

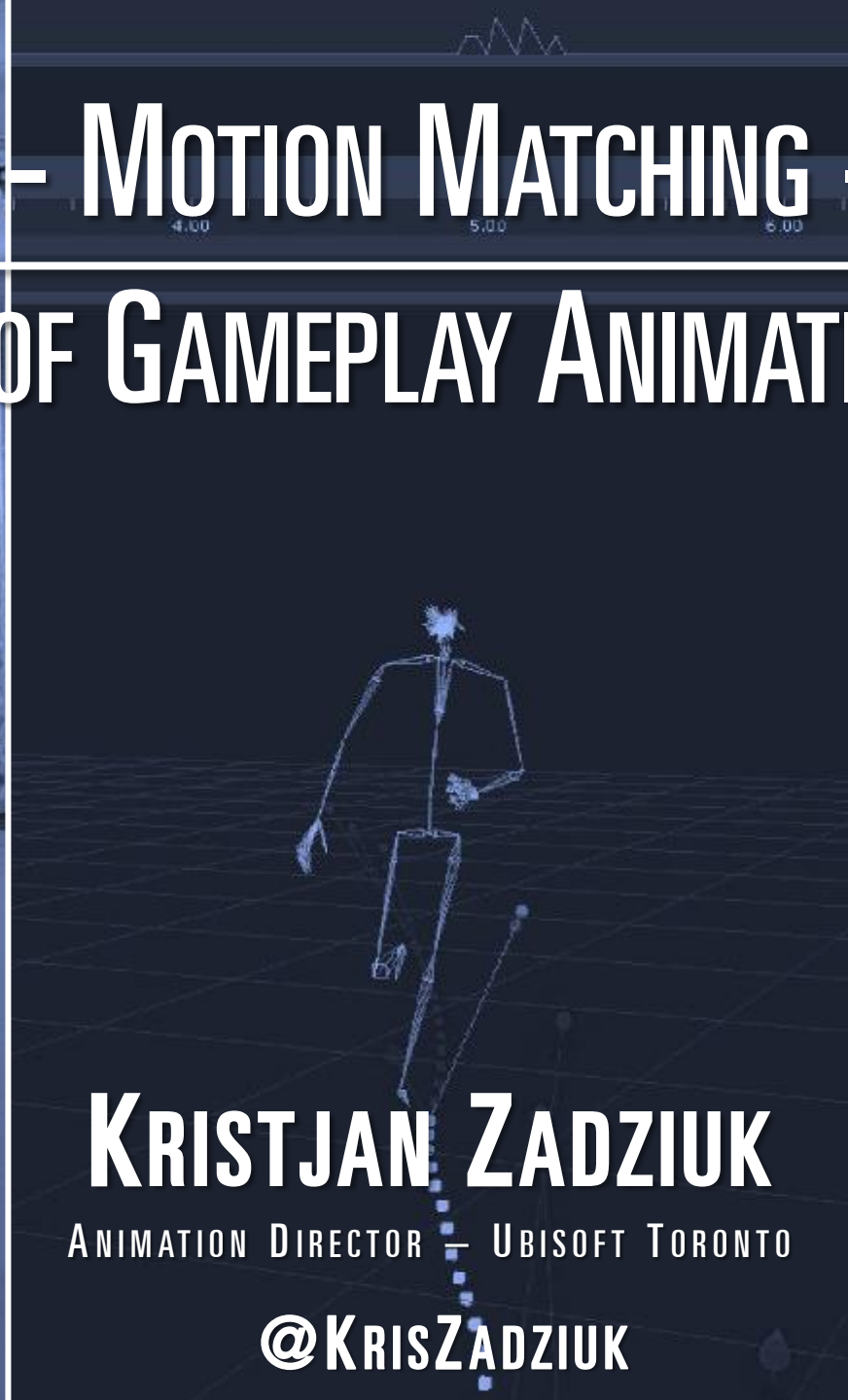


PRESENTER NOTES ARE HERE AS COMMENTS



– MOTION MATCHING –

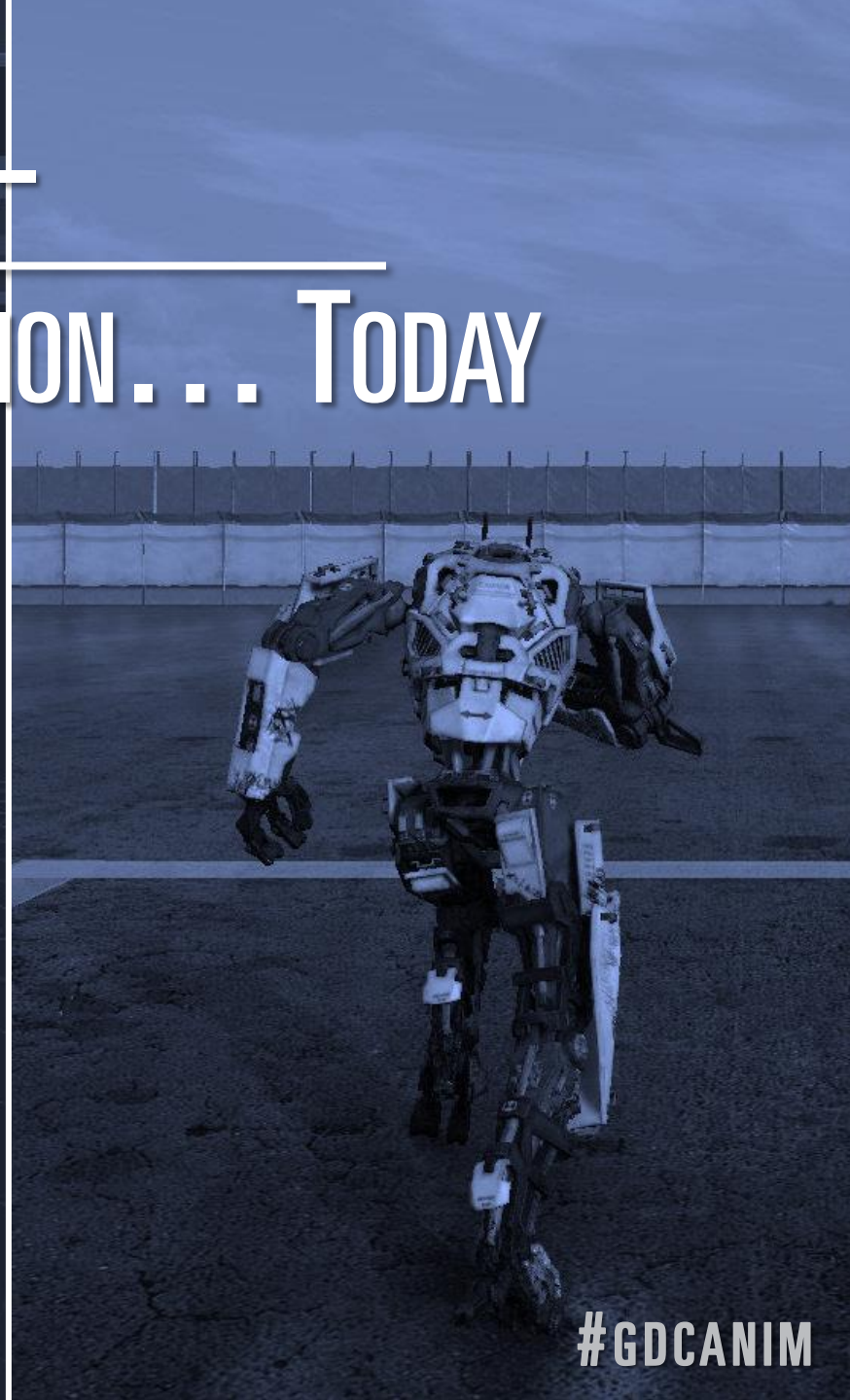
THE FUTURE OF GAMEPLAY ANIMATION... TODAY



KRISTJAN ZADZIUK

ANIMATION DIRECTOR — UBISOFT TORONTO

@KRISZADZIUK



#GDCANIM



WHO AM I?

[2000 — 2004] Hothouse Creations. Bristol, UK.

Who Wants To Be a Millionaire (Multiple)

Casino Inc

Pop Idol / American Idol

Crimelife: Gang Wars

[2004 — 2007] Ubisoft Montreal. Canada.

Assassin's Creed

[2007 — 2008] Pivotal Games. Bath, UK.

Unannounced Project's

[2008 — 2011] Bizarre Creations. Liverpool, UK.

Blur

James Bond 007: Bloodstone

[2011 — Present] Ubisoft Toronto. Canada.

Splinter Cell Blacklist

??????



@KRISZADZIUUK



Disclaimer

Everything you are about to see in this talk is in a prototype gym...

...This presentation demonstrates a new animation prototype, the assets used do not represent any game currently in development at Ubisoft.



the OVERVIEW

1 What is Motion Matching?

2 Process

3 Manipulation

4 Tests

5 Conclusion



What is Motion Matching?



