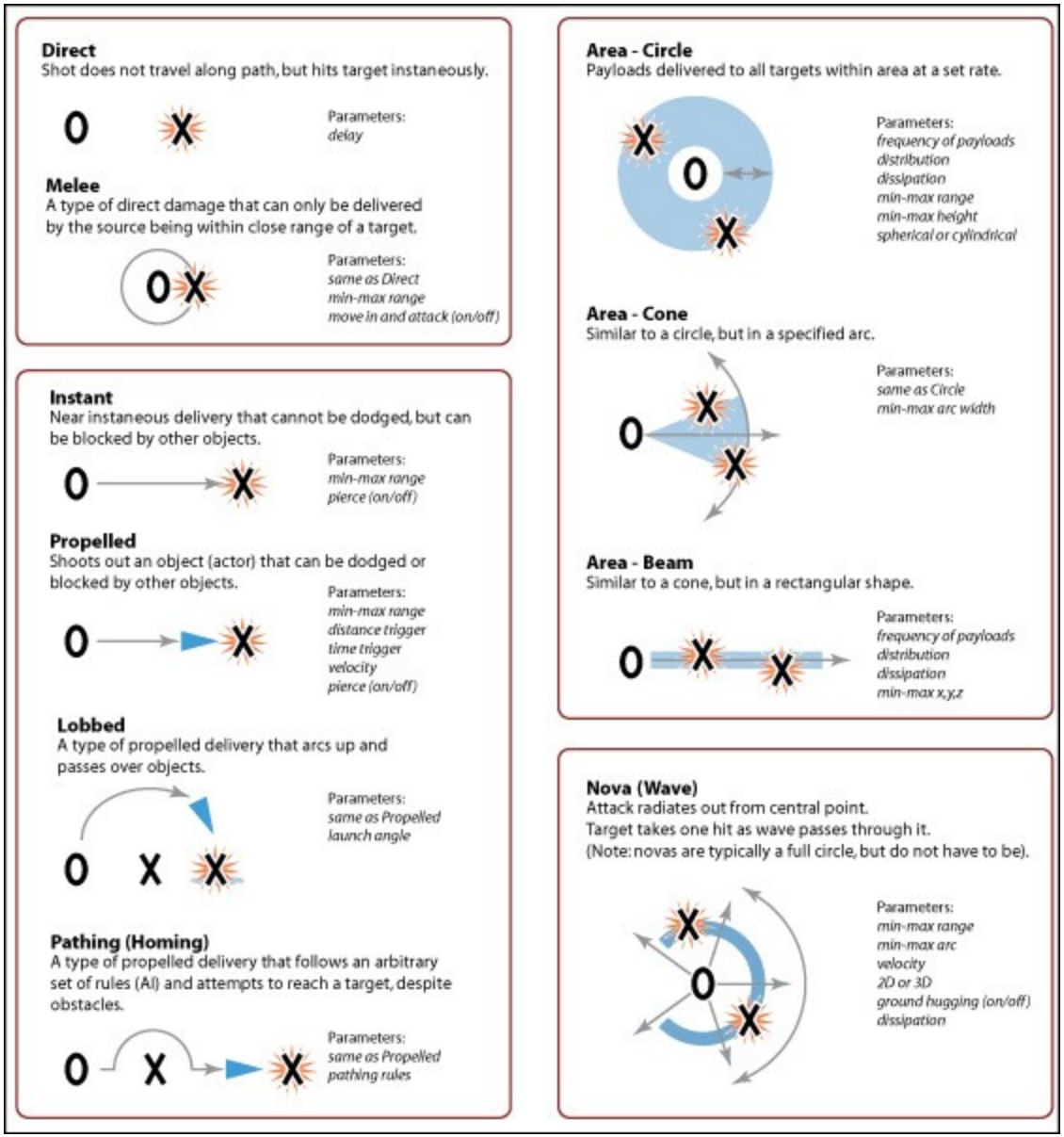
Diablo



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Diablo

Demonic Mage

Fire Chain

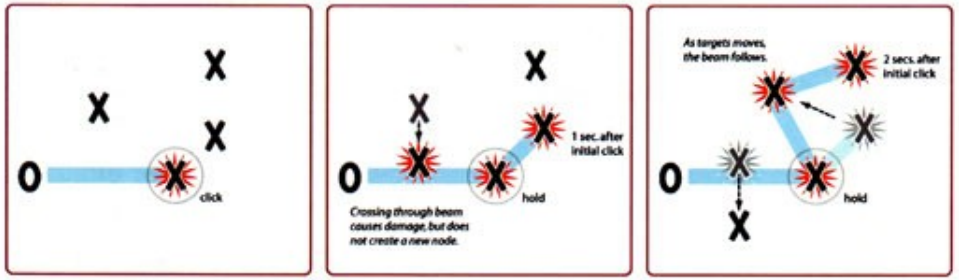
Skill Category

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.

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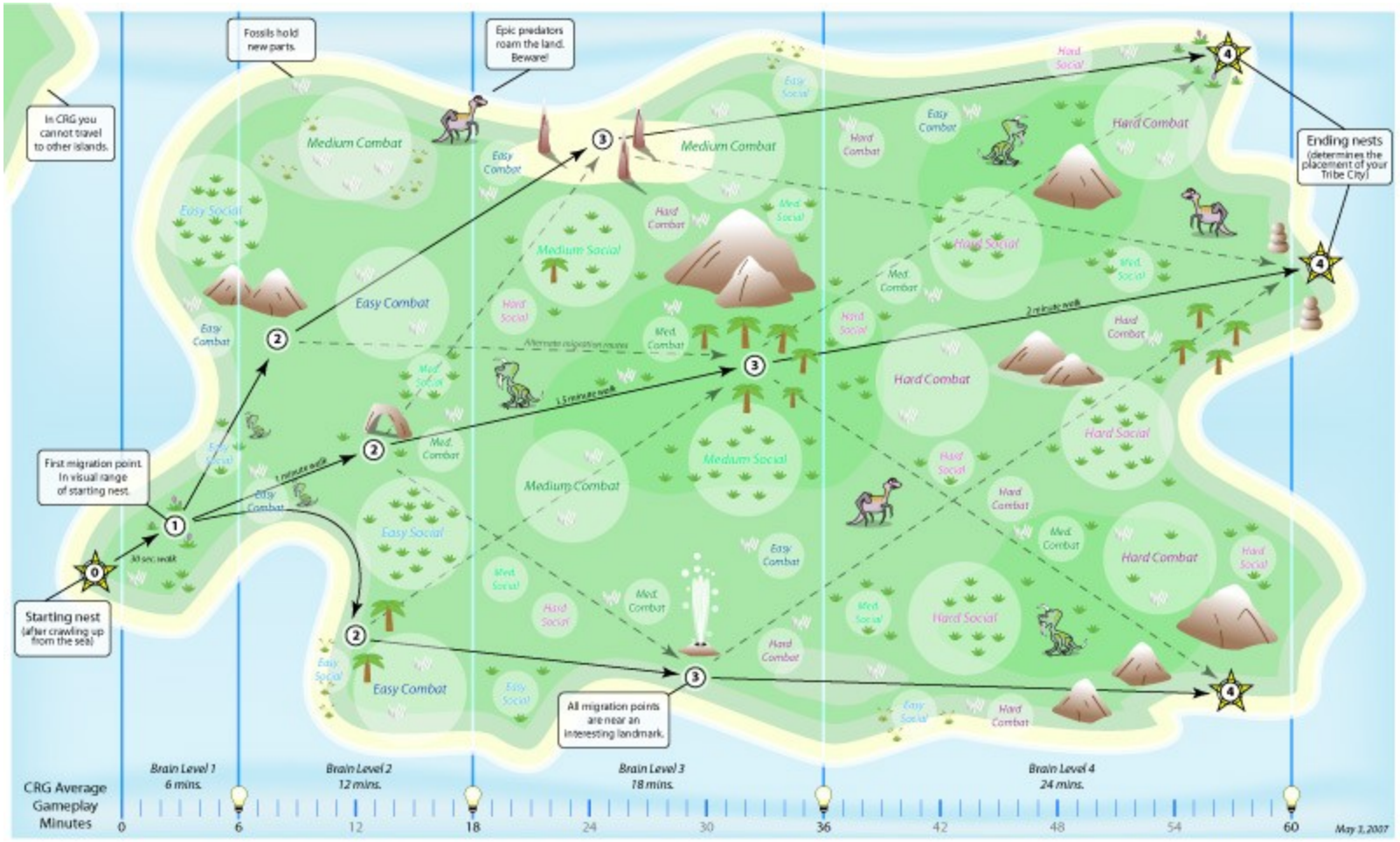
Time + Space



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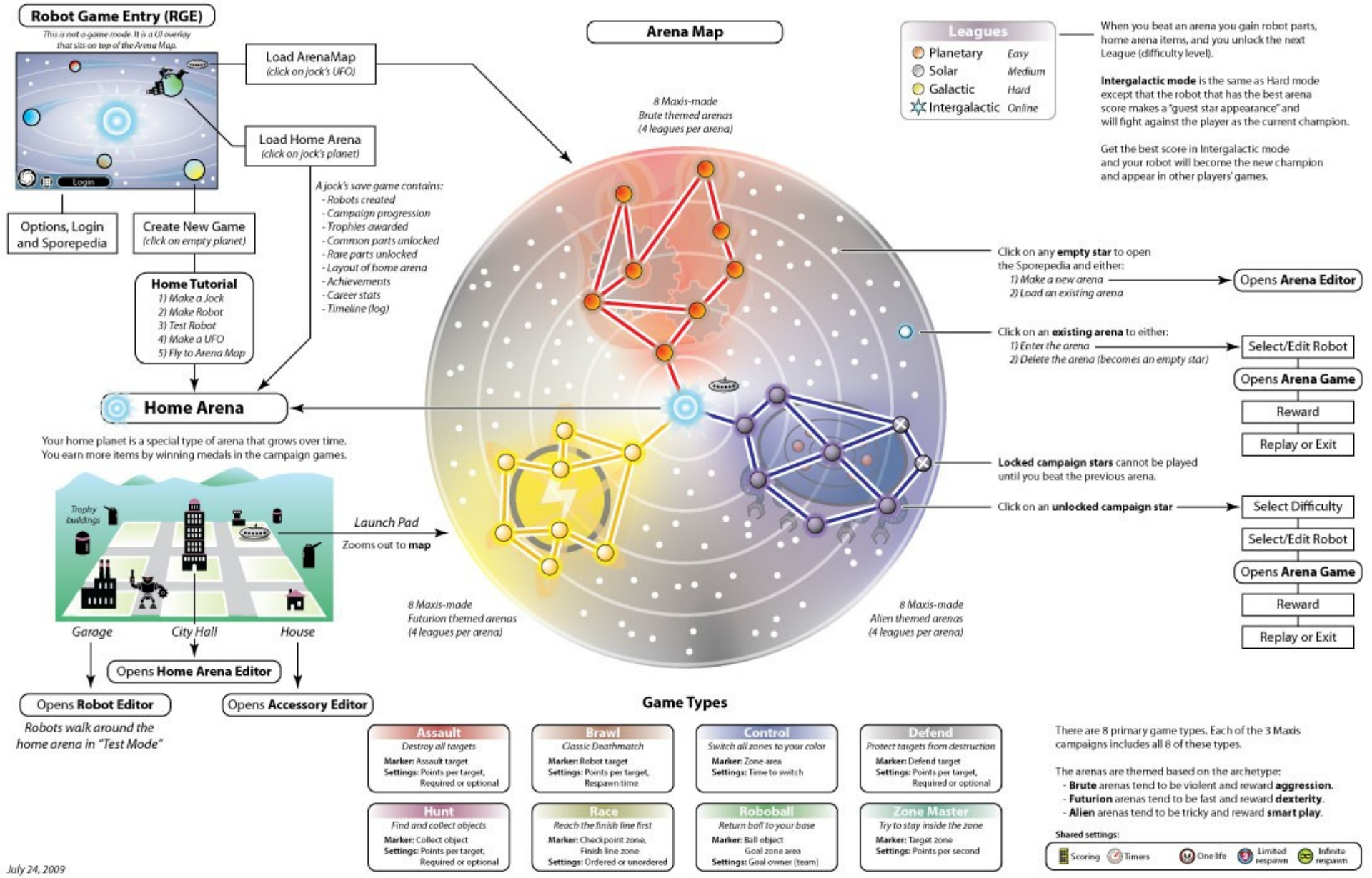
Relationships Between Modules



