

Melee AI in 'The Last of Us Part II'

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Melee Animation

Overview

- Melee in TLOU & Uncharted 4 vs. TLOU2
- Melee Data
- Environmental & Animation Analysis Tools
- Building Blocks

Melee in The Last of Us & Uncharted 4



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Melee in Previous ND Games

- Short enemy attack tells.
- No player dodge.
- Enemy starts swinging = certain hit.



Melee in The Last of Us Part II

Melee in The Last of Us Part II

- Longer enemy attack tells.
- More obvious enemy attack tells.
- Player can now dodge.
- More skill-based.



Goals

- Equal weight & complexity to gun combat.
- Encourage melee encounter.
- Skilled players can survive unscathed.
- Polished feel.

Melee Data

Melee Attacks/Moves

```
(new melee-attack
  :anim 'swing-attack
  :start-func
    (and
      (characters-in-range? 3.0)
      (is-in-front?)
      (has-line-of-motion?)
    )
  :end-func
    (target-out-of-range? 5.0)
    (line-of-motion-blocked?)
  :events
    (make-event-list
      (npc-track-target)
      (avoid-overshoot-event)
    )
)
```

- Animations
- Starting/Ending conditions.
- Events
 - e.g.
 - Hit frames
 - Target tracking
 - Invincibility



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Melee Behaviors

```
(new melee-attack-behavior
  :name 'attack-basic-tell-close-combo
  :attack-list 'npc-basic-tell-close-attacks
  :test-hit-frame-overlap      #t
  :destination                 (melee-destination target)
  :range                       (range - -)
  :time-since-last-attack-ended (range 0.5 -)
  :range-hysteresis-upper      2.0
  :cooldown-npc                1.0
  :cooldown-global             0.0
  :num-ally-attackers-in-circle (range - 2)
  :start-func                  (...)
  :end-func                    (...)
  :update-func                 (...)
  :enter-func                  (...)
  :exit-func                   (...))
```

- Attack list
- Destination
- Motion type
- Enter/exit conditions



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Environmental & Animation Analysis Tools

Collision Casts

Vision Raycasts: npc-maxd-1
-> Player
@ default -> head (fail) (+grass)



[npc-maxd-1]
IdleSkill ()
BehaviorNone

NotVisible

maxd-normal [DEV TASKED]
v-1 t2final @Apr 22 2021 18:06:05 asset view: live,achou (NOTICE: YOU ARE USING 2 LOCAL ASSETS)



max navmeshes 3, polys 234, polycon 688, taps 40, polytaps 4

Nav Probes



[npc-maxd-1]
IdleSkill ()
BehaviorNone

31

test0

[-4.13, -0.00, -3.47] [-58.04] [1.69]

test1

test2

0

maxd-normal [DEV TASKED]

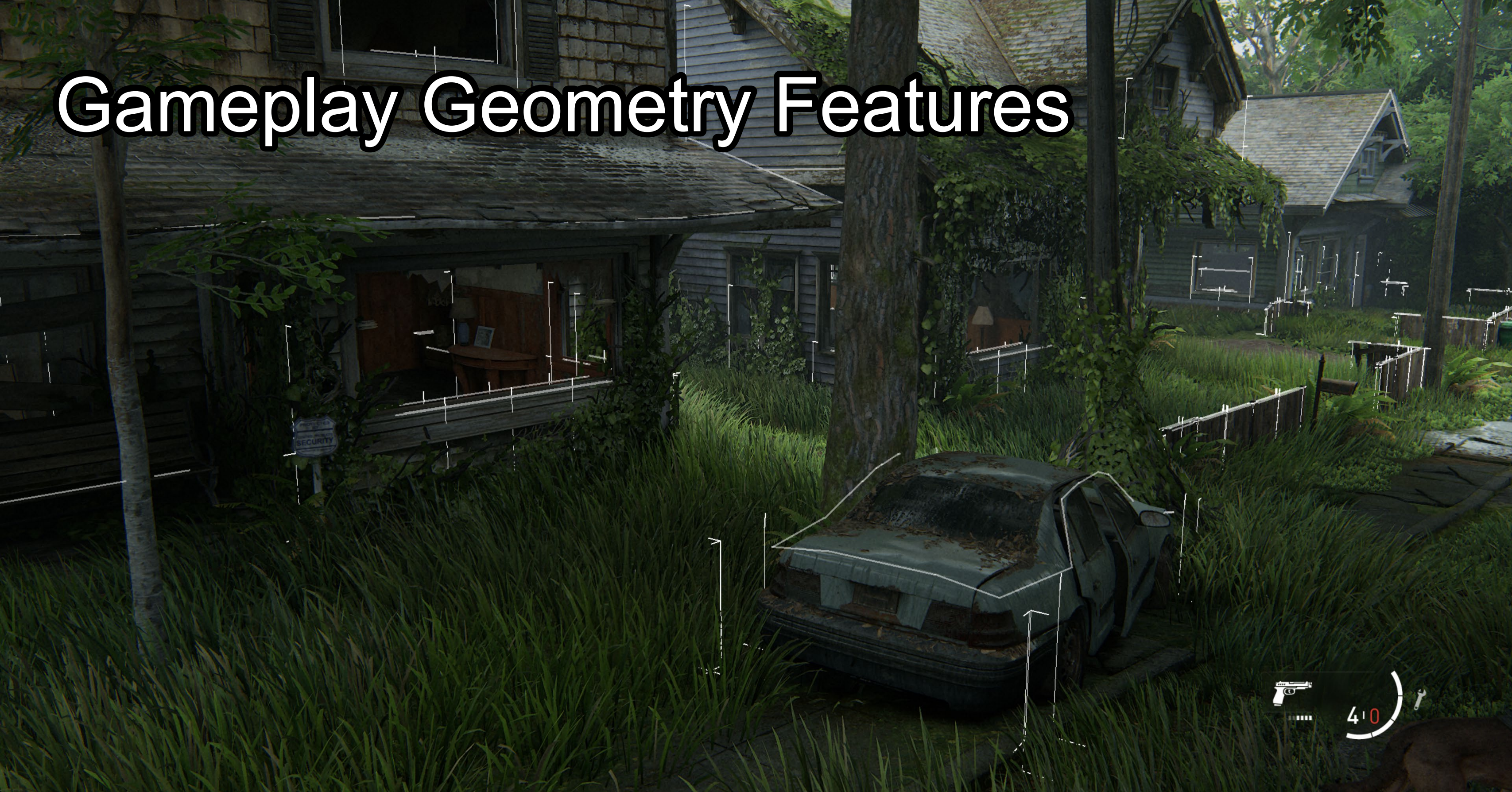
v-1 t2final @Apr 22 2021 18:06:05 asset view: live,achou (NOTICE: YOU ARE USING 2 LOCAL ASSETS)