CURRENT PROCESS



1 Motion Capture



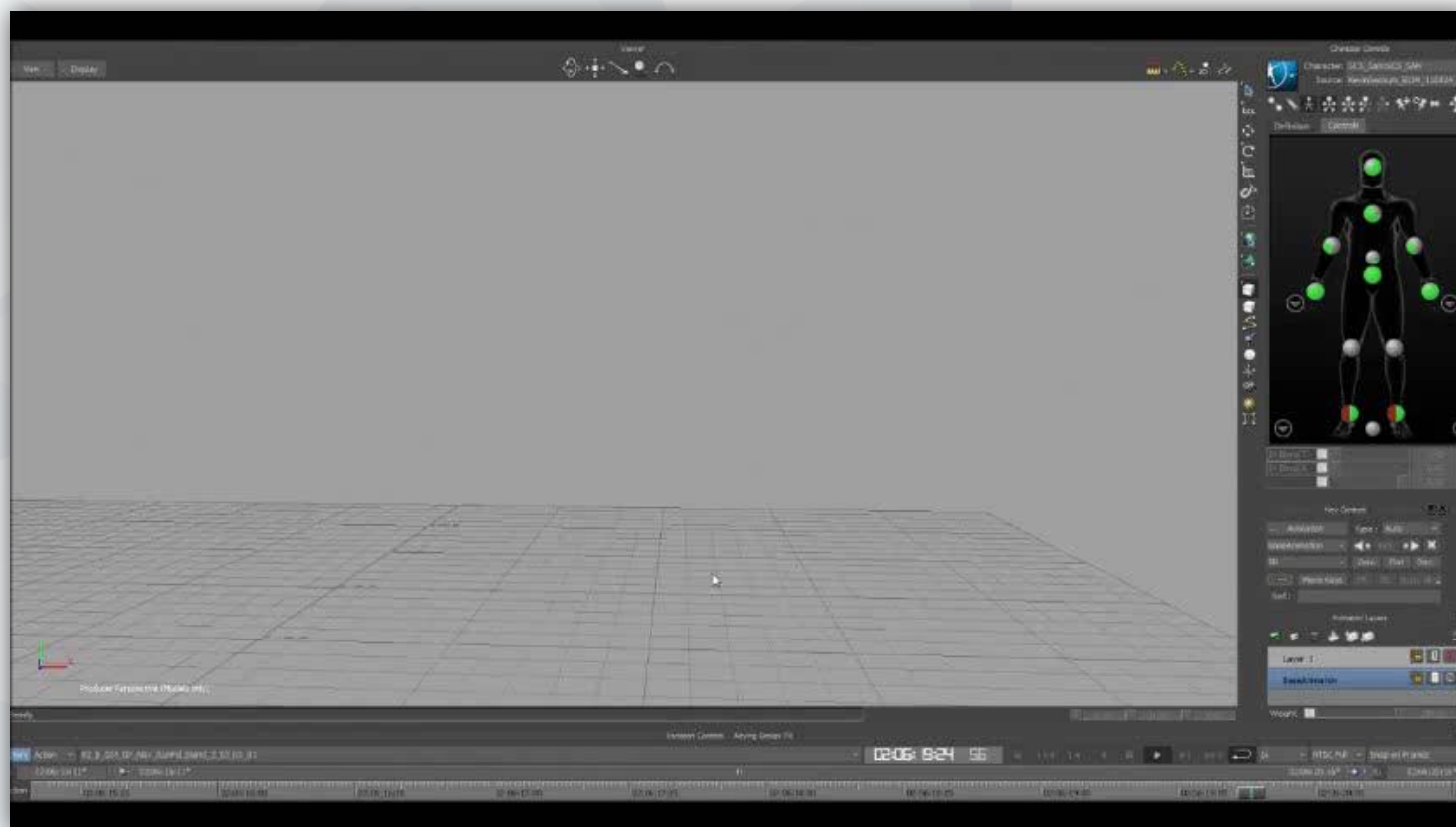


CURRENT PROCESS



1 Motion Capture

2 Manipulation



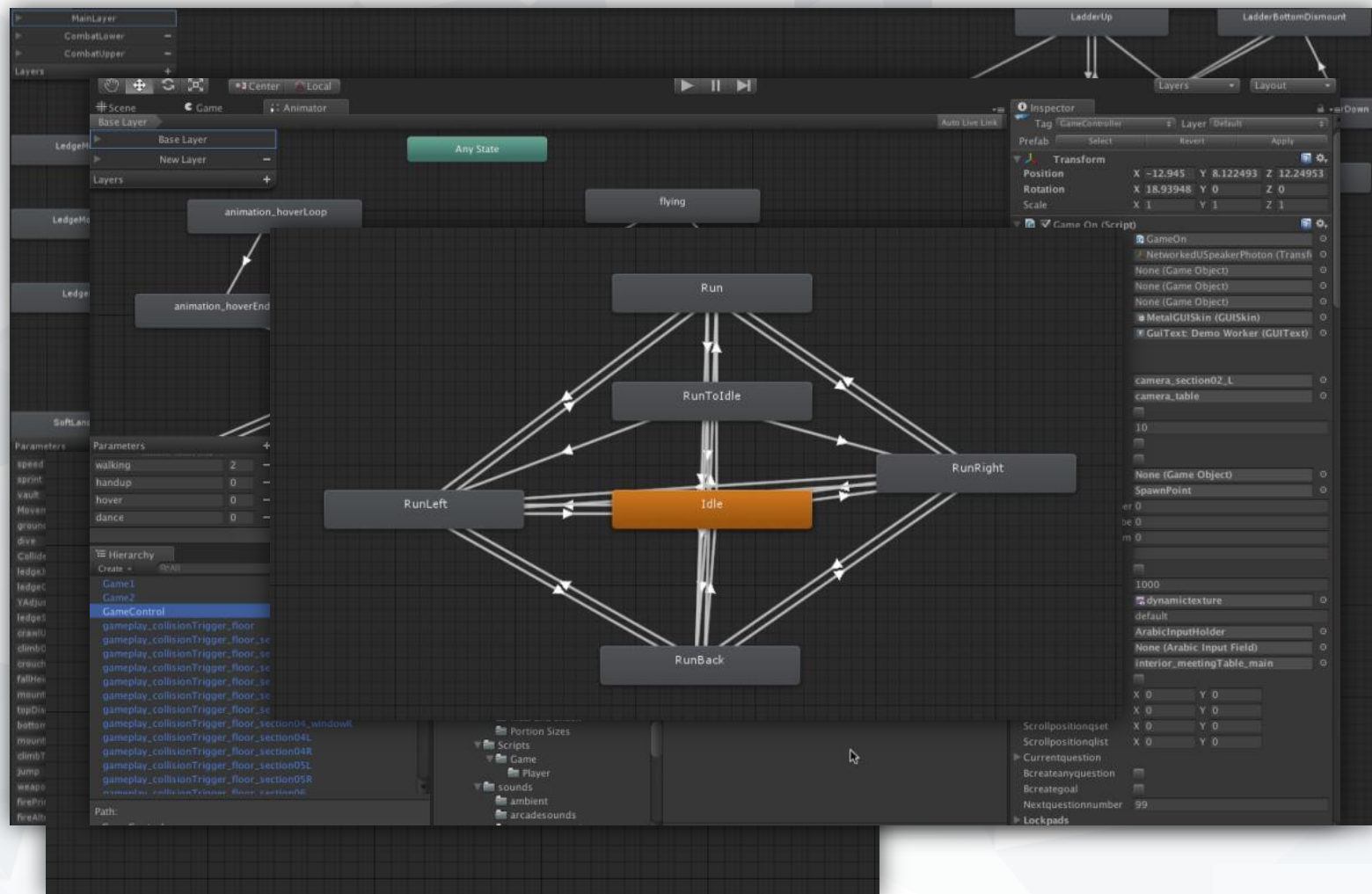


CURRENT PROCESS

1 Motion Capture

2 Manipulation

3 Implementation



CURRENT PROCESS

1 Motion Capture

2 Manipulation

3 Implementation

4 Game





It's time to **EVOLVE.**





WEIGHT SHIFTING



#GDCANIM



WEIGHT SHIFTING



#GDCANIM



Alex Bereznyak



Betina Marquis



Me



Michael Buttner