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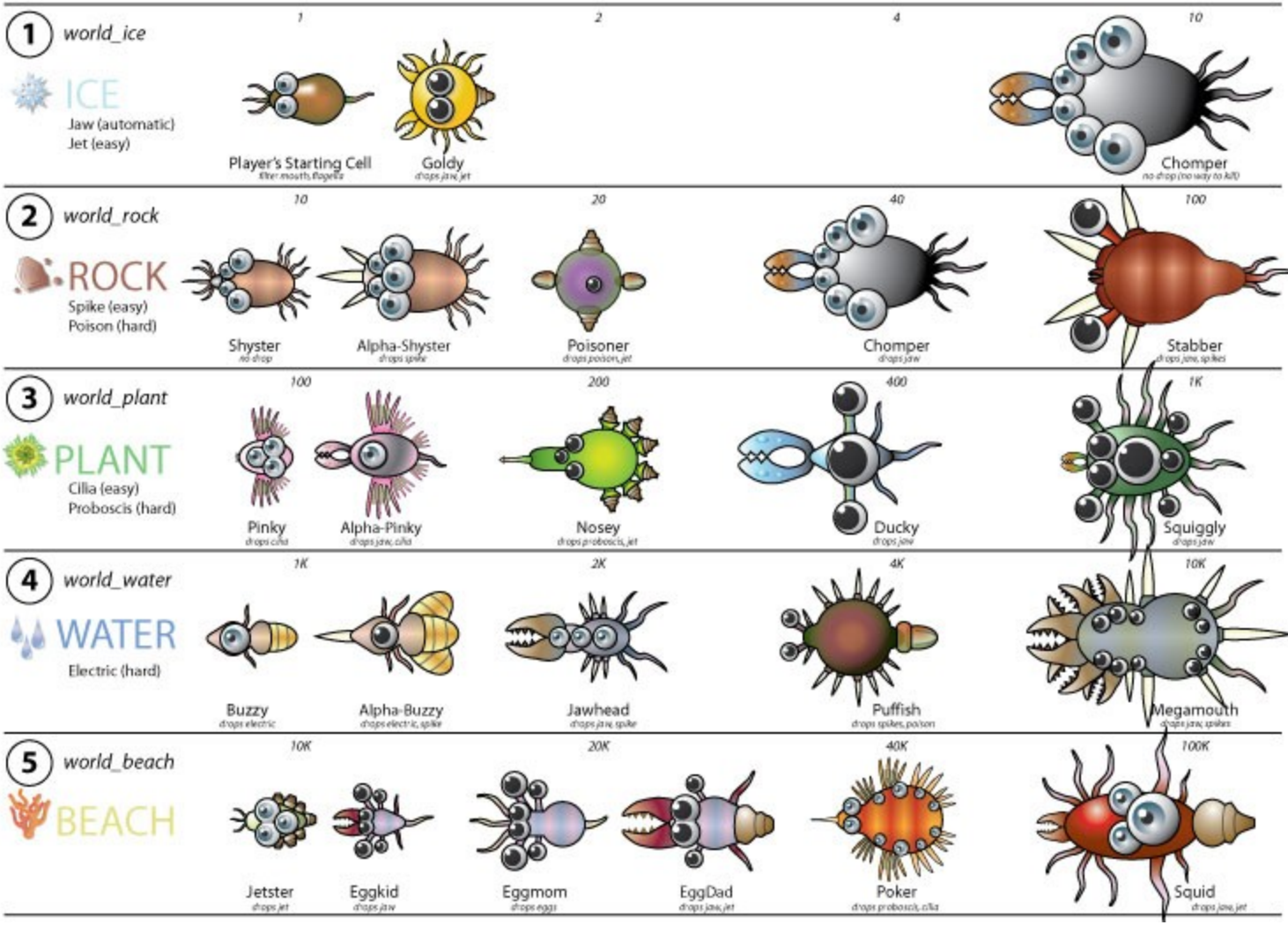
Spore



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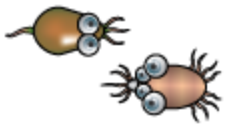
Spore

'EER interactions

February 22, 2007

	Jaw	Proboscis	Spike	Poison	Electric
Base Interaction	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 temporily slows. 3 seconds to kill. Leaves carcass.	Each zap does 1 damage and temporarily stuns. 3 zaps to kill. Leaves carcass.



CELL-B \ CELL-A	Jaw	Proboscis	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.

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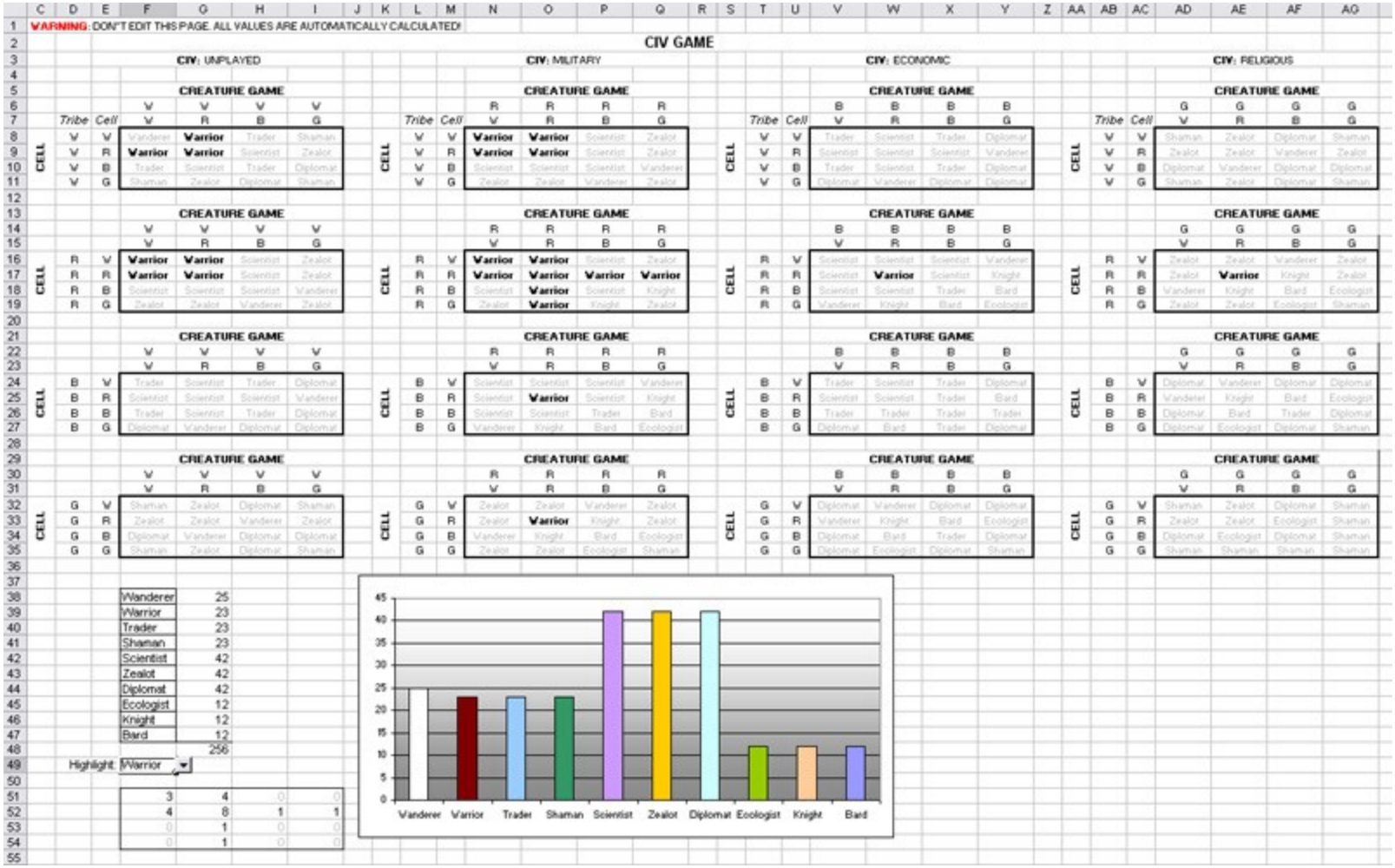
Spore



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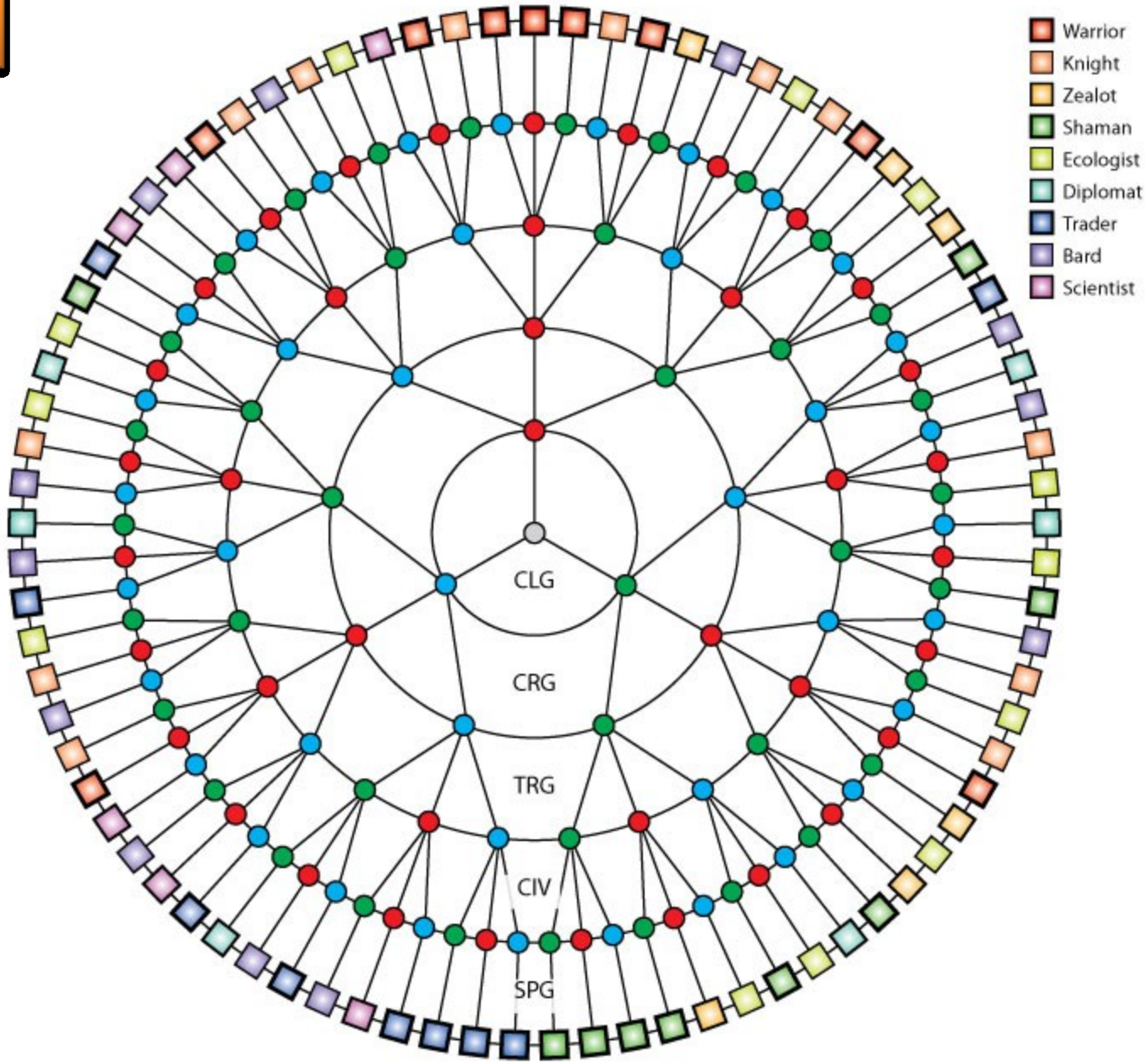

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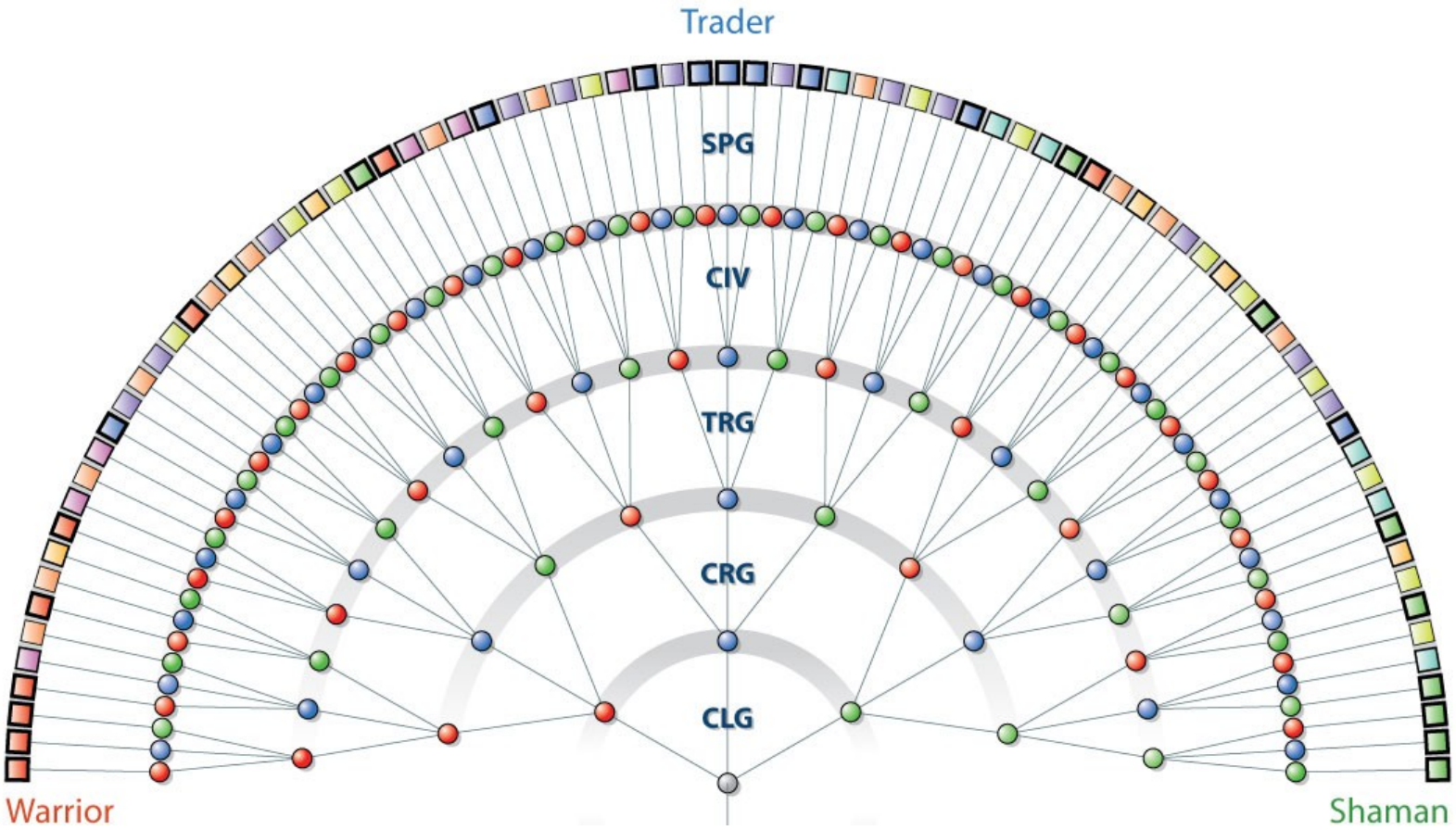