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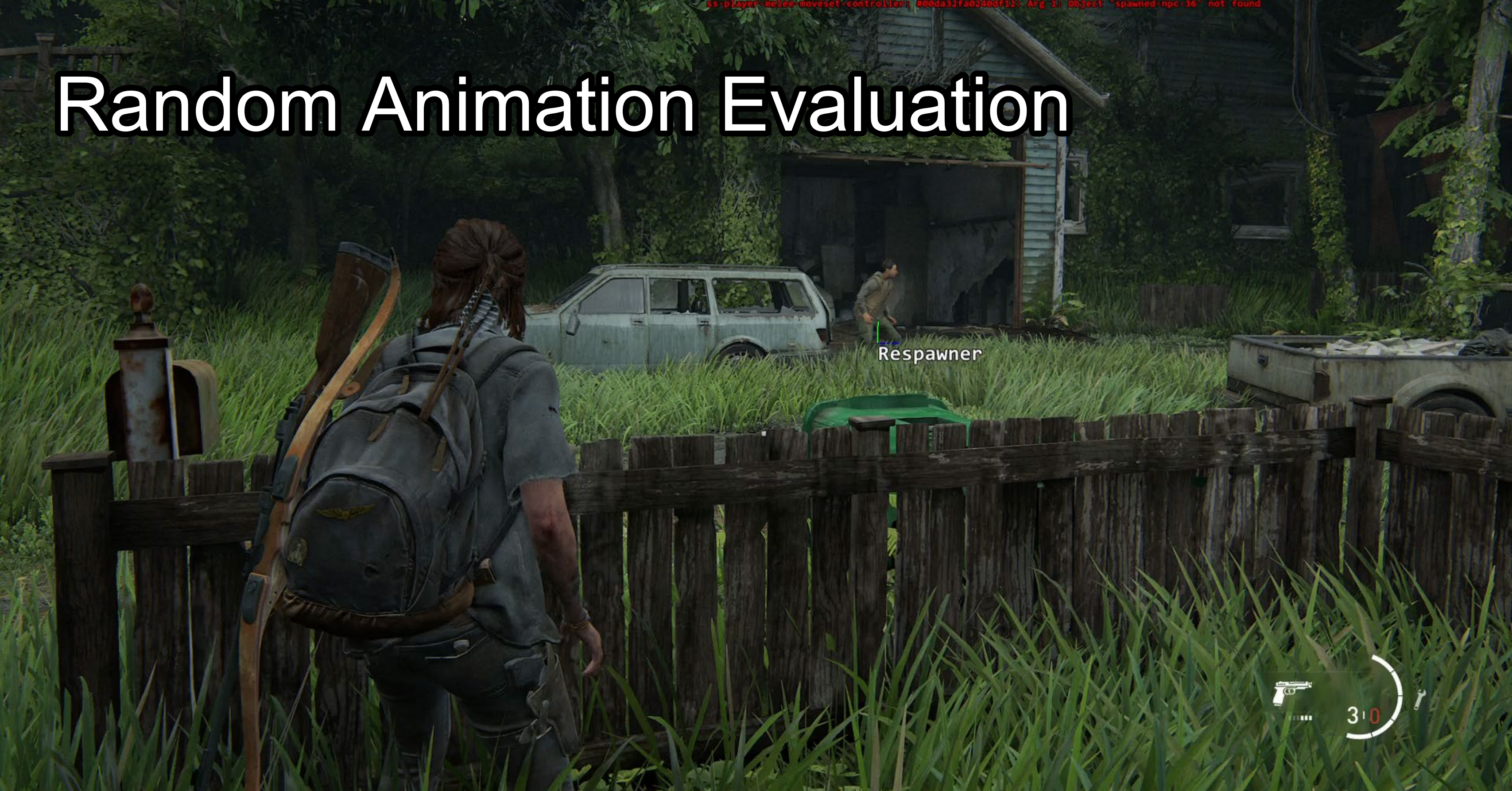
Gameplay Geometry Features



Random Animation Evaluation

“What is the transform (position/rotation/scale)
of bone X at frame Y of animation Z?”