Mike Wasilewski

#SQUADGOALS

#GDCANIM



MANDATE

4

GOALS



Realism



Control



Simplify



Variety



MANDATE

4

GOALS



Realism



Control



Simplify



Variety



MANDATE



GOALS



Realism



Control



Simplify



Variety



MANDATE



4

GOALS



Realism



Control



Simplify



Variety



MANDATE

4

GOALS



Realism



Control



Simplify



Variety



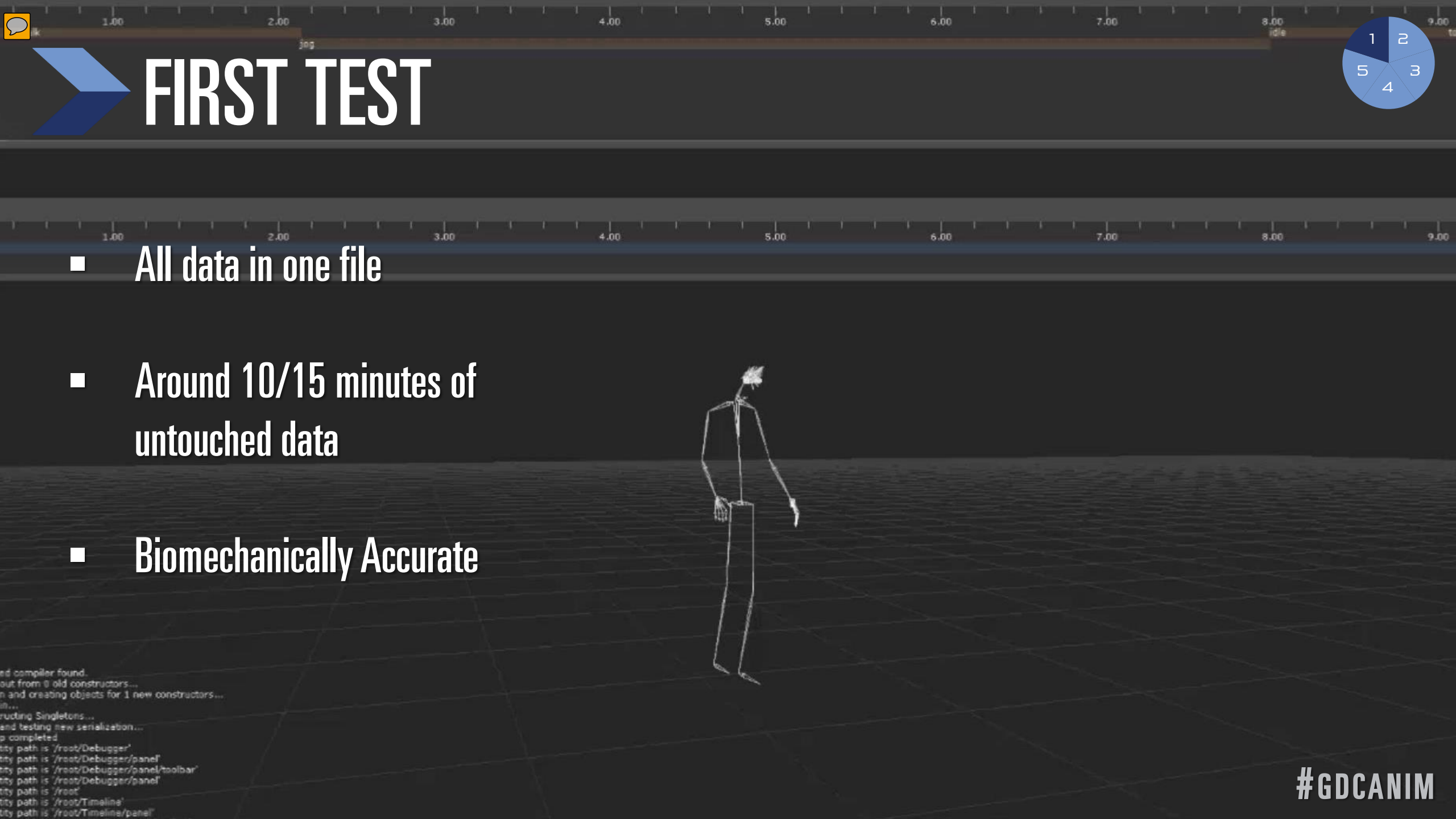
MOTION MATCHING — WHAT IS IT?

Describe a small number criteria
Over set time...