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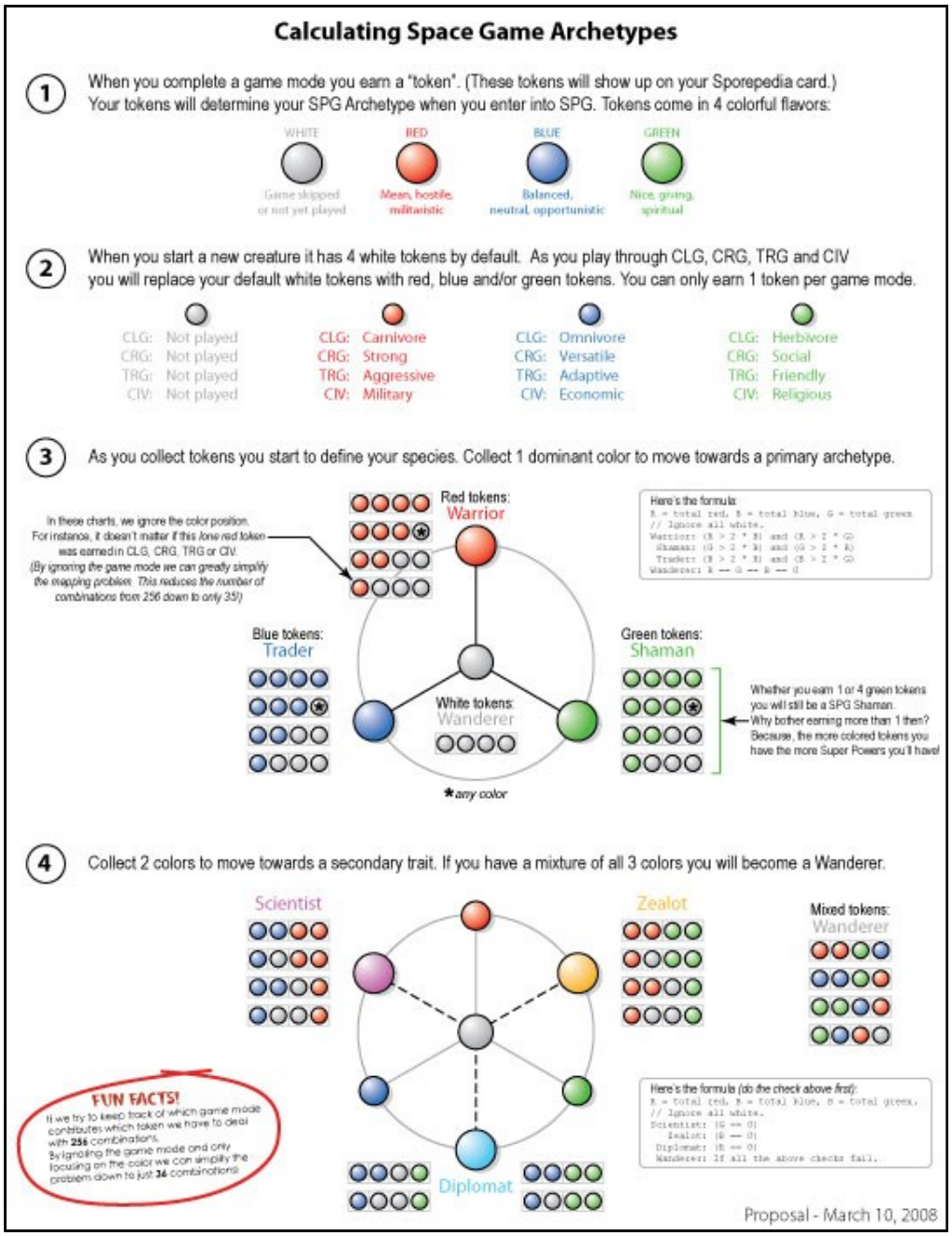

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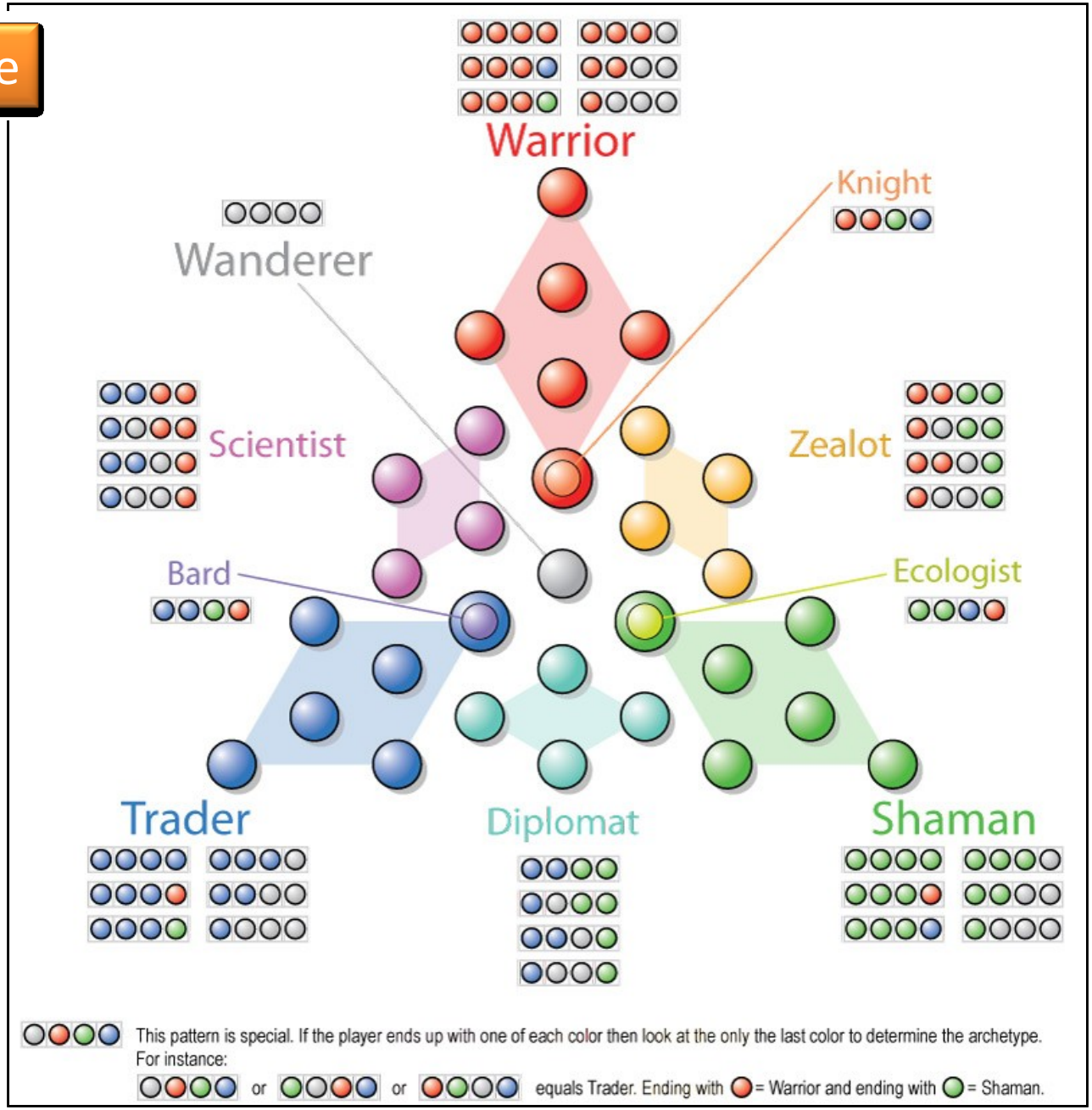

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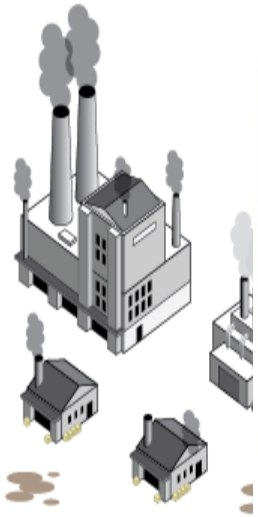
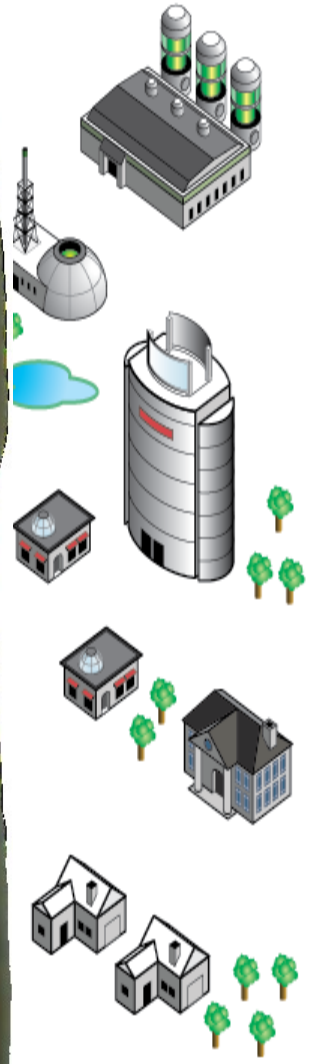
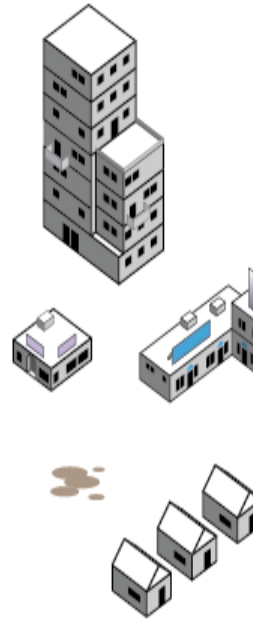




SIMCITY

Simulating a City, One Page at a Time

Stone Librande
Lead Designer, *SimCity*



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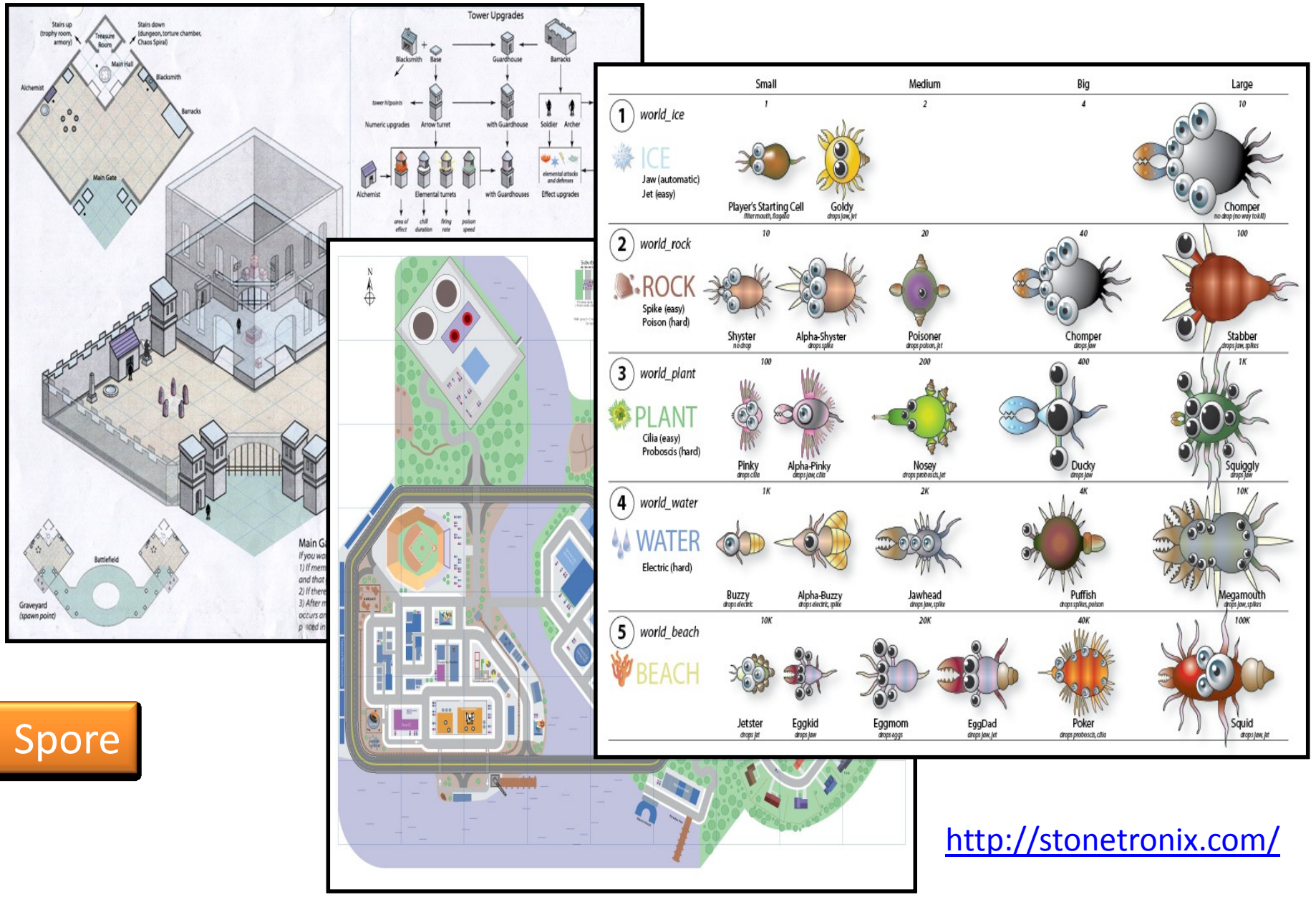
@StoneLibrande

