

Faculty of Mathematics and Physics
Charles University in Prague
19th April 2016



UT2004 bots made easy!

Pogamut 3

Lecture 8 – BOD & DeathMatch



Warm Up!

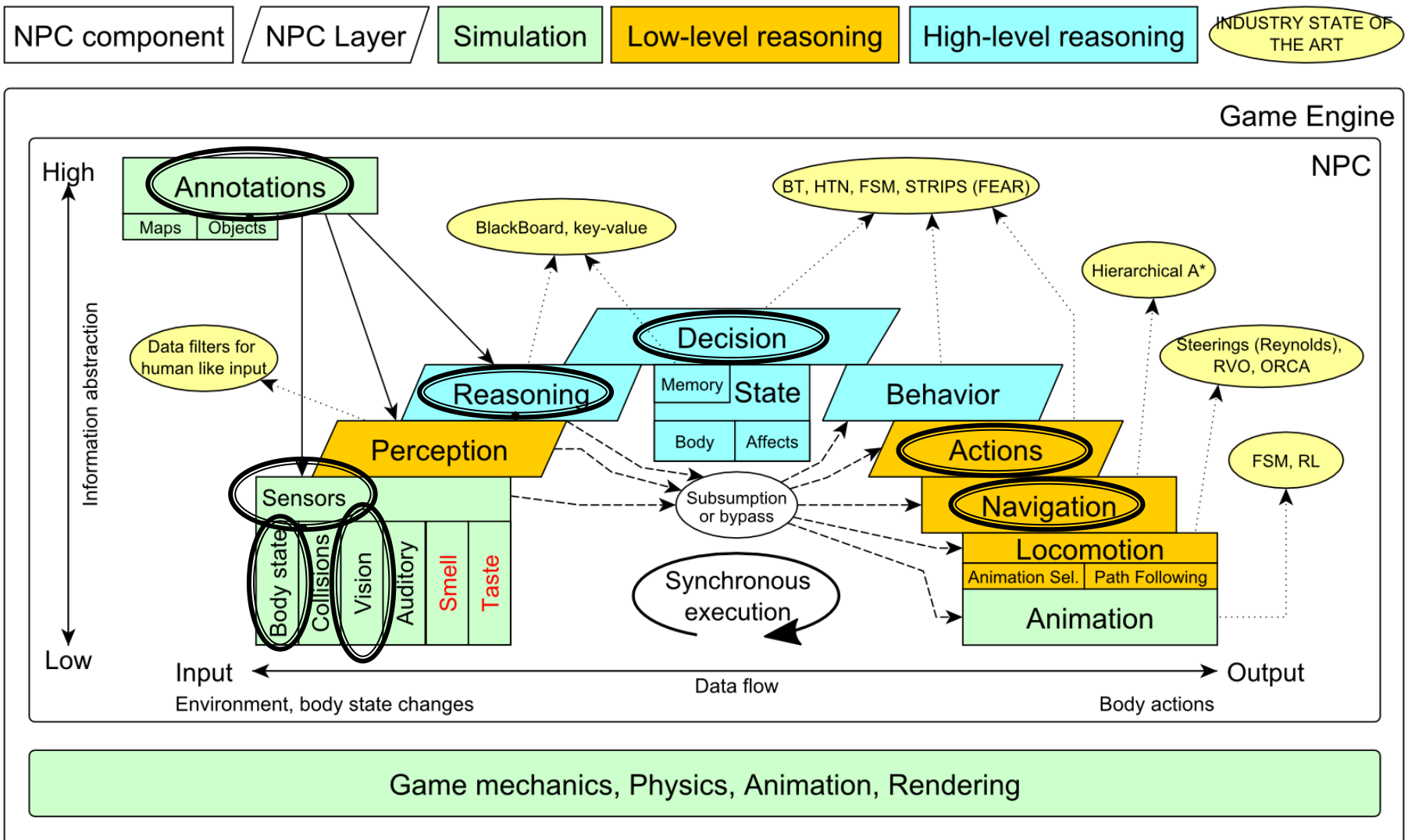


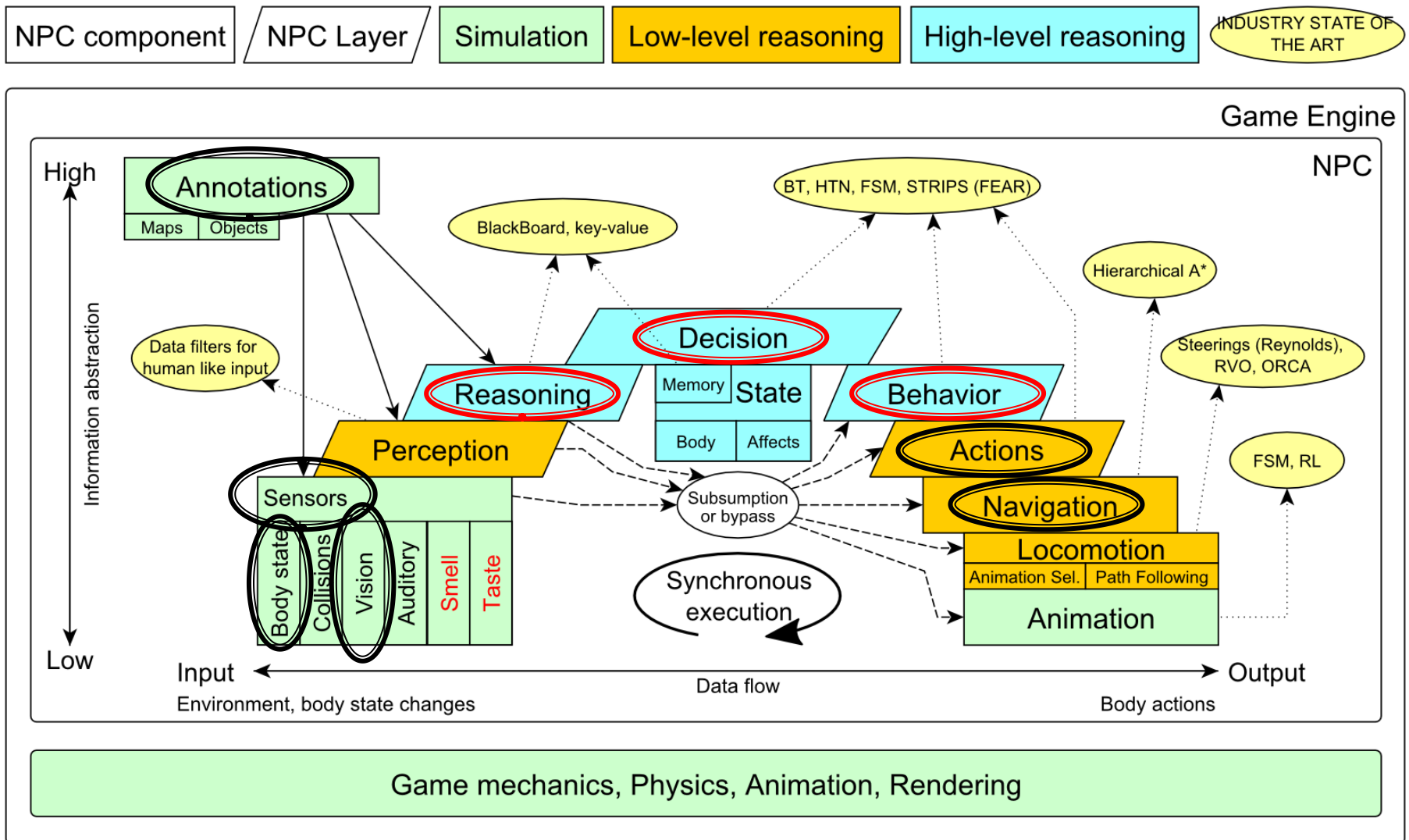
- Fill the short test for this workshop
 - 8 minutes limit
 - <https://goo.gl/rP71DQ>
 - https://docs.google.com/forms/d/1V_4N2HcBRrrDTGliJbRCsTl3JXOlinO1oKOlo2PVMtM/viewform

Today's menu



1. **Big Picture**
2. Weapons & Shooting
3. DM & BOD





Today's menu



1. Big Picture
2. **Weapons & Shooting**
 - <http://planetunreal.gamespy.com/View.php?view=UT2004GameInfo.Detail&id=26>
 - <http://unreal.standardof.net/unreal-tournament-2004/weapons-and-tactics/>
3. DM & BOD

Weapons

UT2004 weapons guide I – the weak



- **UT2004ItemType.SHIELD_GUN** (DEFAULT)
 - Melee weapon (can be charged)
 - Secondary mode – shield (handy from distance!)
- **UT2004ItemType.ASSAULT_RIFLE** (DEFAULT)
 - Weak, basic, inaccurate (can have two)
 - Secondary mode – grenades (charged), don't use
- **UT2004ItemType.BIO_RIFLE**
 - Fires green blobs, short range, defense weapon
 - Secondary mode – charged (big blob)
 - Avoid ... weak
- **UT2004ItemType.LINK_GUN**
 - Primary fires rather slow, but decent projectiles
 - Secondary – medium-to-short range beam
 - Max 1150 distance!