Random Animation Evaluation



Building Blocks

Strafe Slots



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Strafe Slots : Incoming Directions

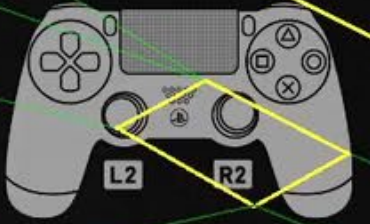
Path Length : 5.173
Linear Dist : 5.242
LoM Path Error: -0.069
LoM Tolerance : 0.100
Line of Motion: exact (respect characters)

Path Length : 7.602
Linear Dist : 7.302
LoM Path Error: 0.300
LoM Tolerance : 0.100
Line of Motion: no

-15.5
-38.0



Strafe Slots : Probes



29.97



410

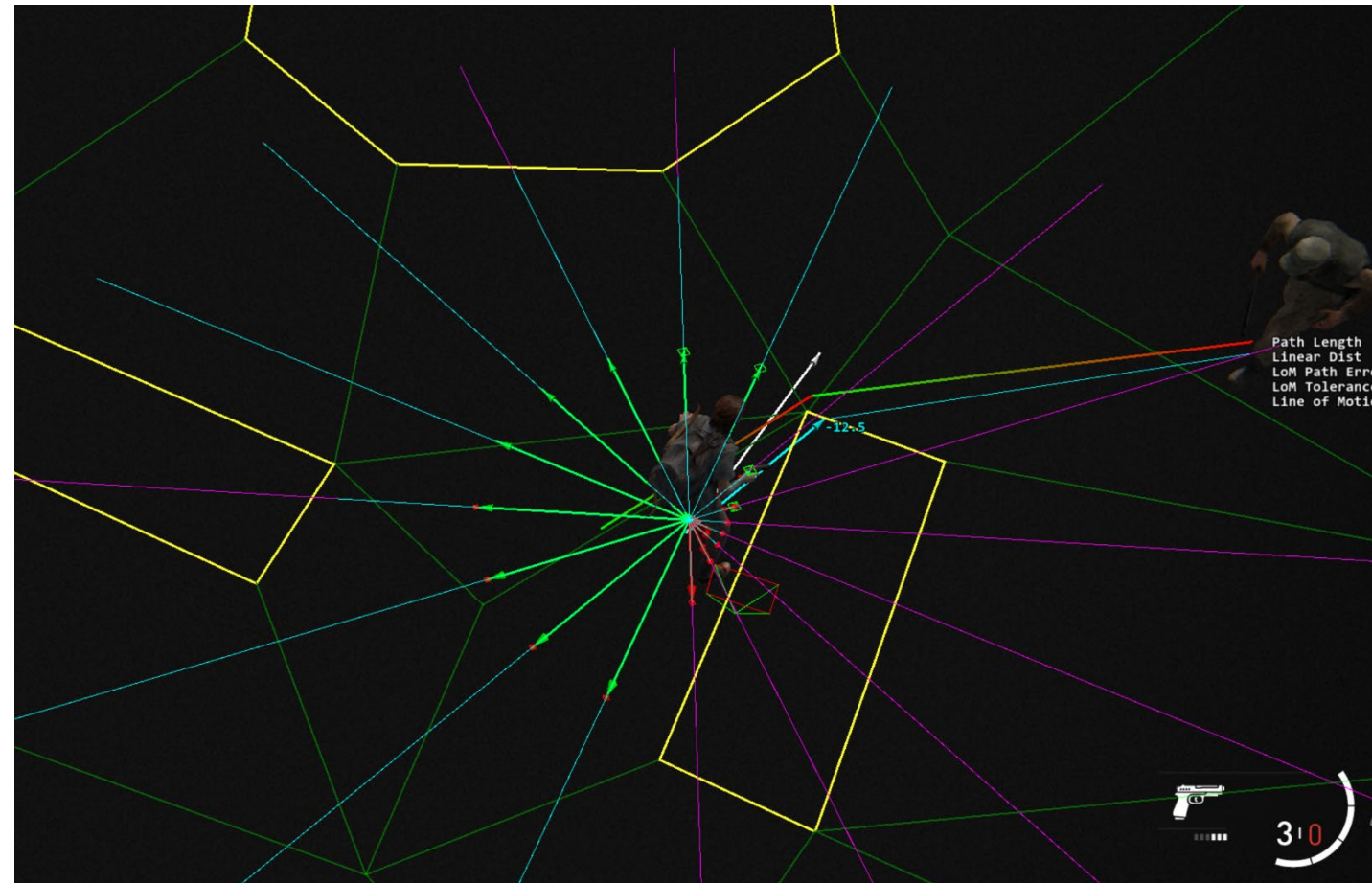


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Strafe Slots : Final Picking

- Initial pick: incoming direction.
- Alternate sides and try the next further slot.