GDC 13



Spore

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SimCity 5

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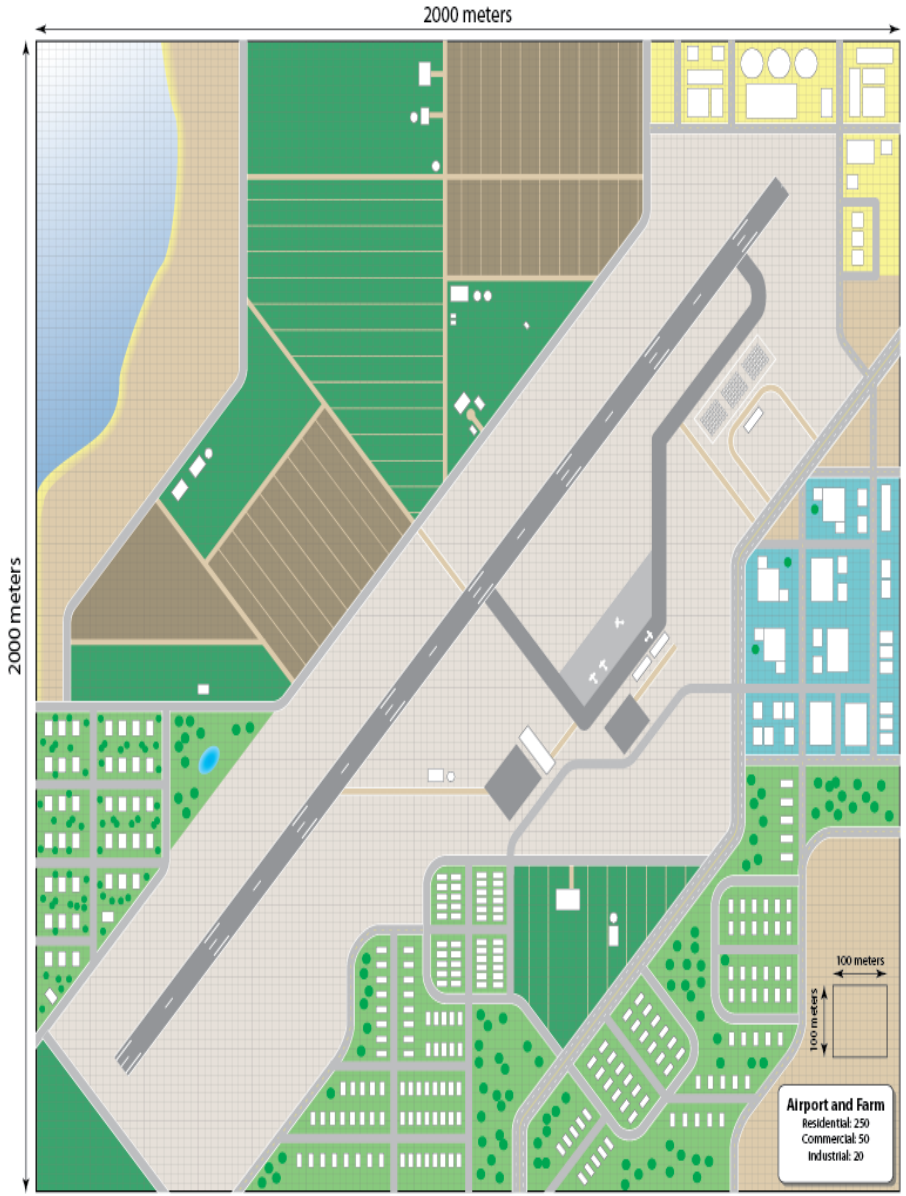

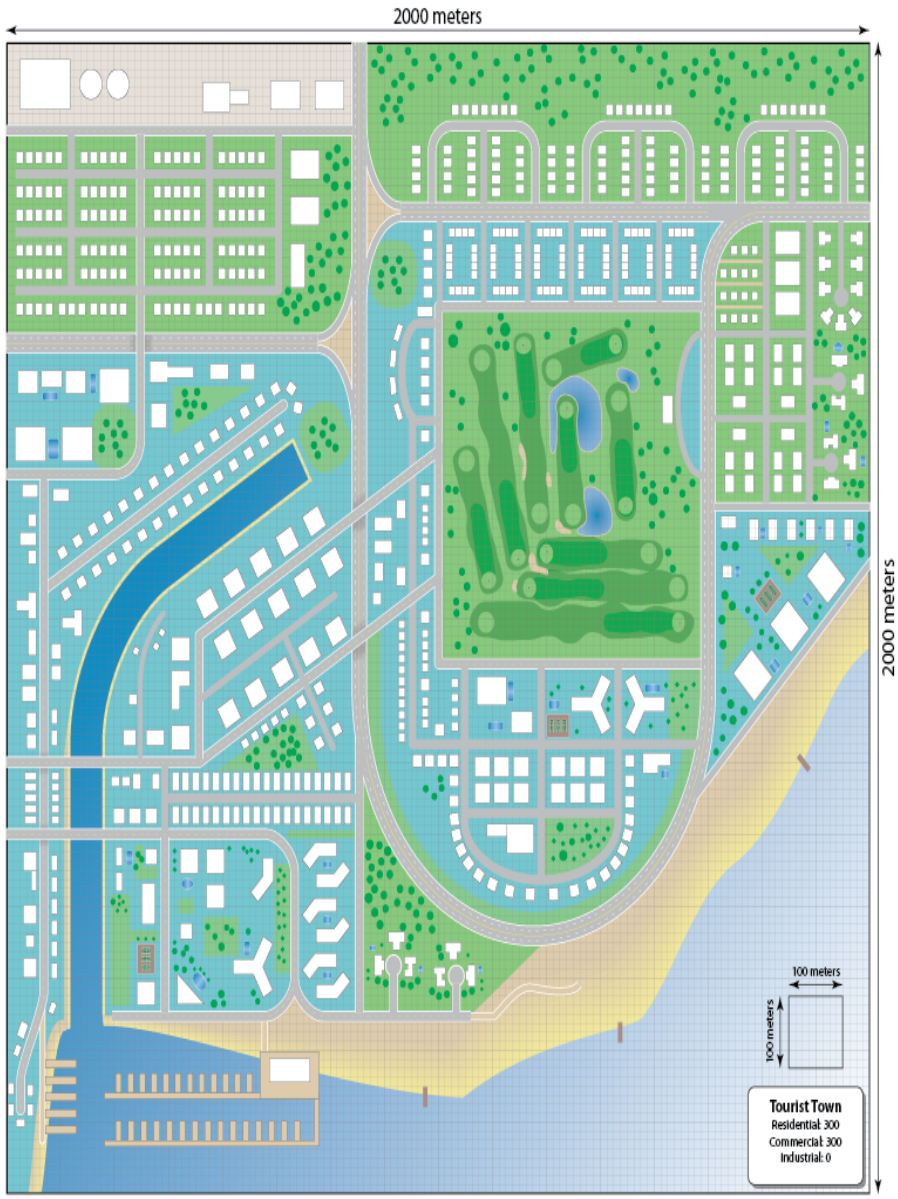

SimCity 5

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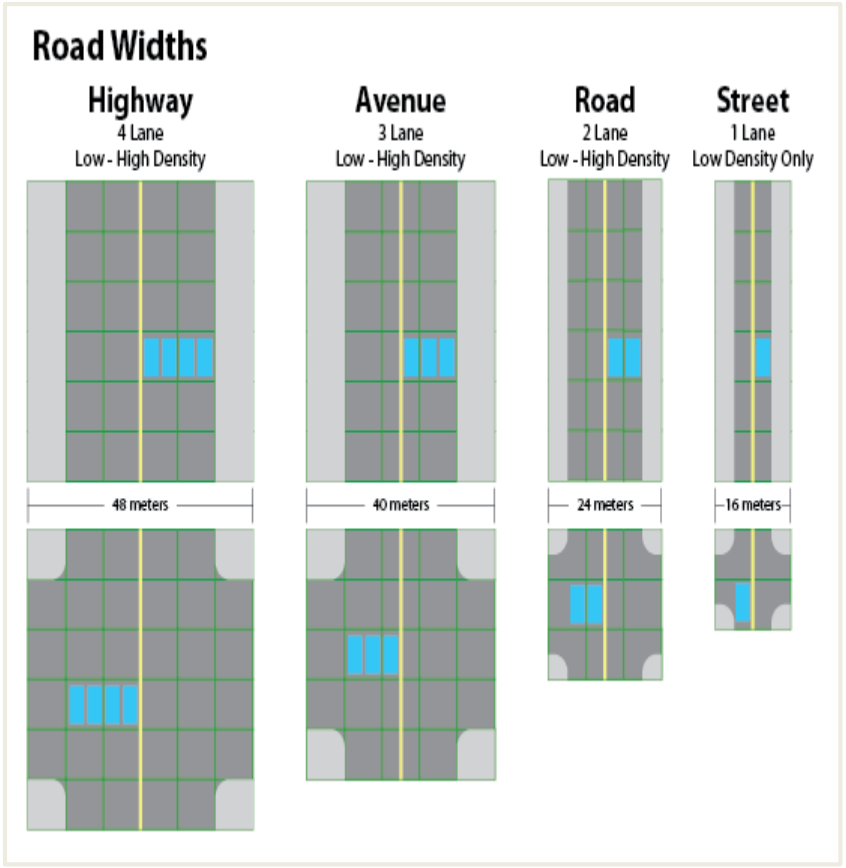

SimCity 5

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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.

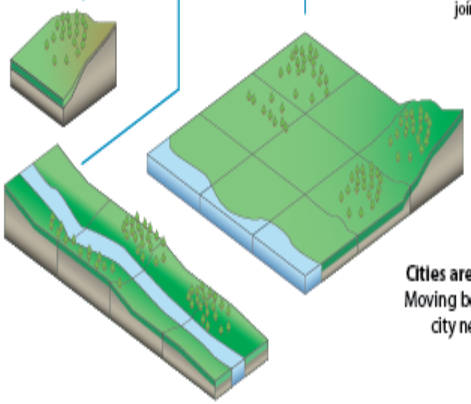
Accept Invite
Automatically loads the region map associated with the invitation.

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.

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

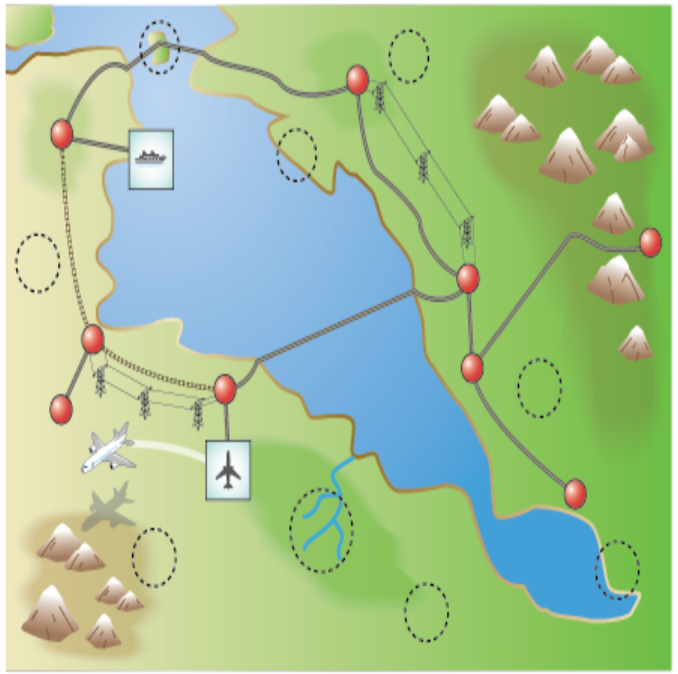
Region Level Gameplay

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.

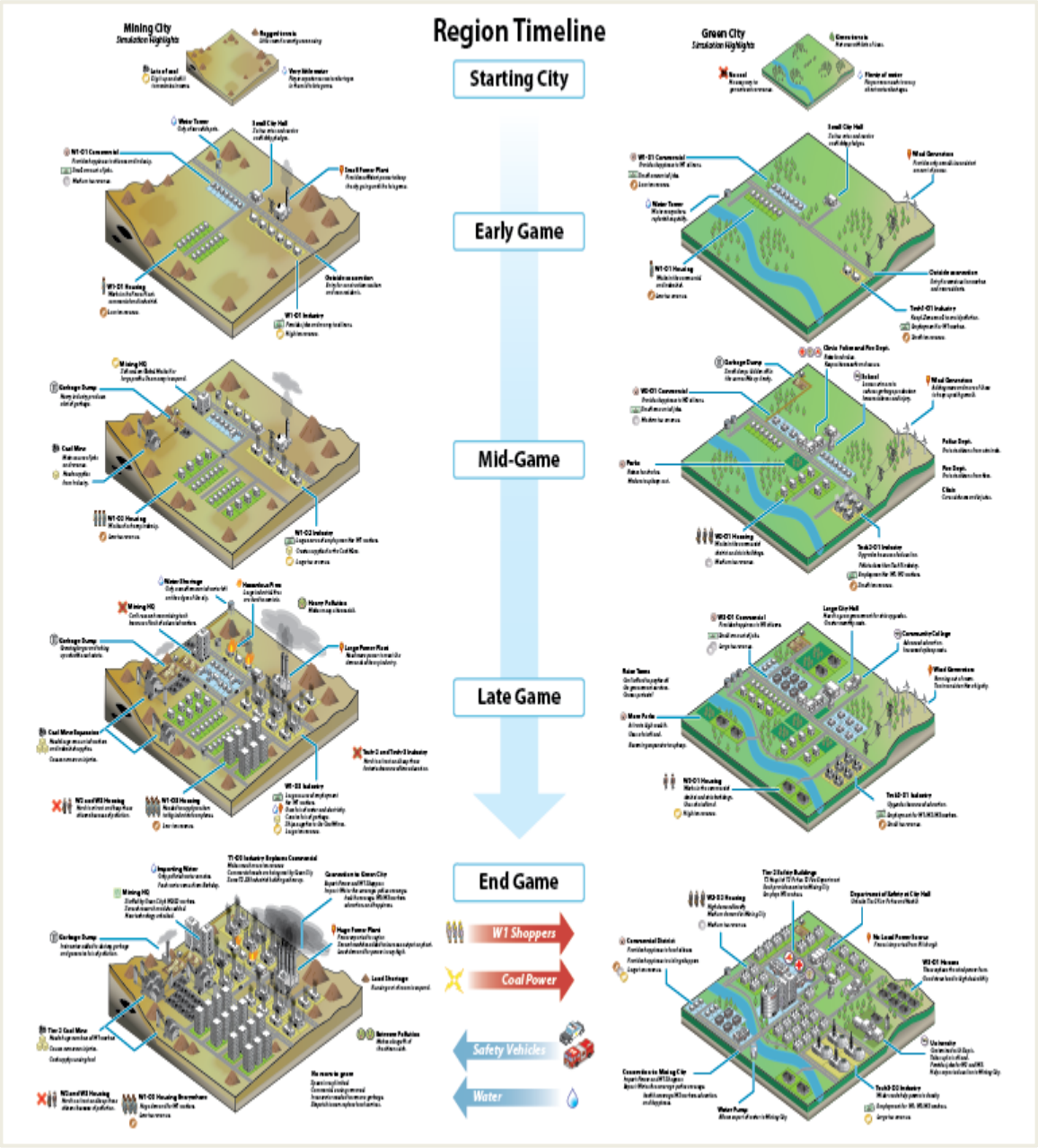
Connect and Prosper
Join cities together with roads, train tracks, and electric wires. Share commuters, resources, universities, and police depts.