Weapons

UT2004 weapons guide II – the strong



- **UT2004ItemType.FLAK_CANNON**
 - Shotgun style weapon – deadly at short range
 - Sec. mode is a grenade launcher, don't use
- **UT2004ItemType.MINIGUN**
 - Choose between rapid fire but less accuracy (pri. mode) or slower fire and more accuracy (sec. mode)
- **UT2004ItemType.SHOCK_RIFLE**
 - Pri. mode is very accurate with medium damage
 - Sec. mode fires slow moving projectiles, that can be detonated by pri. fire making a big explosion (tricky to do though)
- **UT2004ItemType.LIGHTING_GUN** & **UT2004ItemType.SNIPER_RIFLE**
 - Sniper rifle – precise, can one-shot others by a headshot
 - Bots can use only pri. fire (sec. is zoom)



Weapons

UT2004 weapons guide III – mayhem



■ **UT2004ItemType.ROCKET_LAUNCHER**

- Good old rocket launcher, rockets have splash damage (beware!)
- Secondary mode can charge up to three rockets



■ **UT2004ItemType.REDEEMER**

- Unleash nuclear mayhem!
 - big splash damage radius
- Bots can use only primary firing mode!



■ **UT2004ItemType.U_DAMAGE_PACK**

- Not enough damage? Grab DOUBLE DAMAGE pack and double your damage output!



Weapons

Weaponry class



- `this.weaponry`
 - All you wanted to know about UT2004 weapons but were afraid to ask
 - Note that it contains also some obsolete and to-be-deprecated methods...

```
weaponry.getCurrentWeapon()  
weaponry.hasWeapon(UT2004ItemType)  
weaponry.hasLoadedWeapon()  
weaponry.hasPrimaryLoadedWeapon()  
weaponry.hasSecondaryLoadedWeapon()  
weaponry.getLoadedWeapons()  
weaponry.changeWeapon()
```

...

Weapons & Shooting

WeaponPreferences



- Weapons' effectiveness depends on distance to target
- Thus you should create different priority list for various "ranges"
- Wrapped in class **weaponPrefs**

```
weaponPrefs.addGeneralPref(UT2004ItemType.MINIGUN, true);  
weaponPrefs.addGeneralPref(UT2004ItemType.LINK_GUN, false);
```

- **true** -> primary firing mode
- **false** -> secondary firing mode

```
weaponPrefs.newPrefsRange(CLOSE_COMBAT_RANGE = 400)  
    .add(UT2004ItemType.FLAK_CANNON, true)  
    .add(UT2004ItemType.LINK_GUN, true); // 0-to-CLOSE  
weaponPrefs.newPrefsRange(MEDIUM_COMBAT_RANGE = 1150)  
    .add(UT2004ItemType.MINIGUN, true)  
    .add(UT2004ItemType.ROCKET_LAUNCHER, true); // CLOSE-to-MEDIUM
```

- If **range** prefs fails, **general** are used
- You have to experiment! (*== behavior parametrization!*)

Weapons & Shooting

Shooting



- Shooting with **WeaponPrefs** is easy!

```
Player enemy = players.getNearestVisiblePlayer();
```

```
shoot.shoot(weaponPrefs, enemy);
```

```
shoot.shoot(weaponPrefs, enemy,  
            UT2004ItemType.ROCKET_LAUNCHER);
```

```
// do not use rocket launcher
```

```
shoot.setChangeWeaponCooldown(millis);
```

Weapons & Shooting

Time your shooting – Cooldown class



- Sometimes you need to perform the behavior “once in a time” => Cooldown

```
Cooldown rocketCD = new Cooldown(2000);  
                        // millis
```

```
if (rocketCD.isCool()) {  
    rocketCD.use();  
    shoot.shoot(weaponPrefs, enemy);  
} else {  
    shoot.shoot(weaponPrefs, enemy,  
        UT2004ItemType.ROCKET_LAUNCHER);  
}
```

Weapons & Shooting

Time your behaviors – Heatup class



- Sometimes you need to pursue some behavior for a while => **Heatup**

```
Heatup pursueEnemy = new Heatup(3000);  
                        // millis
```

```
if (players.canSeeEnemy()) {  
    pursueEnemy.heat();  
    // fight the enemy  
} else  
if (pursueEnemy.isHot()) {  
    // pursue the enemy  
} else {  
    // collect items  
}
```

Today's menu



1. Big Picture
2. Weapons & Shooting
3. **DM & BOD**

Deathmatch Bot

BOD Revisited

Behavior Oriented Design

by Joanna J. Bryson (UK)

<http://www.cs.bath.ac.uk/~jjb/web/bod.html>

1. Specify top-level decision
 - a) Name the behaviors that the bot should do
 - b) Identify the list of sensors that is required to perform the behavior
 - c) Identify the priorities of behaviors
 - d) Identify behavior switching conditions
2. Recursion on respective behaviors until primitive actions reached

Deathmatch Bot

BOD Revisited

1. `if (seeEnemy) combatBehavior()`
2. `collectItems()`

■ Simple approach

1. We either fight the enemy
2. Or we're collecting some items when not in contact

■ Problems?