Strafe Slots



Line of Motion

set-character-force-contact-with-big-collision: Arg 1: Object '(INVALID_STRING_ID_64)' not found
npc-is-buddy?: Arg 1: NPC '(INVALID_STRING_ID_64)' not found
spawn-particles-at-joint: Arg 2: Object '(INVALID_STRING_ID_64)' not found

29.97

[spawned-npc-7]
MeleeSkill1 (Melee)



Forcing reached type stop



4/0



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Corner Line of Motion



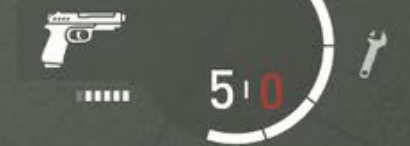
Target Tracking



npc-1hblade-1t-foot-3m-upward-swing-a-enter spawned-npc-1 (ground-1h-novussh) Player [unsynced]

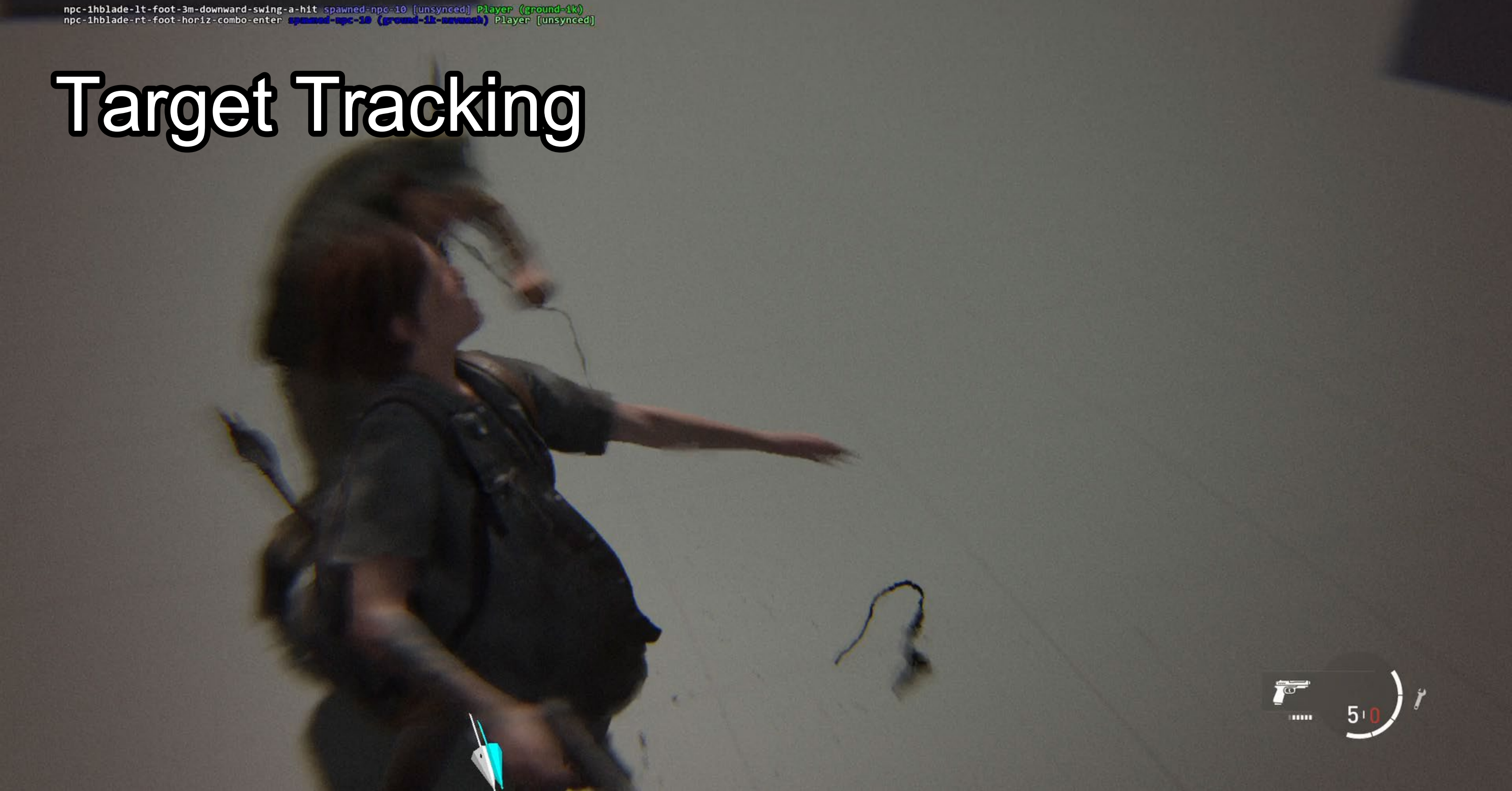
Target Tracking

Dodge



npc-1hblade-lt-foot-3m-downward-swing-a-hit spawned-npc-10 [unsynced] Player (ground-1k)
npc-1hblade-rt-foot-horiz-combo-enter spawned-npc-10 (ground-1k-newdash) Player [unsynced]