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.

SimCity 5

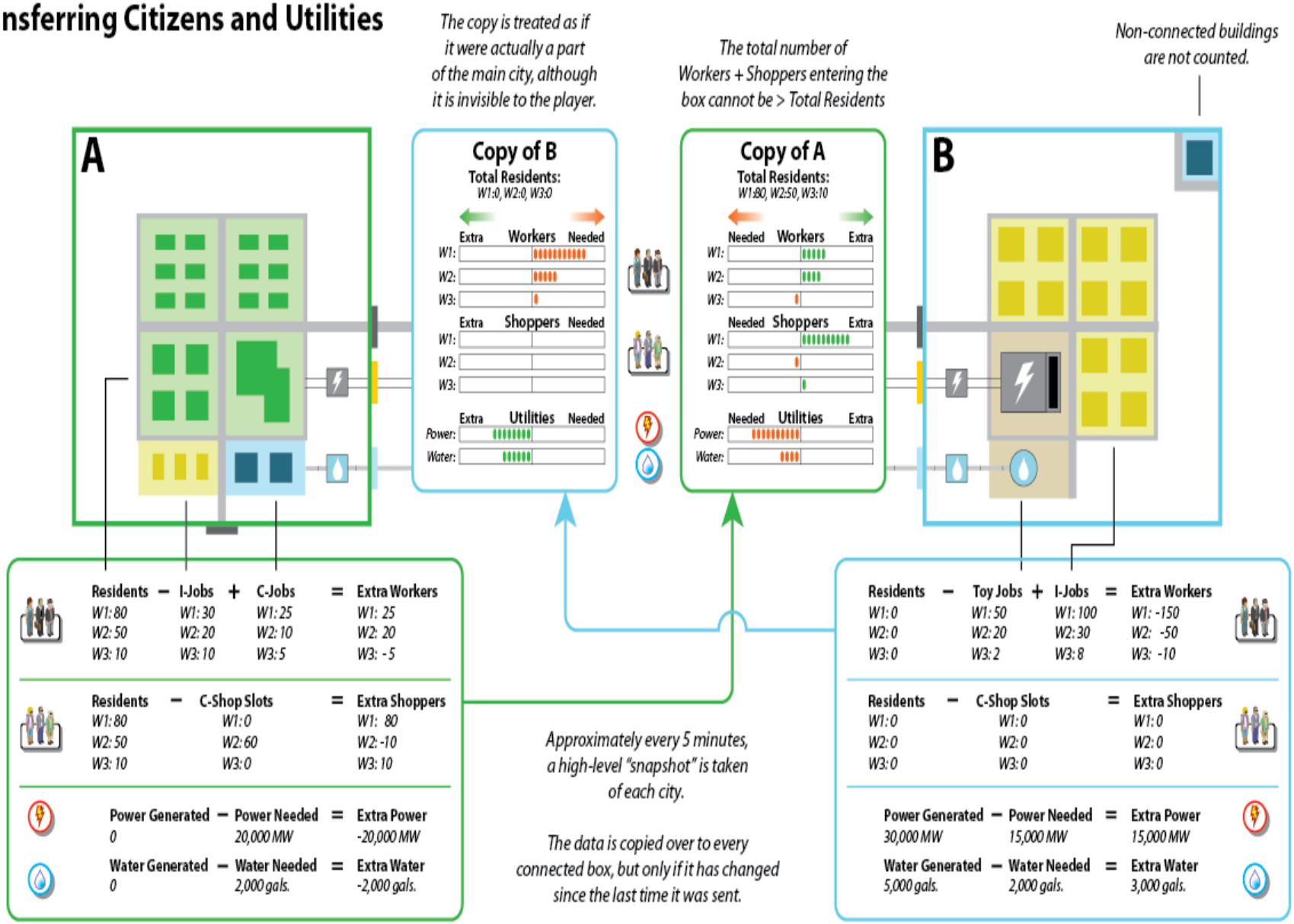
http://stonetronix.com/



SimCity 5

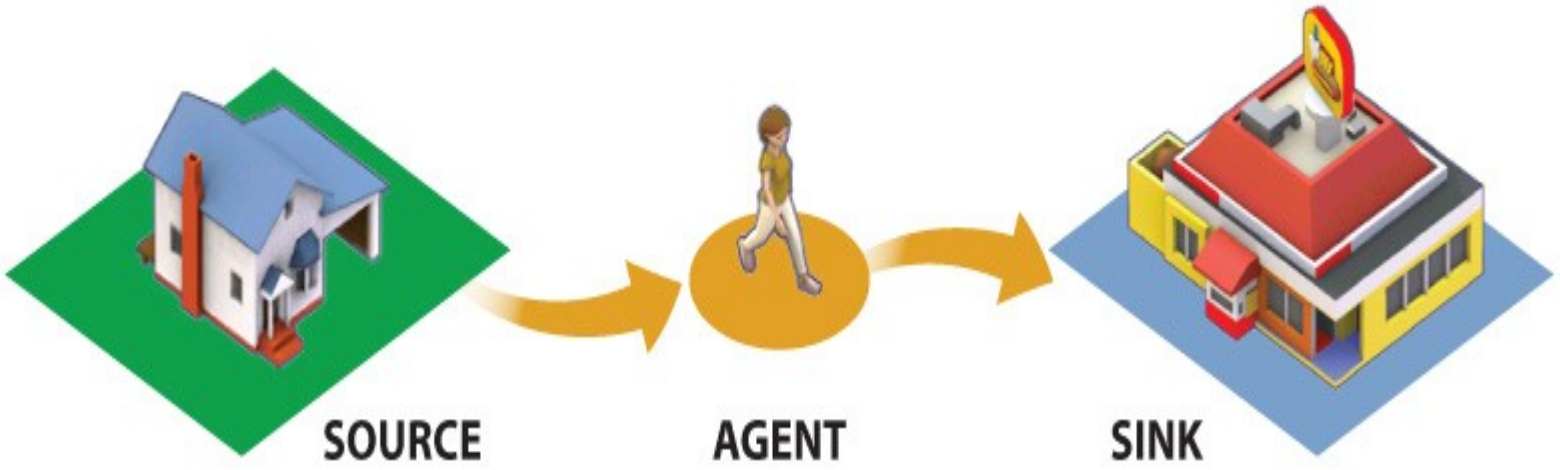
http://stonetronix.com/

Transferring Citizens and Utilities



SimCity 5

http://stonetronix.com/



Carries information

http://stonetronix.com/

SimCity 5

RESOURCES

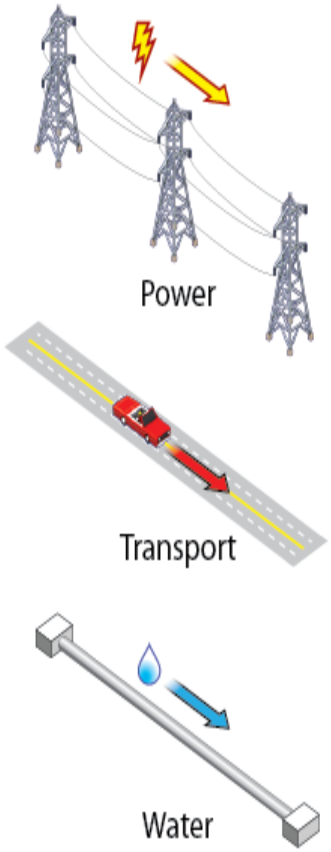
are the simulation variables that flow between units and are carried by agents.

AGENTS

transport resources between units.

PATHS

connect units.



UNITS

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

SimCity 5

http://stonetronix.com/

GlassBox

A New Simulation Architecture

Andrew Willmott (Maxis)
"GlassBox
A New Simulation Architecture“
http://www.andrewwillmott.com/talks/inside-glassbox

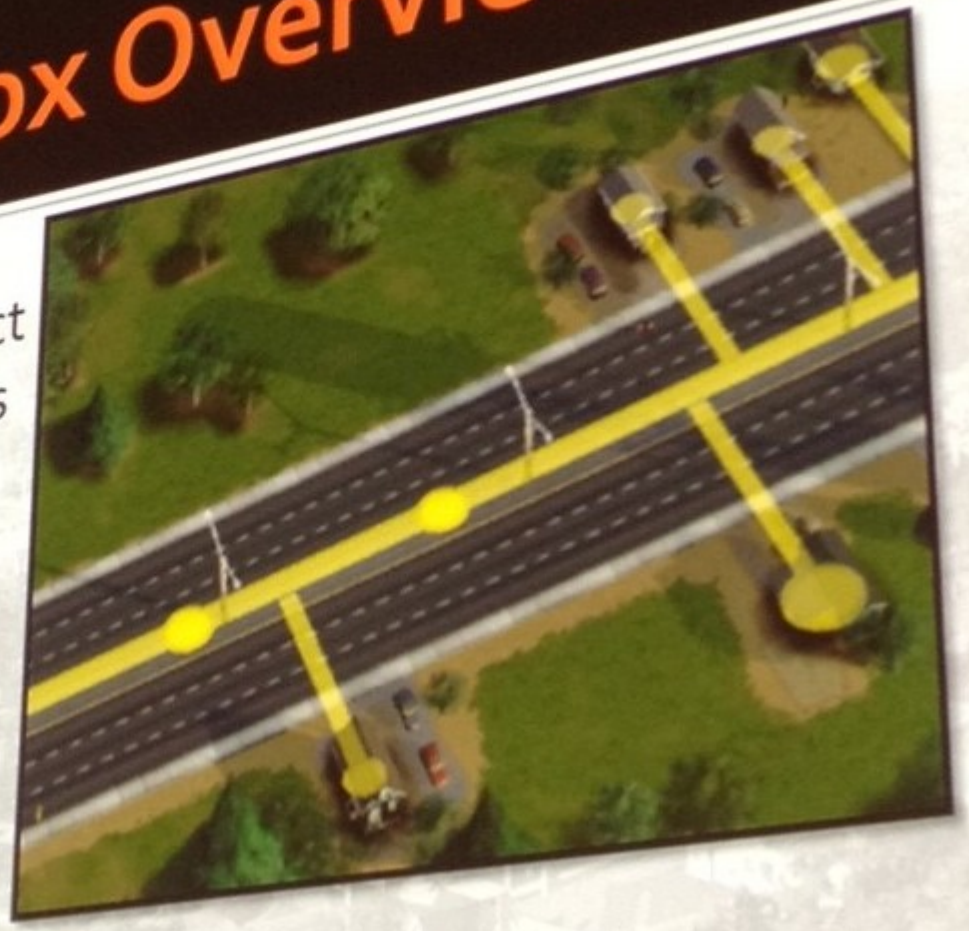
DAY / TIME / LOCATION: Wednesday 5:00- 6:00 Room 304, South Hall
TRACK / DURATION / FORMAT / AUDIENCE LEVEL: Programming / 60-Minute / Lecture / All