- What if enemy is covering / reappearing?
- What if I don't want to fight the enemy?

Deathmatch Bot

BOD Revisited

1. `if (seeEnemy & wantToFight)`
`combatBehavior()`
2. `if (hunting) interceptEnemy()`
3. `collectItems()`

■ Problems?

- `seeEnemy & !wantToFight`
 - What should we be doing?
 - `collectItems()` does not expect contact with the enemy!

Deathmatch Bot

BOD Revisited

```
1. if ( seeEnemy & wantToFight )  
    combatBehavior()  
2. if ( hunting )    interceptEnemy()  
3. if ( seeEnemy )    coverBehavior()  
4. collectItems()
```

■ Problems?

- What if enemy is reappearing and we're switching between 3 + 4?

Deathmatch Bot

BOD Revisited

```
1.  if ( seeEnemy & wantToFight )
                                   combatBehavior()
2.  if ( hunting )               interceptEnemy()
3.  if ( seeEnemy )              coverBehavior()
4.  if ( seenEnemy )             maintainFocus() +
                                   coverFire()
5.  collectItems()
```

■ Problems?

- We're breaking If-Then rules here! 4 must be executed in parallel with 5!
- Where is "hunting" flag raised & dropped?

Deathmatch Bot

On the Nature of Actions



- Every bot has several action “categories” that can be executed in parallel
- In case of UT2004
 - There are only two (three) of them
 1. Movement
 2. Shooting
 3. (Focus)
 - Each category is having multiple actions that interfere with each others / cancel themselves out
 - And there are multiple behaviors that make use of them and they are going to overlap

Deathmatch Bot

On the Nature of Actions



- Behaviors
 - 1. Combat / Intercept (possible decomposition)
 - Movement Covering, Approaching, Projectile dodging, Aiming, Item picking
 - Shooting Weapon selection and fire rates
 - Focus Enemy
 - 2. Item picking
 - Movement Navigation, Item prioritization
 - Focus On path
- Practically, the bot is doing both of them at once! (It might just not have the other part specified.)
- => Be careful with switches and correctly maintain shooting/navigation/focus

Deathmatch Bot

On the Nature of Actions



■ Behaviors

2. Item picking

- Movement Navigation, Item prioritization
- Focus On path

```
collectItems(boolean canUseFocus,  
             IFilter<Item> itemFilter)
```

- ⇒ Sort of “subsumption architecture” approach
- ⇒ Provides better control over the behavior
- ⇒ Better reusability (e.g. from `coverBehavior`)

Assignment 8

(or Homework)



- Create **DeathMatchBot**
 - That arms himself and is able to fight an opponent
 - **Combat, Intercept, Cover, Focus, Item Collecting behaviors**
 - Try to come up with methods that can be reused between combat / item collection

DM Bot Tournament

Announcement!



- All your **DeathMatchBots** will automatically take part in DM Bot Tournament
 - 1_{vs}1, 10 frags, 10 minutes max
 - DM-10n1-Roughinery-FPS map
- Deadline for submission is **1.5.2016 8:00**

Send us finished assignment



Via e-mail:

- *Subject*
 - "Pogamut homework 2016 – Assignment X"
 - Replace 'x' with the assignment number and the subject has to be without quotes of course
 - ...or face **-2 score penalization**
- *To*
 - jakub.gemrot@gmail.com
 - Jakub Gemrot (Tuesday practice lessons)
- *Attachment*
 - Completely zip-up your project(s) folder except 'target' directory and IDE specific files (or face **-2 score penalization**)
- *Body*
 - **Please send us information about how much time it took you to finish the assignment + any comments regarding your implementation struggle**
 - *Information won't be abused/made public*
 - *In fact it helps to make the practice lessons better*
 - Don't forget to mention your full name!

Questions?

I sense a soul in search of answers...



- In case of doubts about the assignment, tournament or hard problems, bugs don't hesitate to contact us!
 - Jakub Gemrot (Tuesday practice lessons)
 - jakub.gemrot@gmail.com