- Root Position / velocity
- Past and Present trajectory
- Joint Positions / velocity
- Tags

... and find an appropriate matching
section in an unstructured library of poses

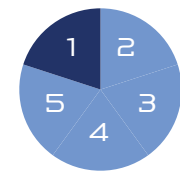




FIRST TEST

- All data in one file
- Around 10/15 minutes of untouched data
- Biomechanically Accurate

```
ed compiler found.  
out from 0 old constructors...  
n and creating objects for 1 new constructors...  
it...  
ructing Singletons...  
end testing new serialization...  
p completed  
ity path is '/root/Debugger'  
ity path is '/root/Debugger/panel'  
ity path is '/root/Debugger/panel/toolbar'  
ity path is '/root/Debugger/panel'  
ity path is '/root'  
ity path is '/root/Timeline'  
ity path is '/root/Timeline/panel'
```



Fears & Assumptions





Fears & Assumptions

1

How does this work?





Fears & Assumptions

2 Will it only work with Motion Capture?





Fears & Assumptions

3

Just plug in data for a finished result





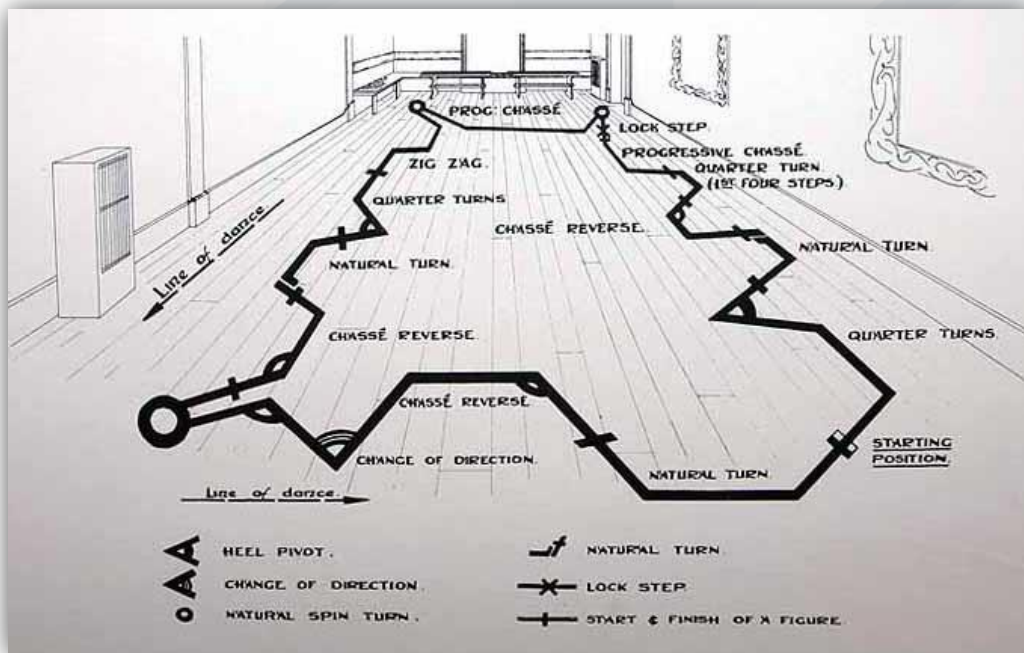
Process



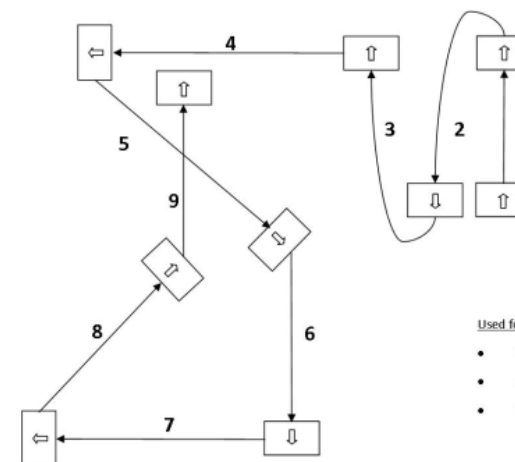


Process - Prep

1 Dance Cards V1.0



BASIC NAV — DIRECTIONS



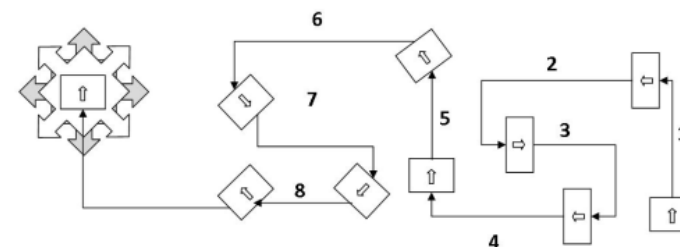
Used for:

- Walk > Jog > Run
- Start Turns
- Plant Turns

BASIC NAV — STOP TO FACE & TURN ON SPOT

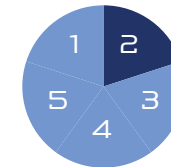
Used for:

- Stopping to face at speed
- Turn on Spot



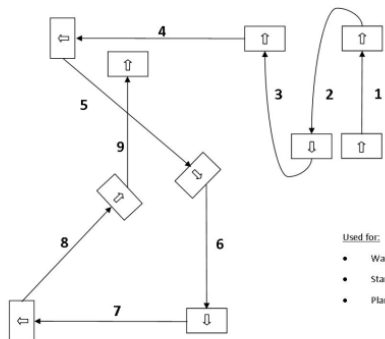


Process - Prep



2 Split files

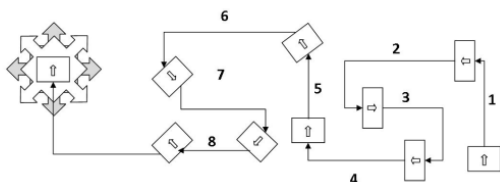
BASIC NAV — DIRECTIONS



Used for:

- Walk > Jog > Run
- Start Turns
- Plant Turns

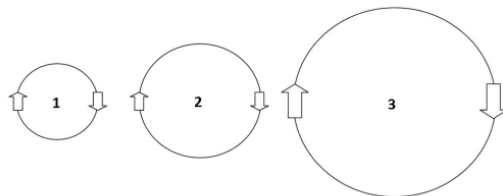
BASIC NAV — STOP TO FACE & TURN ON SPOT



Used for:

- Stopping to face at speed
- Turn on Spot

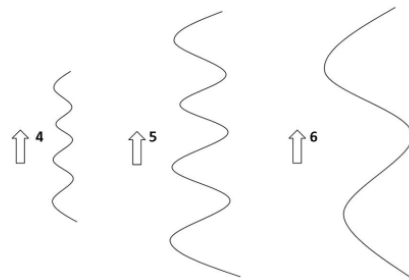
BASIC NAV — CIRCLE NAV



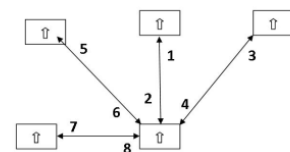
Used for:

- Walk > Jog > Run
- Acceleration / Deceleration

BASIC NAV — SNAKE DIRECTION NAV



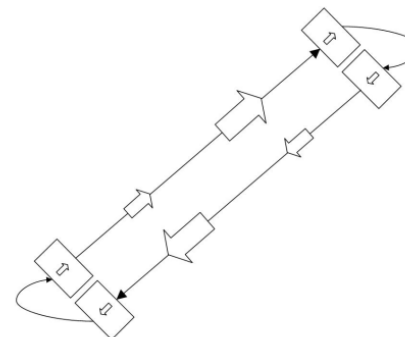
BASIC NAV — STRAFE NAV

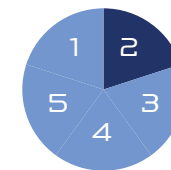


Used for:

- Walk > Jog > Run
- Start / Stop
- Plant Turns

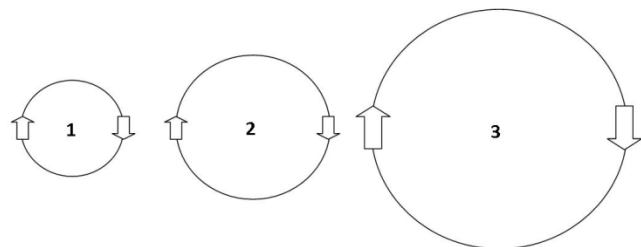
BASIC NAV — ACCELERATE / DECELERATE





Process - Prep — Dance Card V1.0

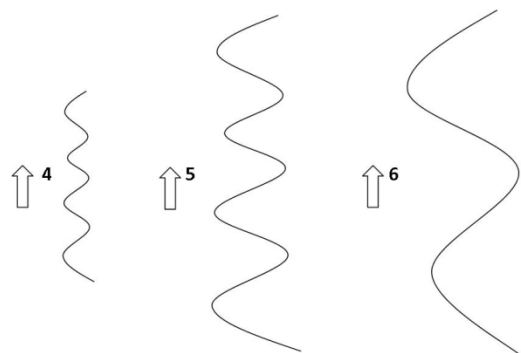
BASIC NAV — CIRCLE NAV



BASIC NAV — SNAKE DIRECTION NAV

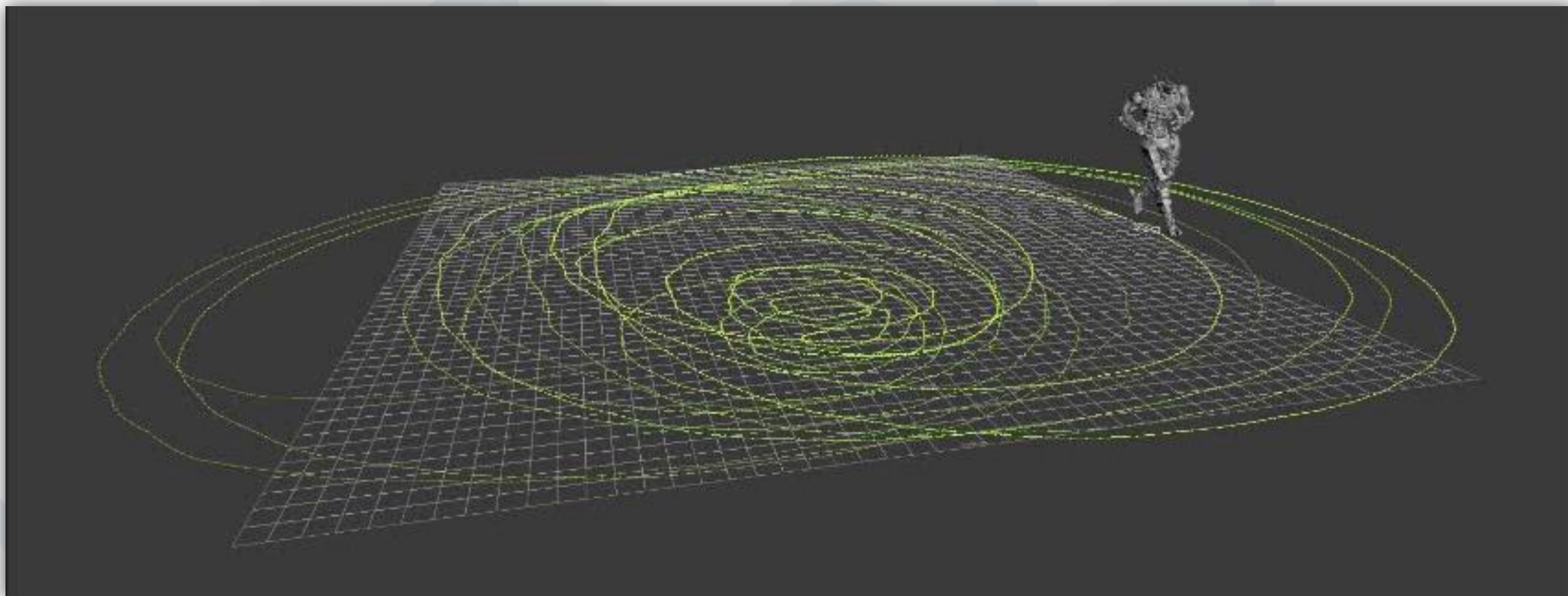
Used for:

- Walk > Jog > Run
- Acceleration / Deceleration





➤ Process - Prep — Dance Card V1.0



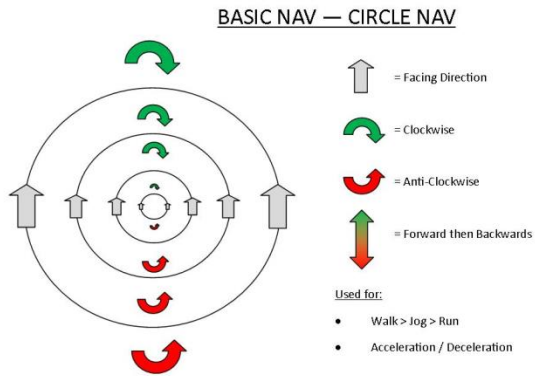


Process - In Engine

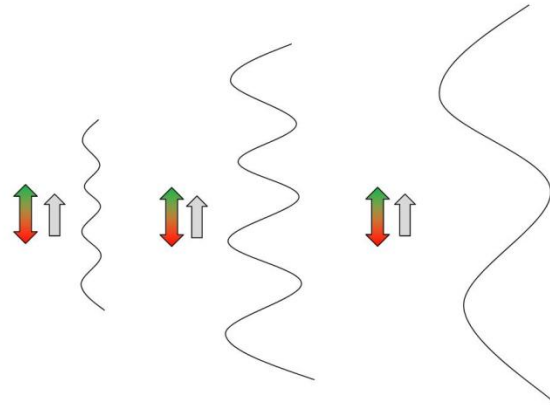


- Player controlled
- No IK on feet
 - Minimal foot sliding and collision
- Using split Dance Card data

Process - Prep — Dance Card V1.2



BASIC NAV — SNAKE DIRECTION NAV

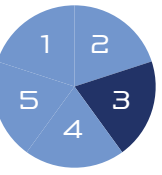




Process - In Engine



- Always facing camera direction
- Reduced/Eliminated Foot Crossover
- Transition between 2nd and 3rd Person



Manipulation



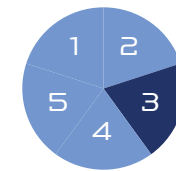


Manipulation - F.A.Q.

1 How can Animators control responsiveness vs quality?

2 Can this be integrated into our existing system?

3 How can Animators work with this system?



Manipulation – Keyframing

What about more unusual locomotion?





Manipulation - Keyframing



Calculated State: ApeNav

State: Movement

```
Blend (0.10/0.20)  
Blend (0.12/0.20)  
Blend (0.15/0.20)  
Anim: mk4_code_ape_jog_strafe_plantturns_01.anim Frame 644  
Anim: mk4_code_ape_jog_strafe_plantturns_01.anim Frame 63  
Anim: mk4_code_ape_jog_strafe_plantturns_01.anim Frame 645  
Anim: mk4_code_ape_jog_strafe_plantturns_01.anim Frame 644  
Trajectory: Translation = 6.40, Rotation = 0.00  
Input: 0.98  
LeadZone: 0.10  
Desired Speed: 5.50  
Actual Speed: 5.65  
External Impulse: 0.00  
Elapsed Time: 0.02  
Supports Strafe: true
```

■ "Ape" Nav



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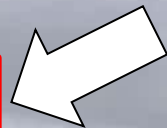
Manipulation - Keyframing



Calculated State: ApeNav

State: Movement

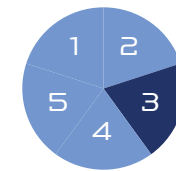
```
Blend (0.10/0.20)  
Blend (0.12/0.20)  
Blend (0.15/0.20)  
Anim: mk4_code_ape_jog_strafe_plantturns_01.anim Frame 644  
Anim: mk4_code_ape_jog_strafe_plantturns_01.anim Frame 63  
Anim: mk4_code_ape_jog_strafe_plantturns_01.anim Frame 645  
Anim: mk4_code_ape_jog_strafe_plantturns_01.anim Frame 644  
Trajectory: Translation = 6.40, Rotation = 0.00  
Input: 0.98  
LeadZone: 0.10  
Desired Speed: 5.50  
Actual Speed: 5.65  
External Impulse: 0.00  
LapsedTime: 0.02  
Supports Strafe: true
```