EXPLORING SIMCITY: A CONSCIOUS PROCESS OF DISCOVERY

SPEAKER: DAN MOSKOWITZ

GlassBox Overview: Agents

- Also more abstract transport handlers
  - Pipe

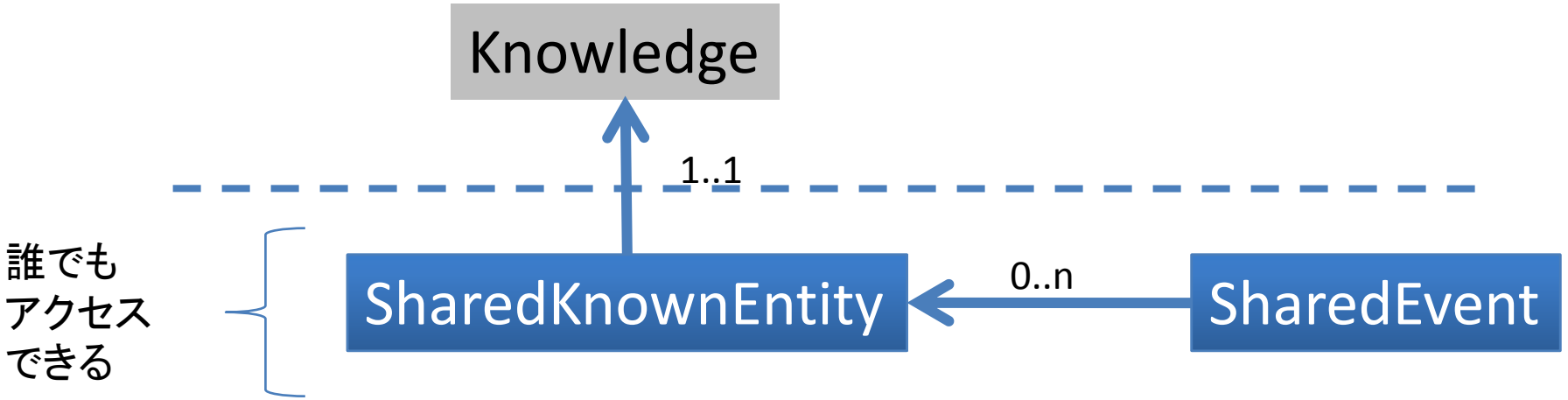


GlassBox Overview: Agents

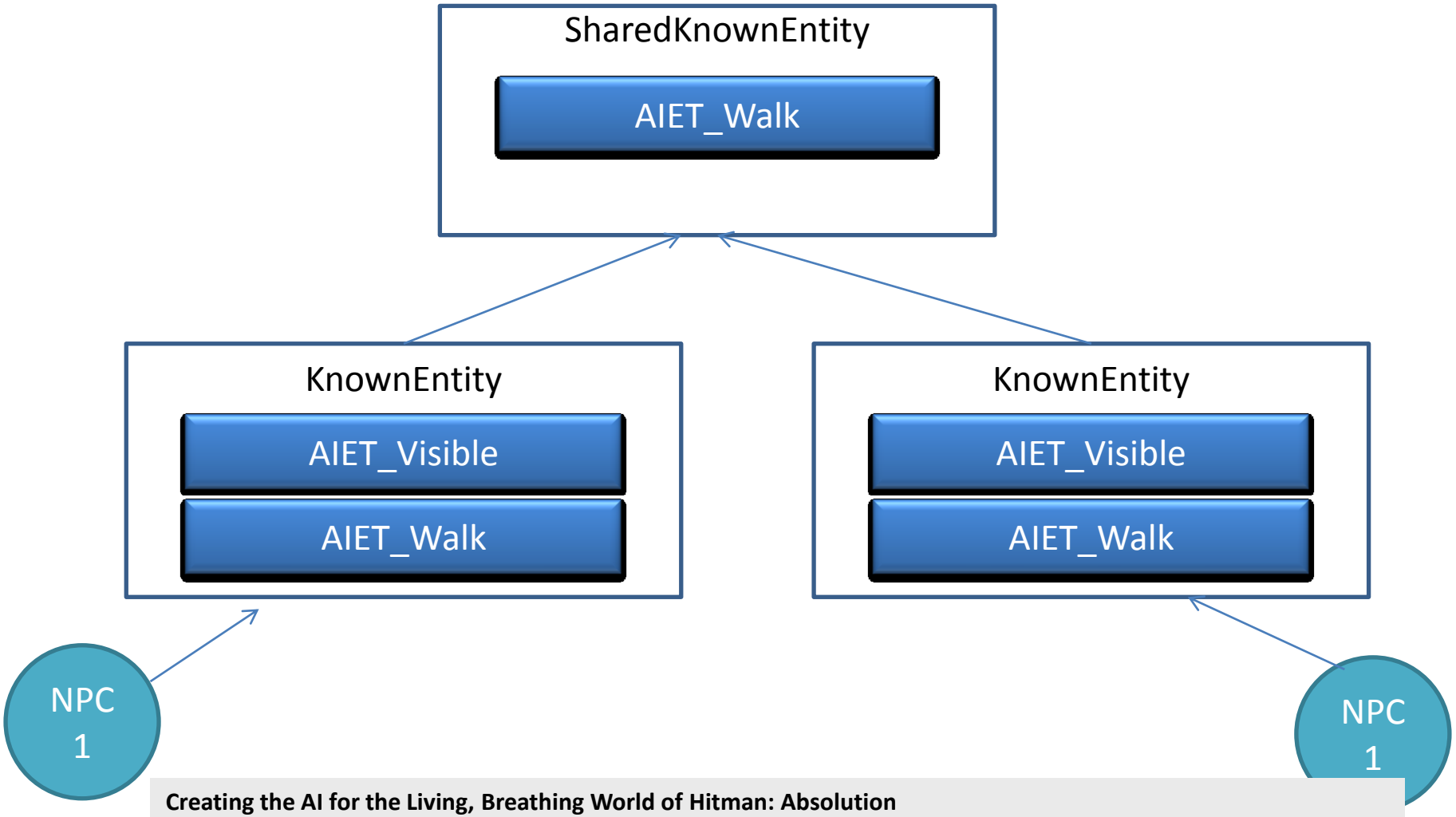
- Agents controlled by "Transport Handlers"
  - Vehicles
  - Pedestrians

第三部
HITMAN : ABSOLUTION の AI/ANIMATION

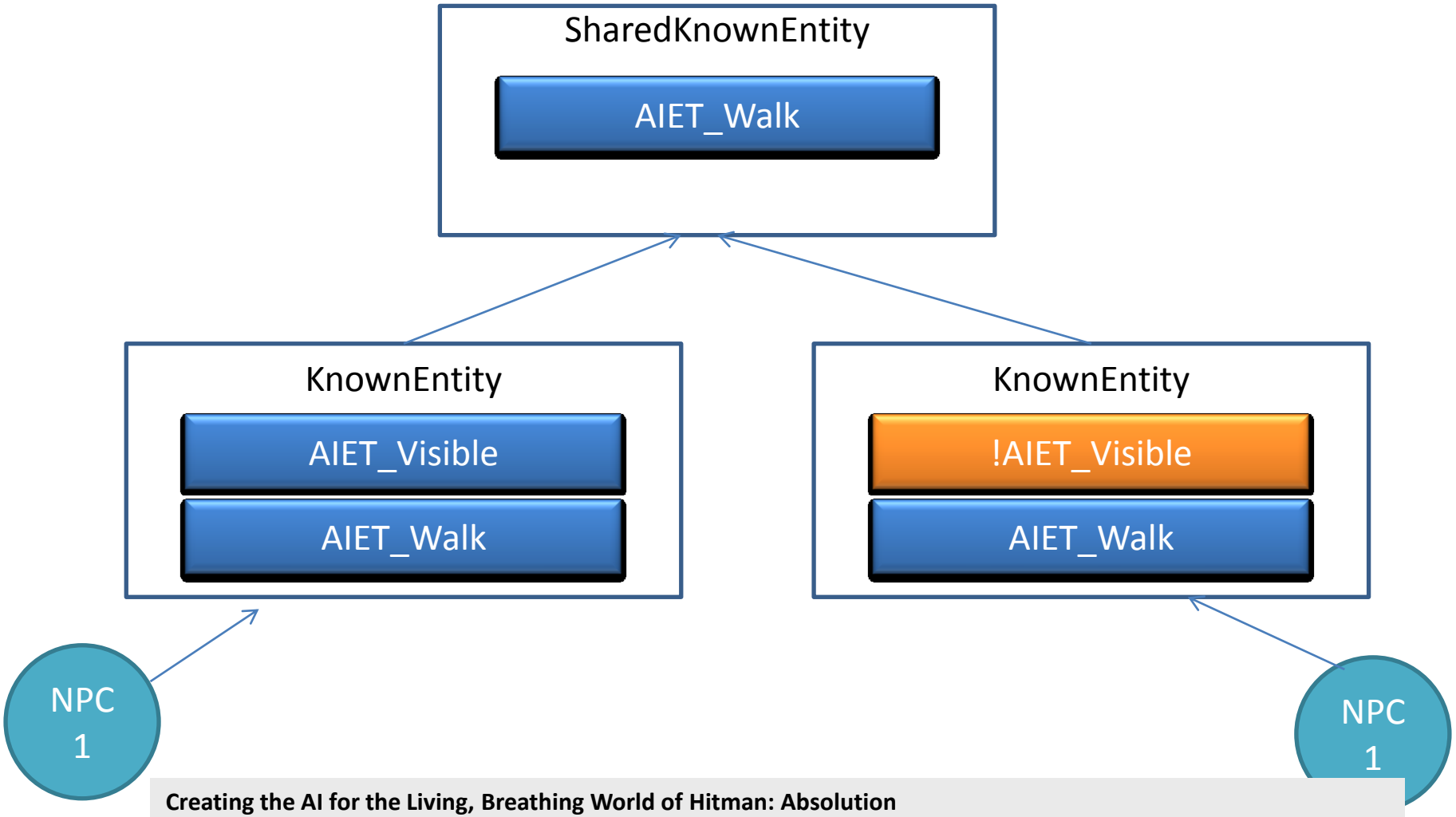
Knowledge


Knowledge
1..1
誰でも
アクセス
できる
SharedKnownEntity
0..n
SharedEvent

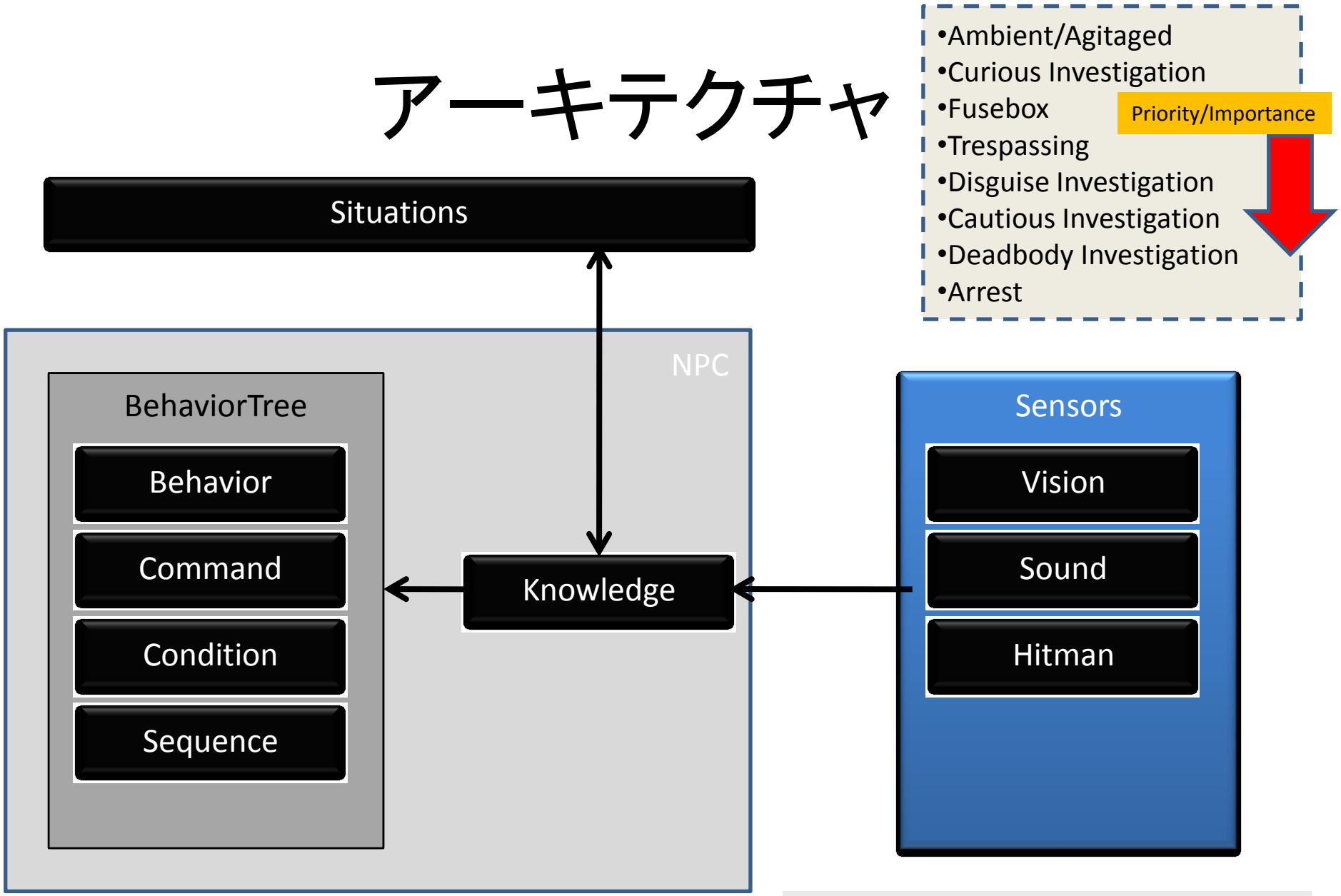
Knowledge


SharedKnownEntity
AIET_Walk
KnownEntity
AIET_Visible
AIET_Walk
KnownEntity
AIET_Visible
AIET_Walk
NPC 1
NPC 1