Target Tracking



npc-1hblade-1t-foot-3m-horiz-sweep-a-hit spawned-npc-8 (ground-1h-sweptash) Player [unsynced]
ellie-1h-hr-hip-back-right-from-right-a spawned-npc-8 [unsynced] Player (custom-align)

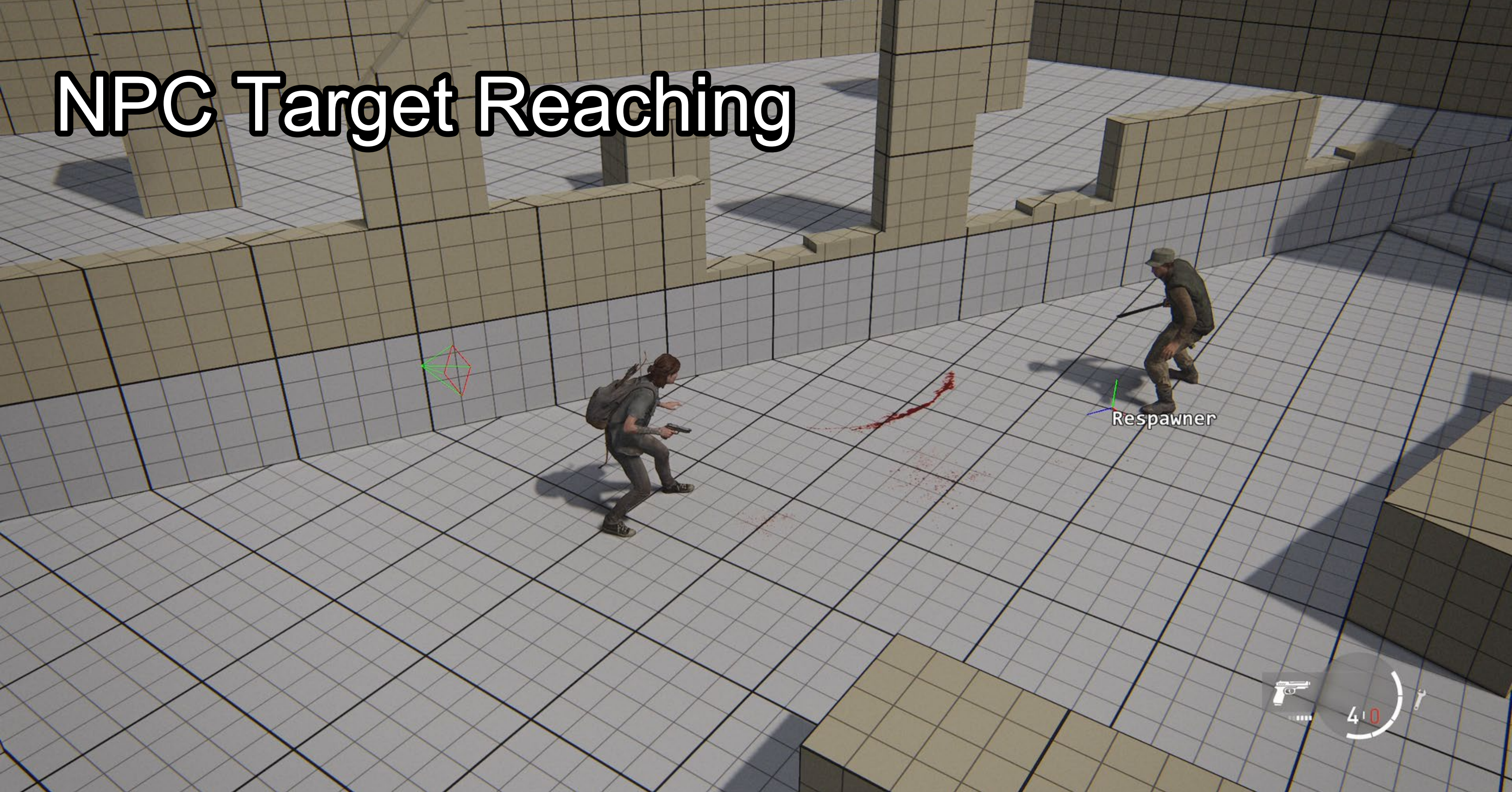
Target Tracking



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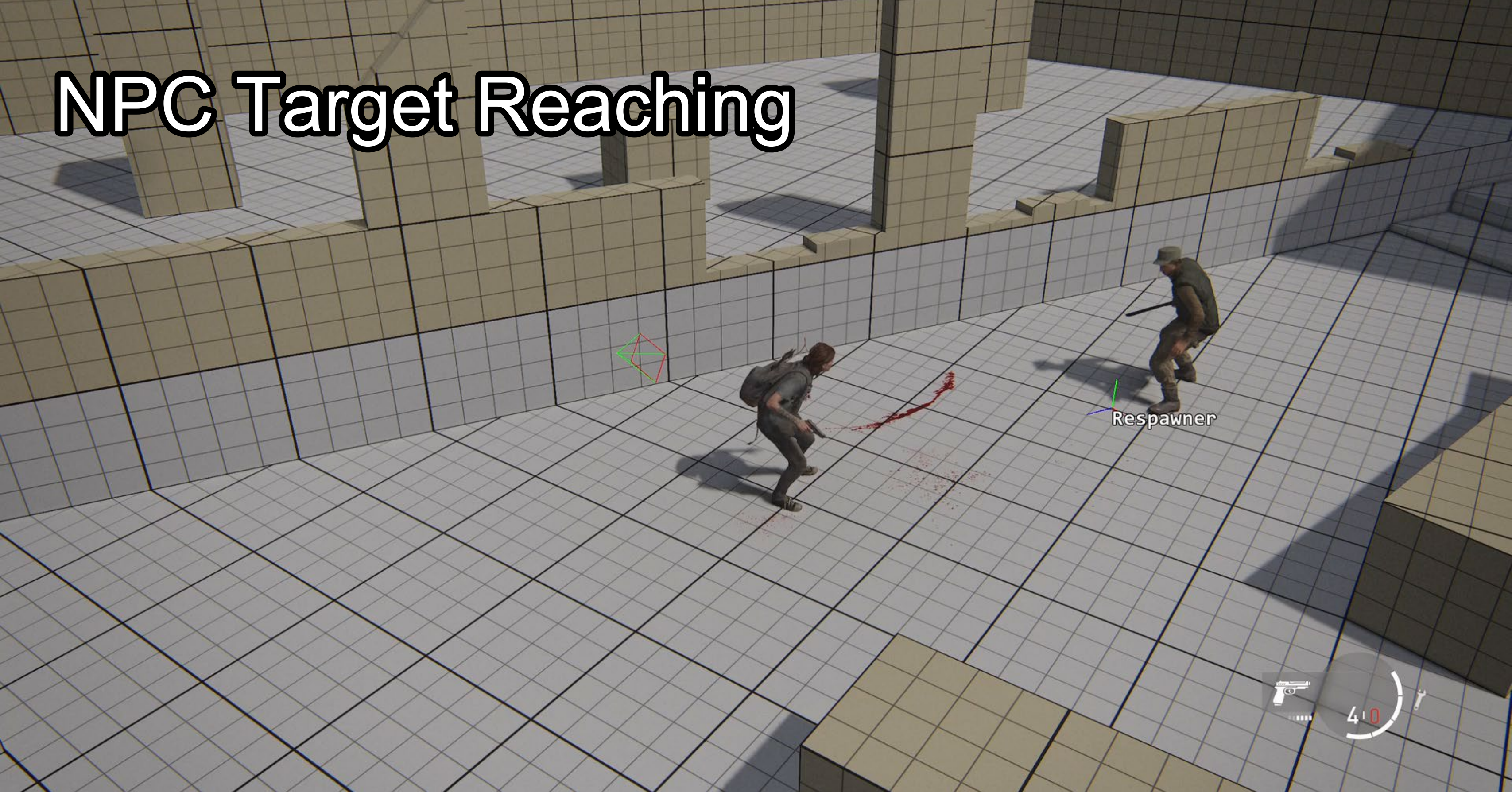