Knowledge

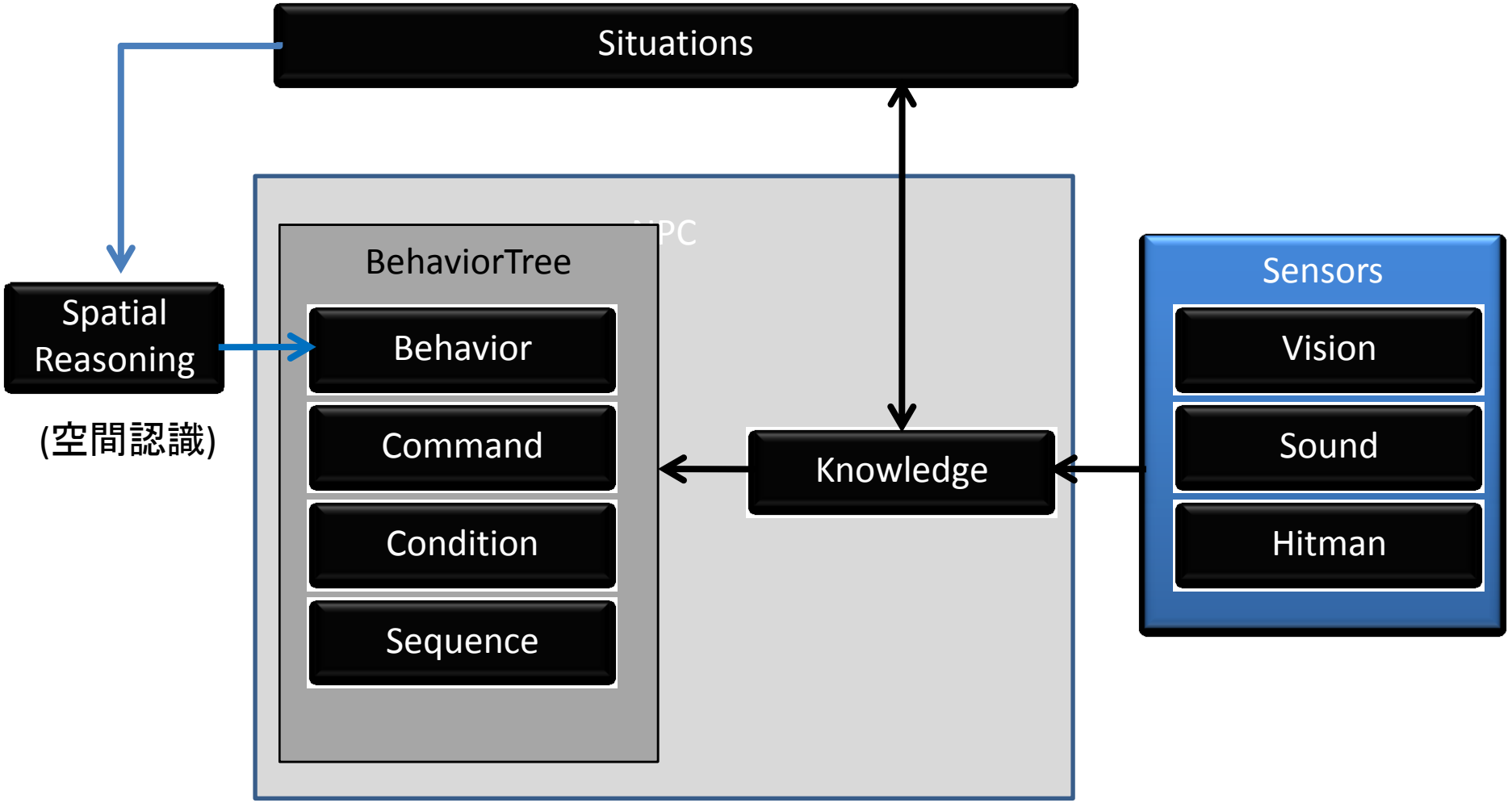

SharedKnownEntity
AIET_Walk
KnownEntity
AIET_Visible
AIET_Walk
KnownEntity
!AIET_Visible
AIET_Walk
NPC 1
NPC 1

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

アーキテクチャ



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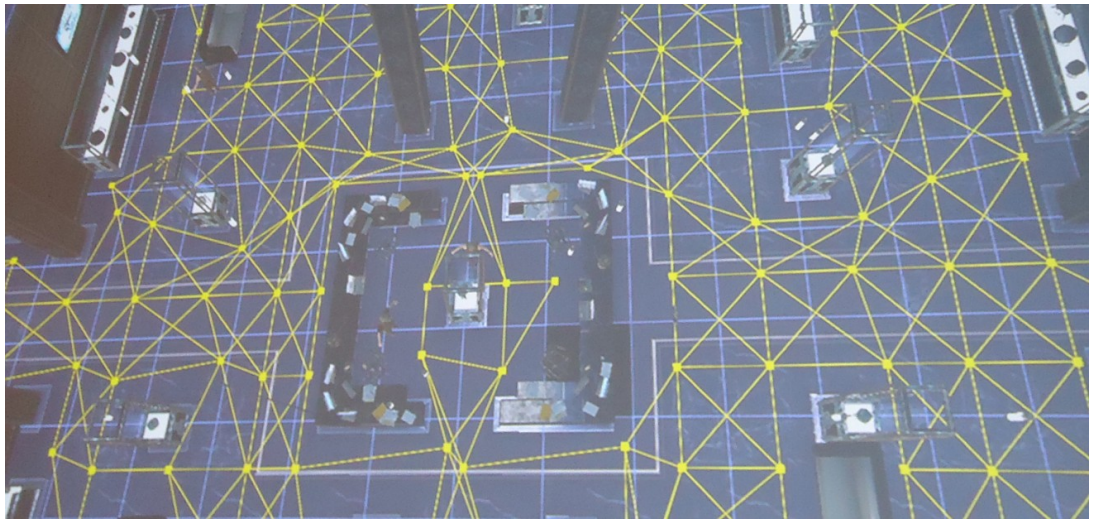
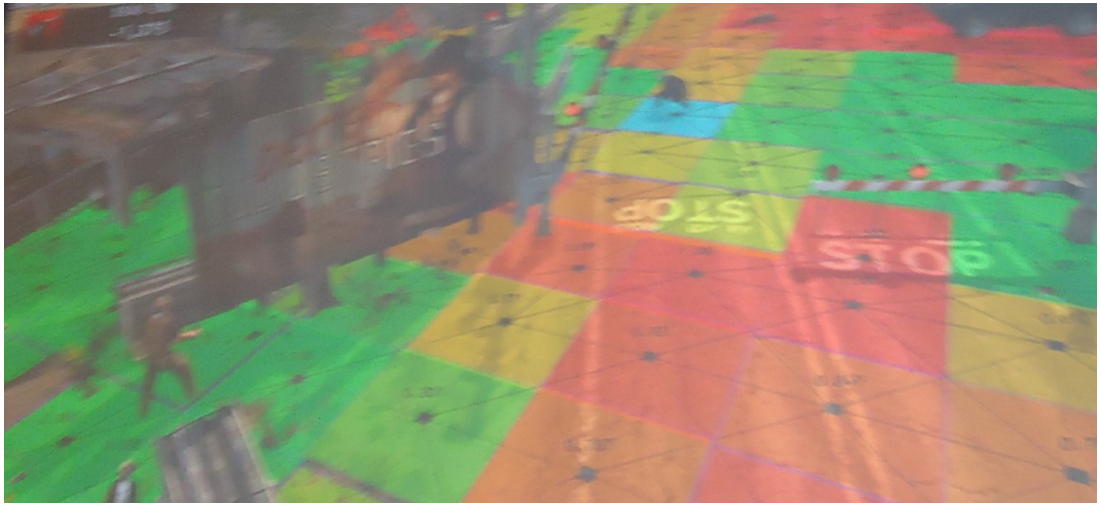
空間認識





- 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。

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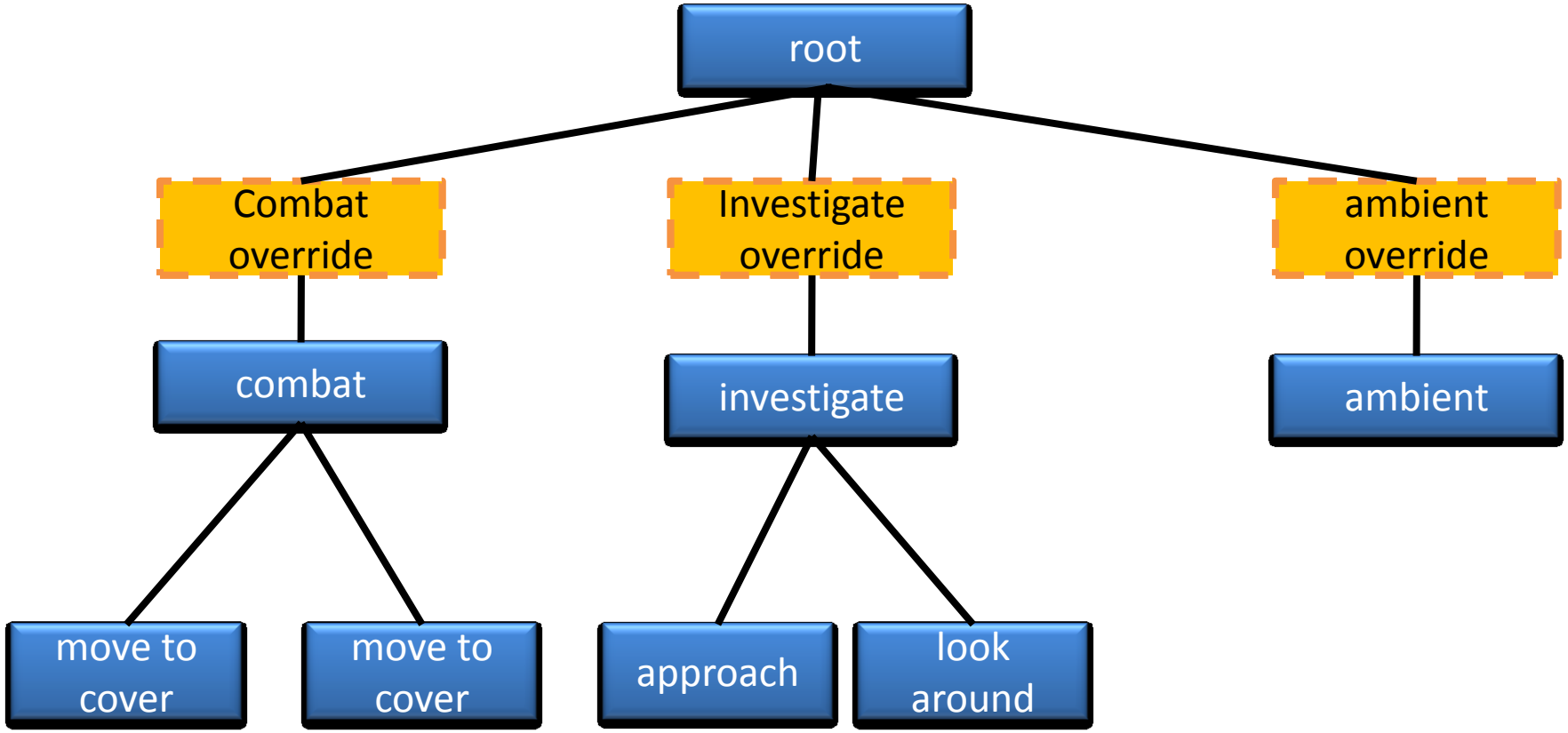
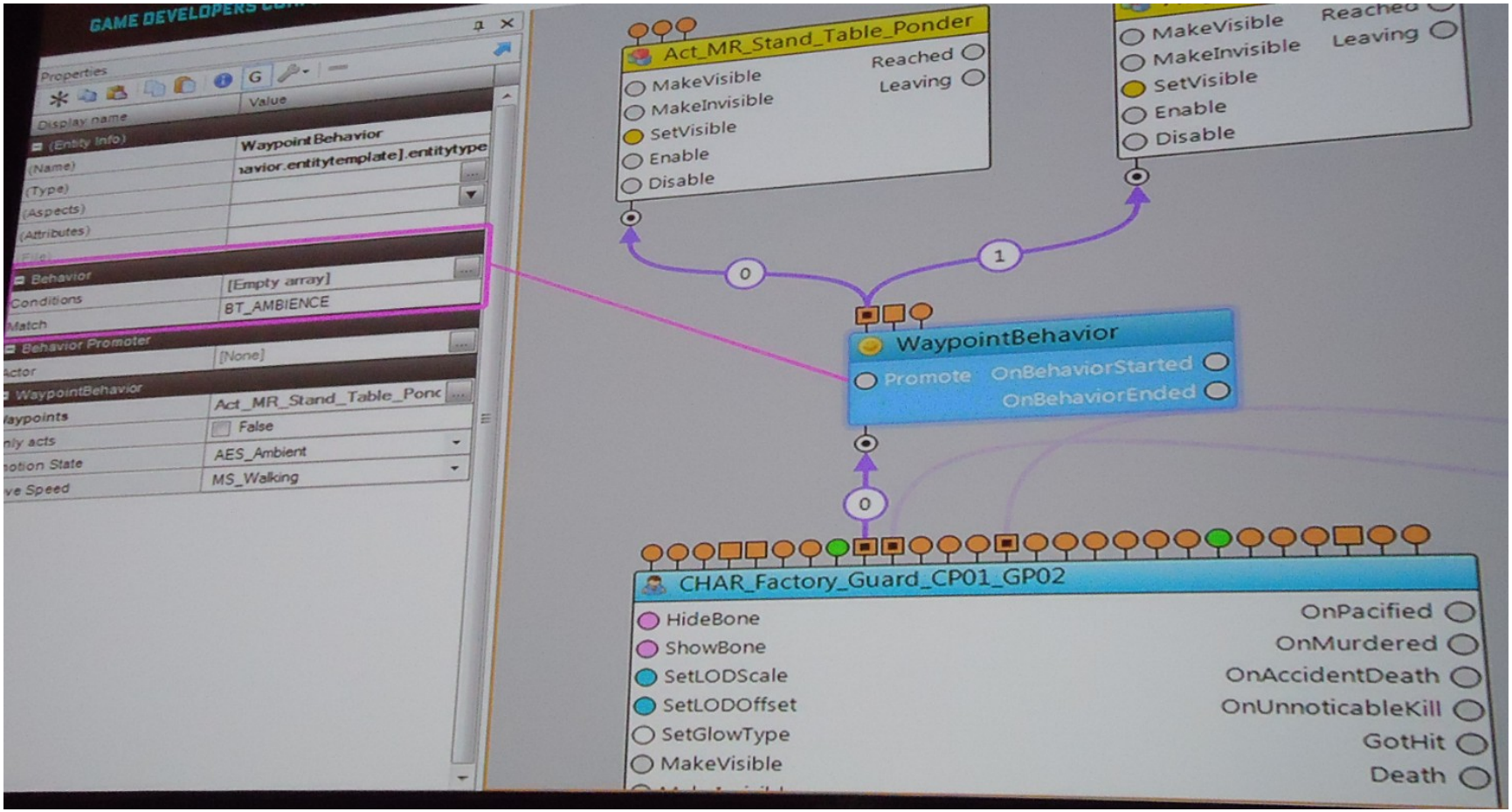
Behavior Tree for NPC (例)





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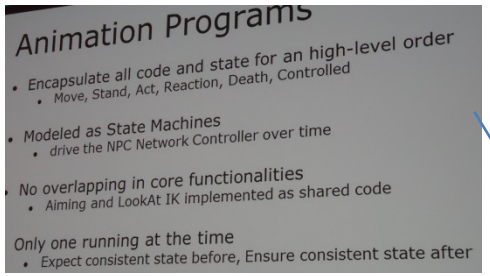
次世代AIの課題

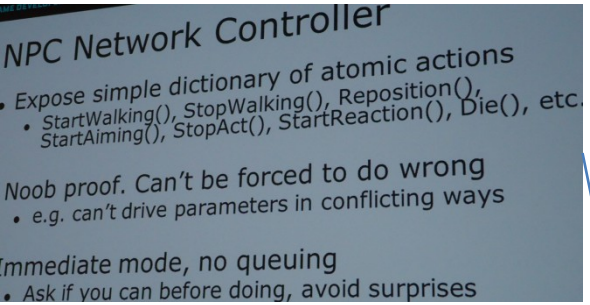
AIとアニメーションの関係をどう構築するのか？

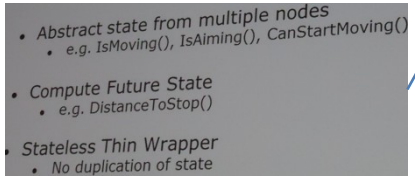
身体と知能の間をどうつなぐか？
（ロボティクス、ゲームAI共通のテーマ）

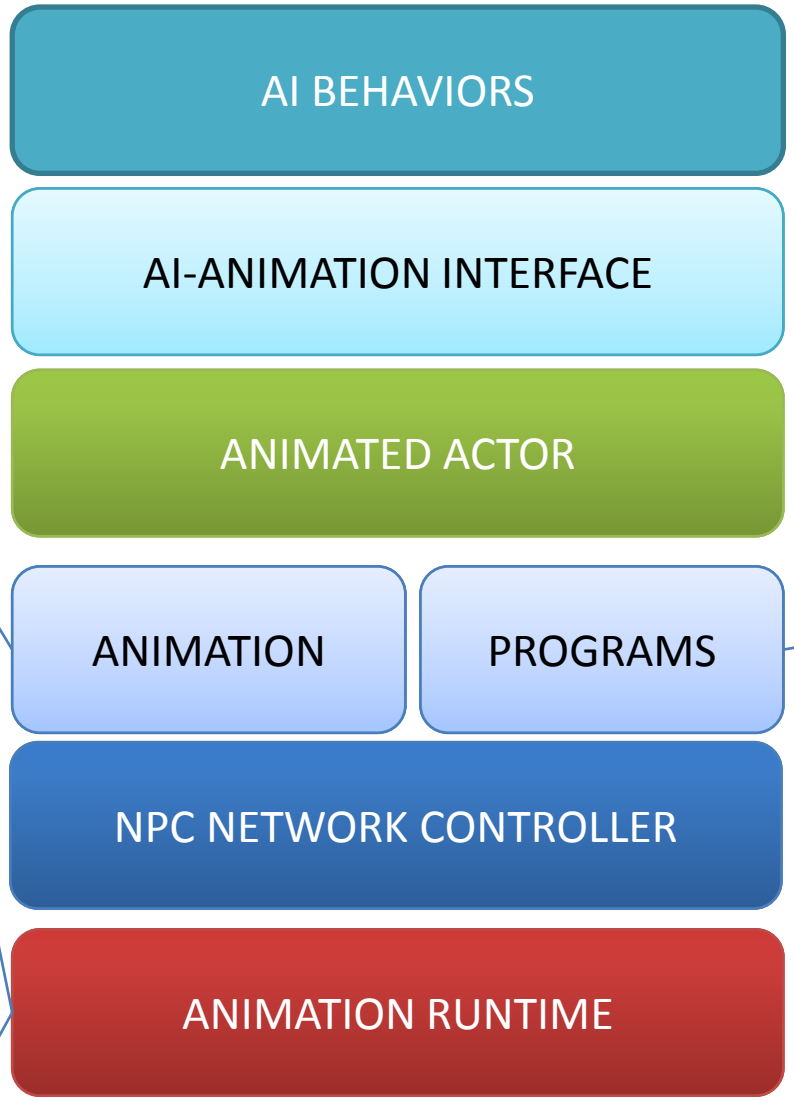
- レイヤー化構造を入れる　＝ゲーム）
- 入れ子（サブサンプション）構造　＝ロボット

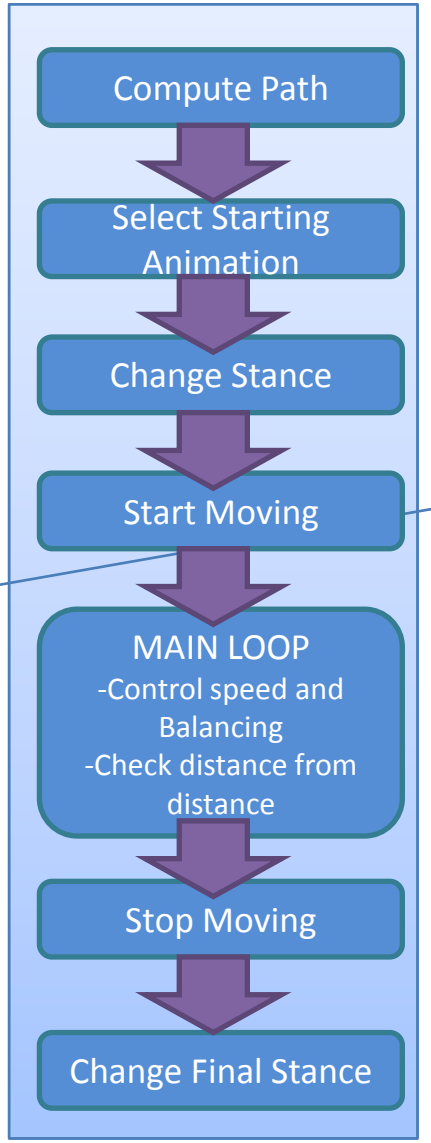
Hitman のAI/Animation Layer構造







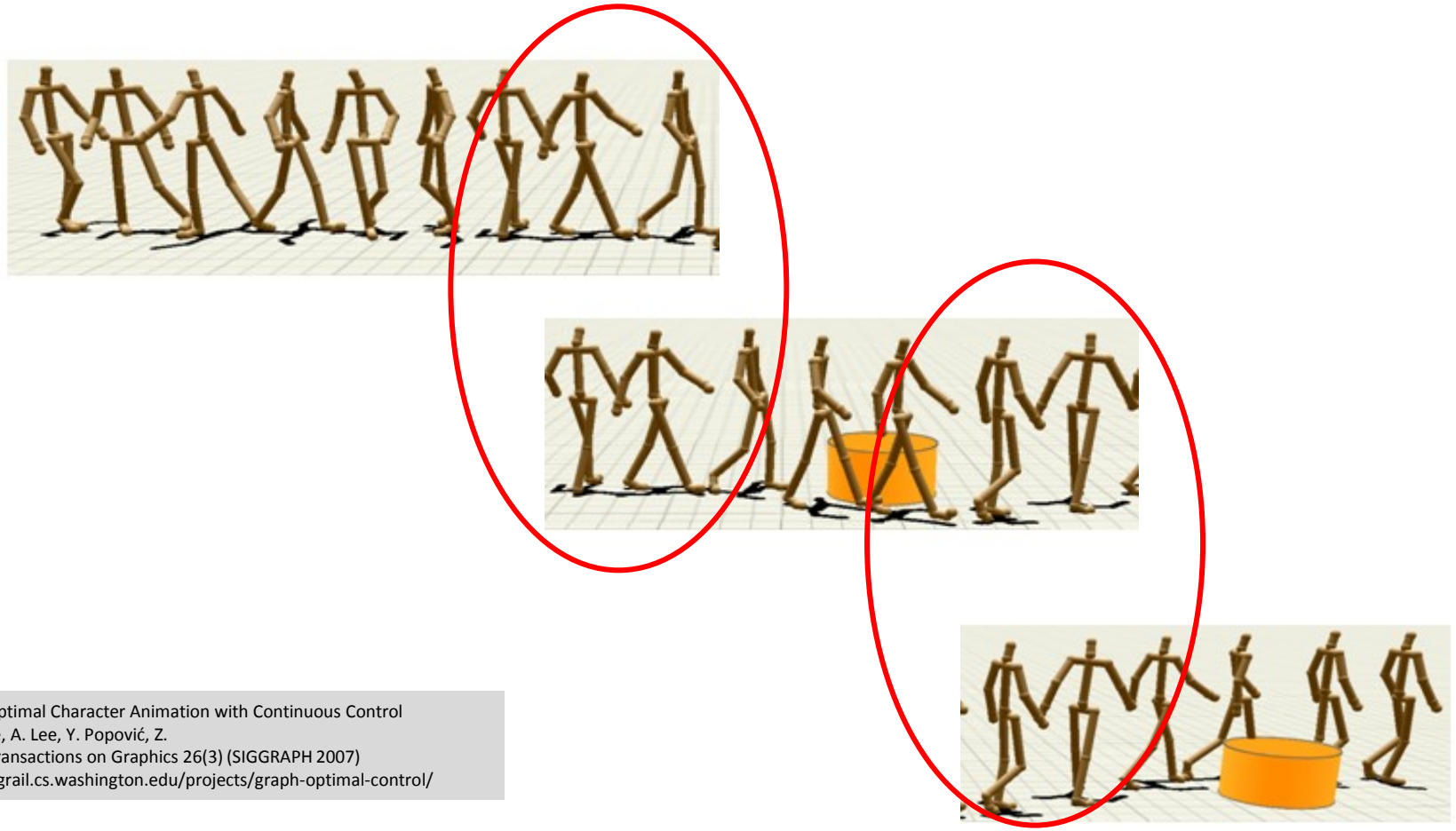




Hitman のAnimaton の特徴

- 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、近し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。

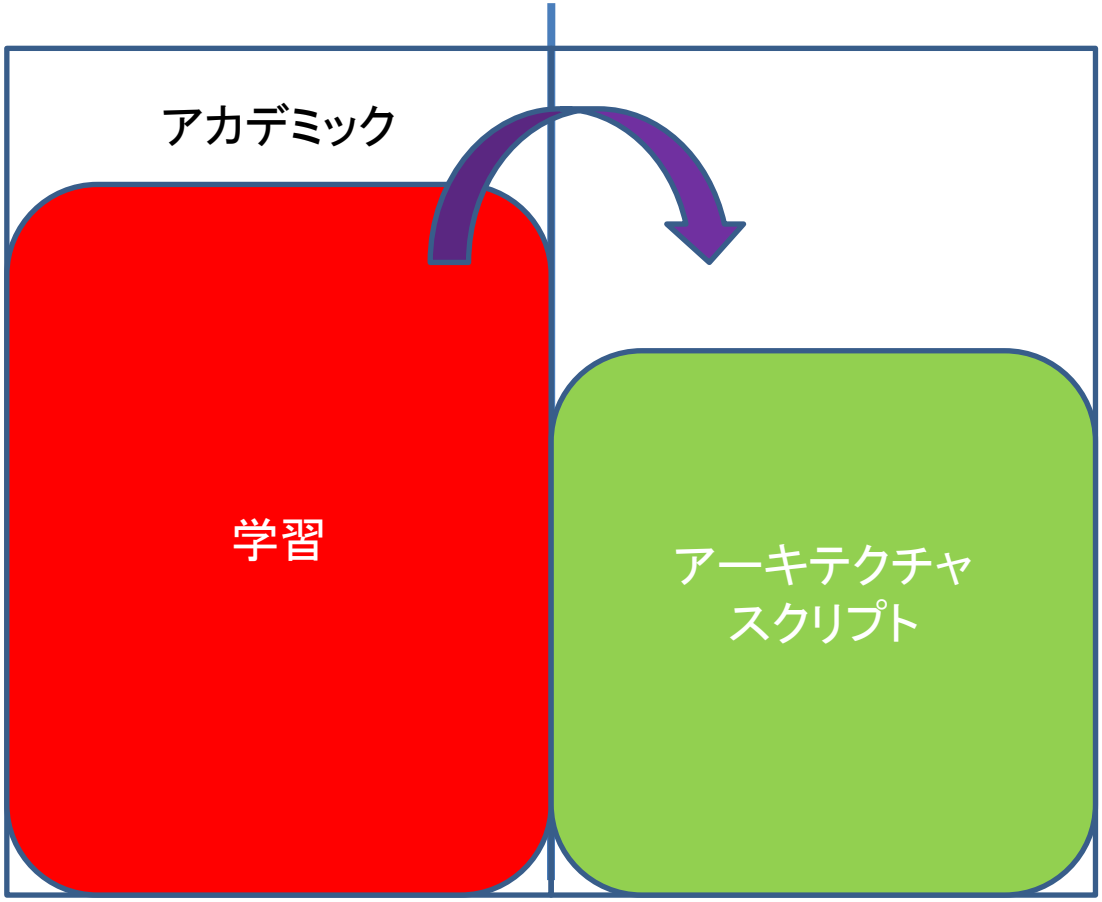
学習について

「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