NPC Target Reaching



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NPC Target Reaching



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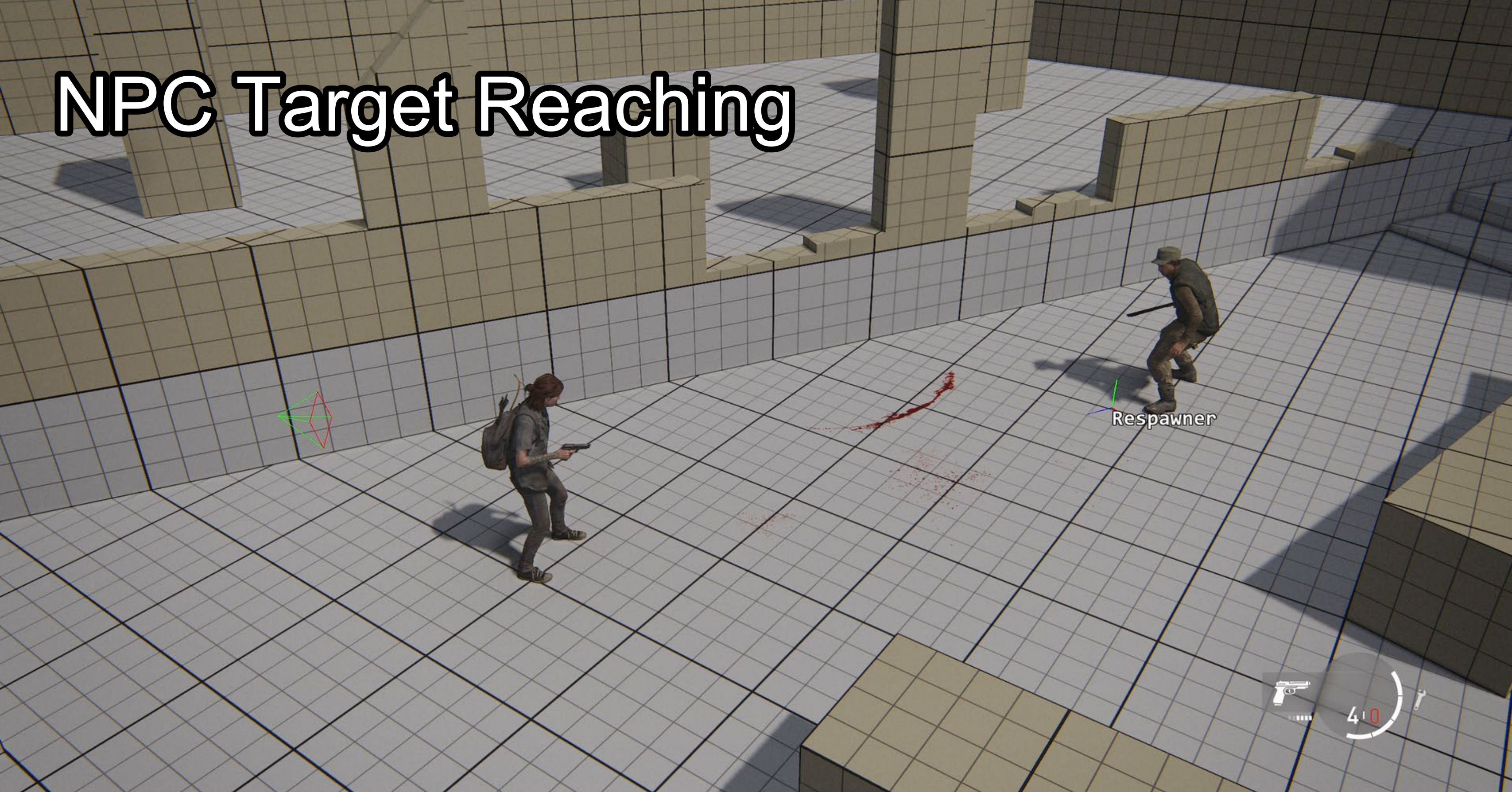
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NPC Target Reaching

$$(\text{Ideal Movement Multiplier}) = \frac{(\text{Projected Distance to Cover})}{(\text{Raw Remaining Distance})}$$

$$\begin{aligned} (\text{Projected Distance to Cover}) = \\ (\text{Current Target Distance}) + (\text{Relative Speed}) \cdot (\text{Remaining Time}) \end{aligned}$$

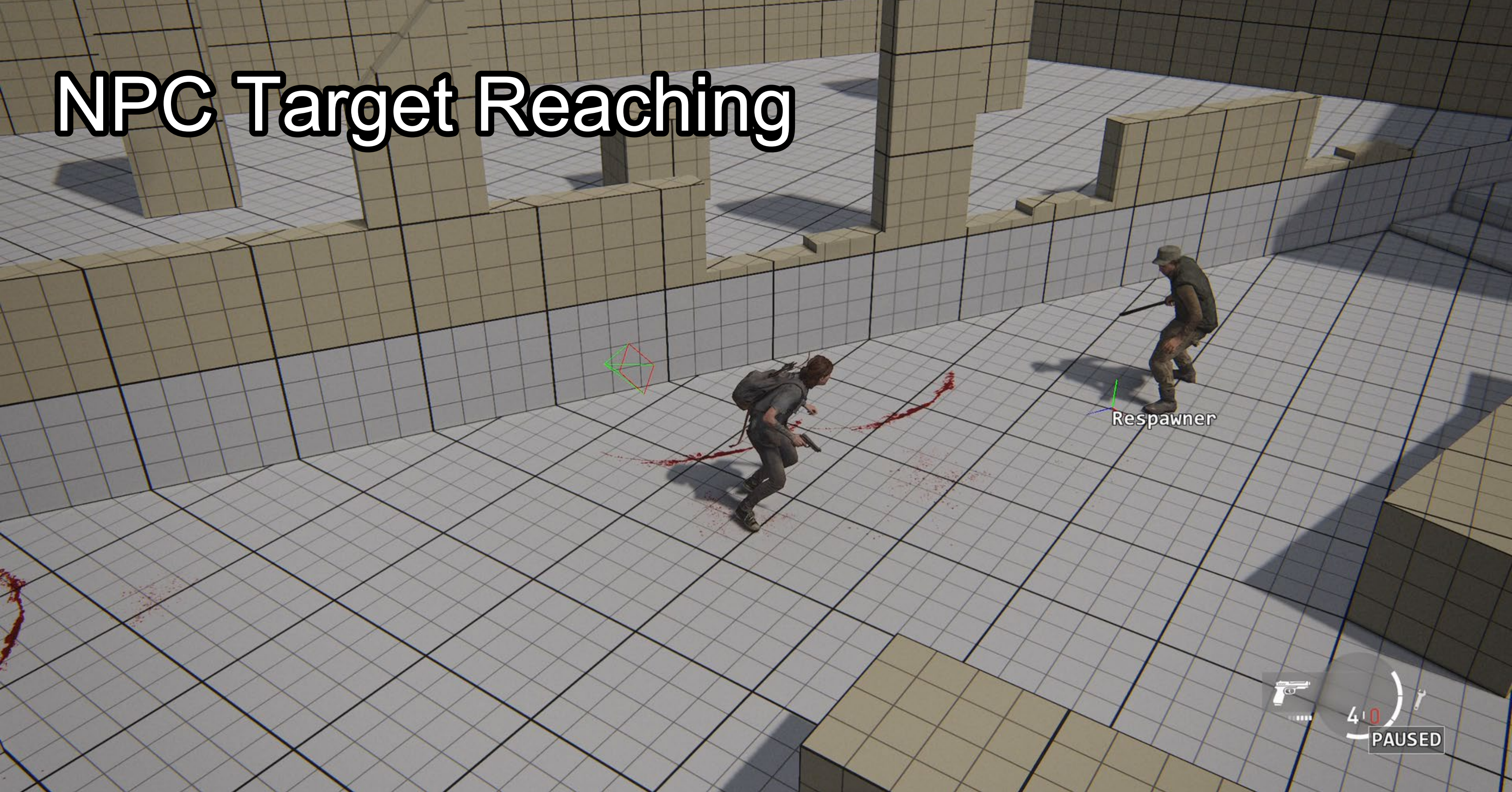
NPC Target Reaching



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NPC Target Reaching



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Player Target Reaching



Wall Moves



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Wall Moves : Wall Probes



Wall Clearance & Features



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Wall Animation Height Adjustment



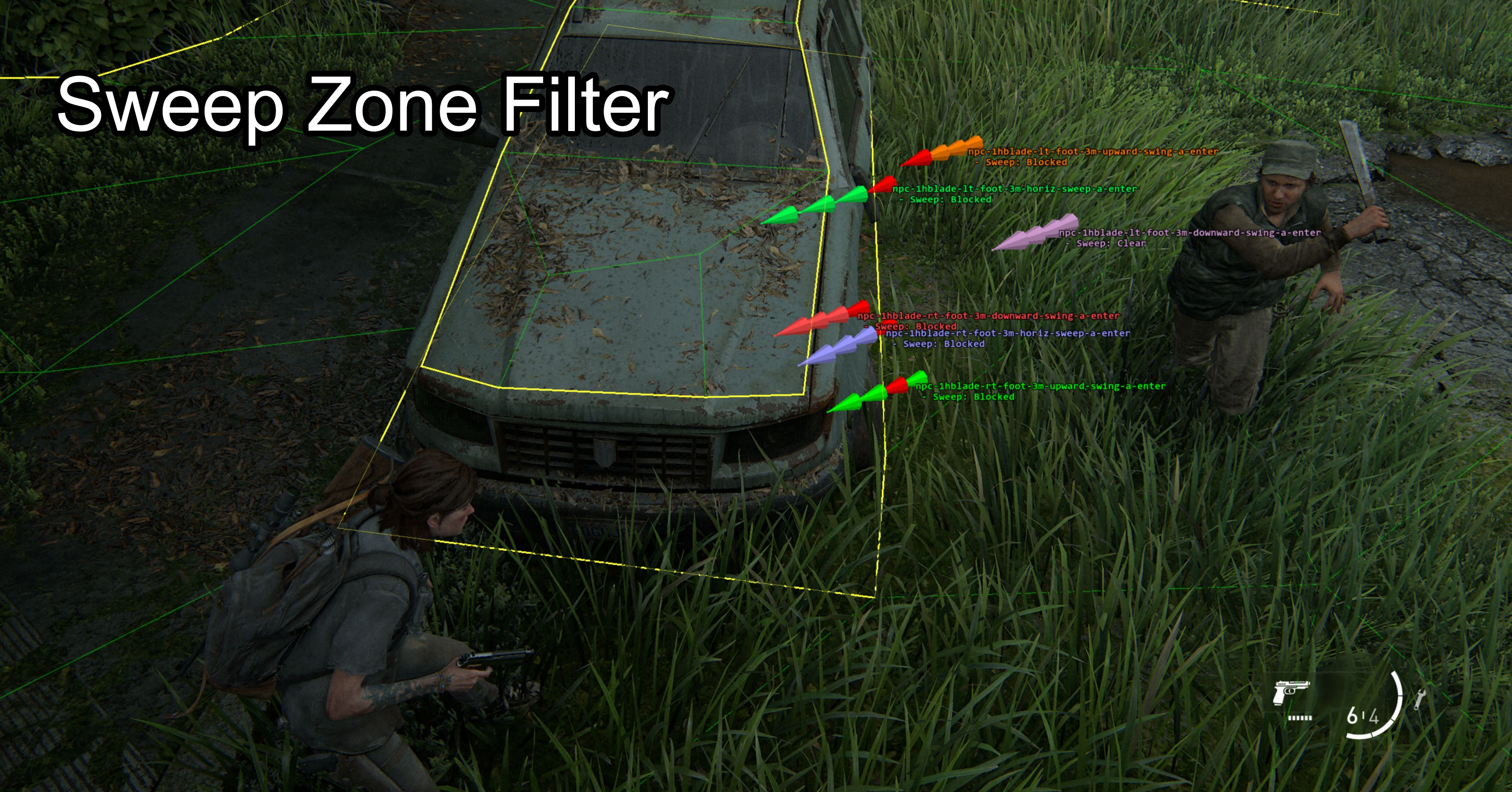
Wall Animation Height Adjustment[®]



Wall Animation Height Adjustment[®]



Sweep Zone Filter



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Summary

- Run-Time Analysis Tools
 - Collision Casts
 - Nav Probes
 - Gameplay Geometric Features
 - Random Animation Evaluation
- Building Blocks
 - Strafe Slots
 - Line of Motion
 - Target Tracking
 - Target Reaching
 - Wall Probes
 - Wall Animation Height Adjustment
 - Sweep Zone Filter

The End

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