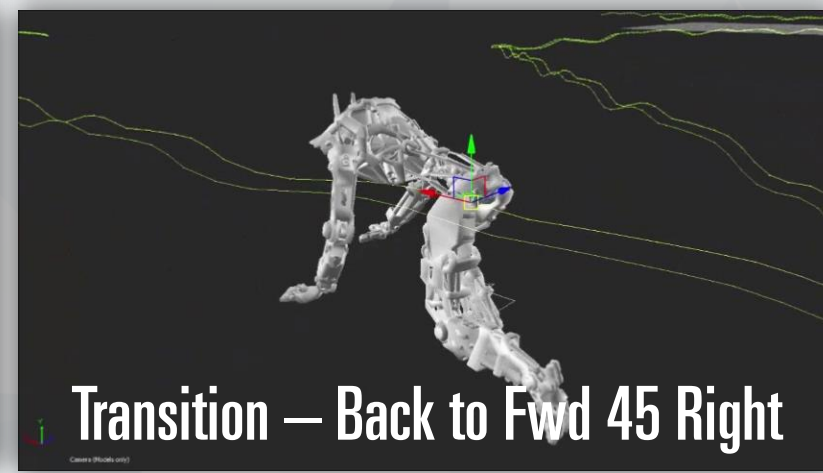
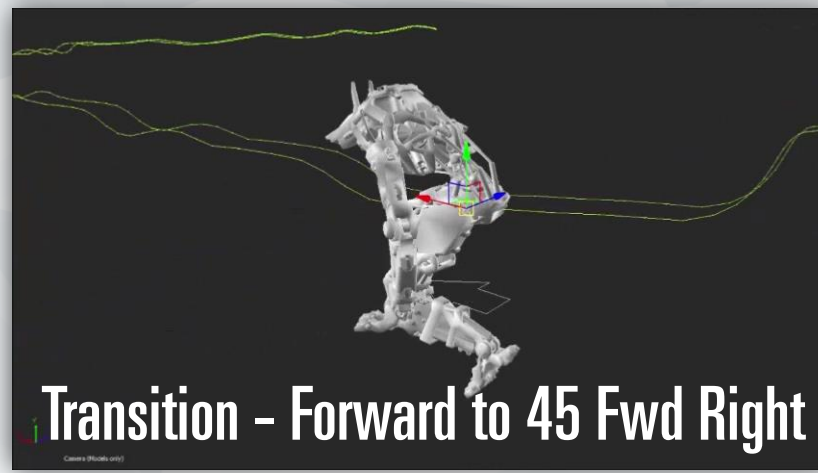
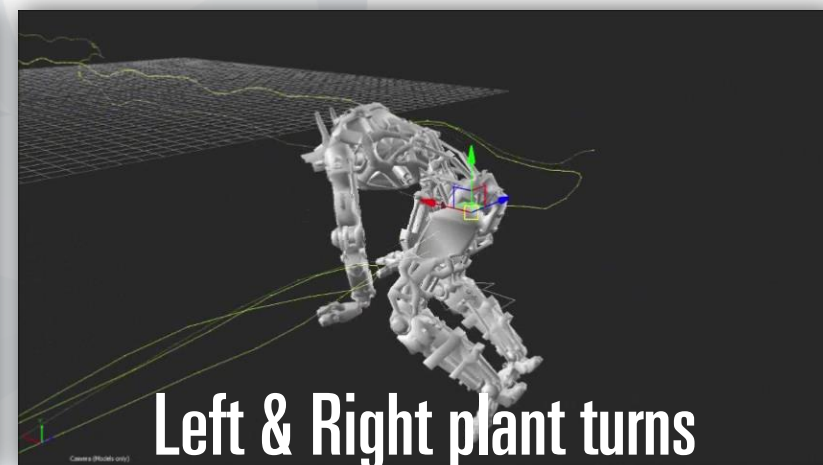
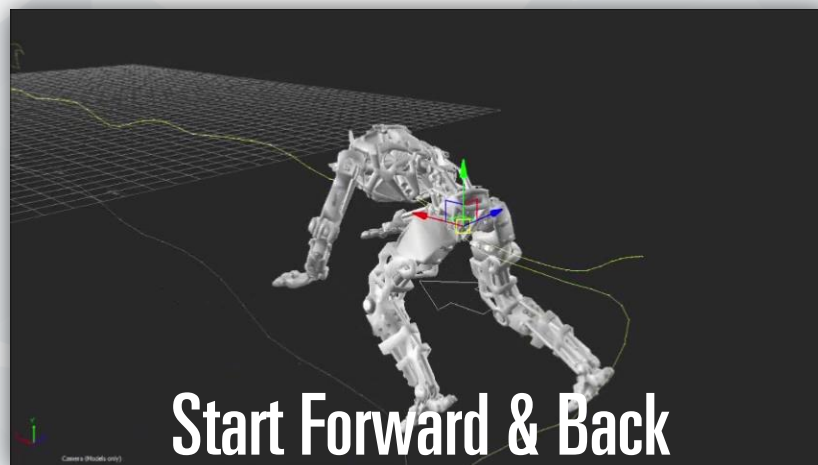
- "Ape" Nav
- 100% Keyframed
- Built loops and created locomotion
 - Story mode in Motionbuilder to follow paths
 - Used to deconstruct Motion Matching

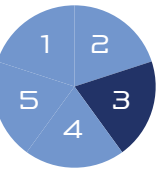


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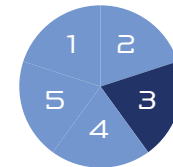
Manipulation – Keyframing



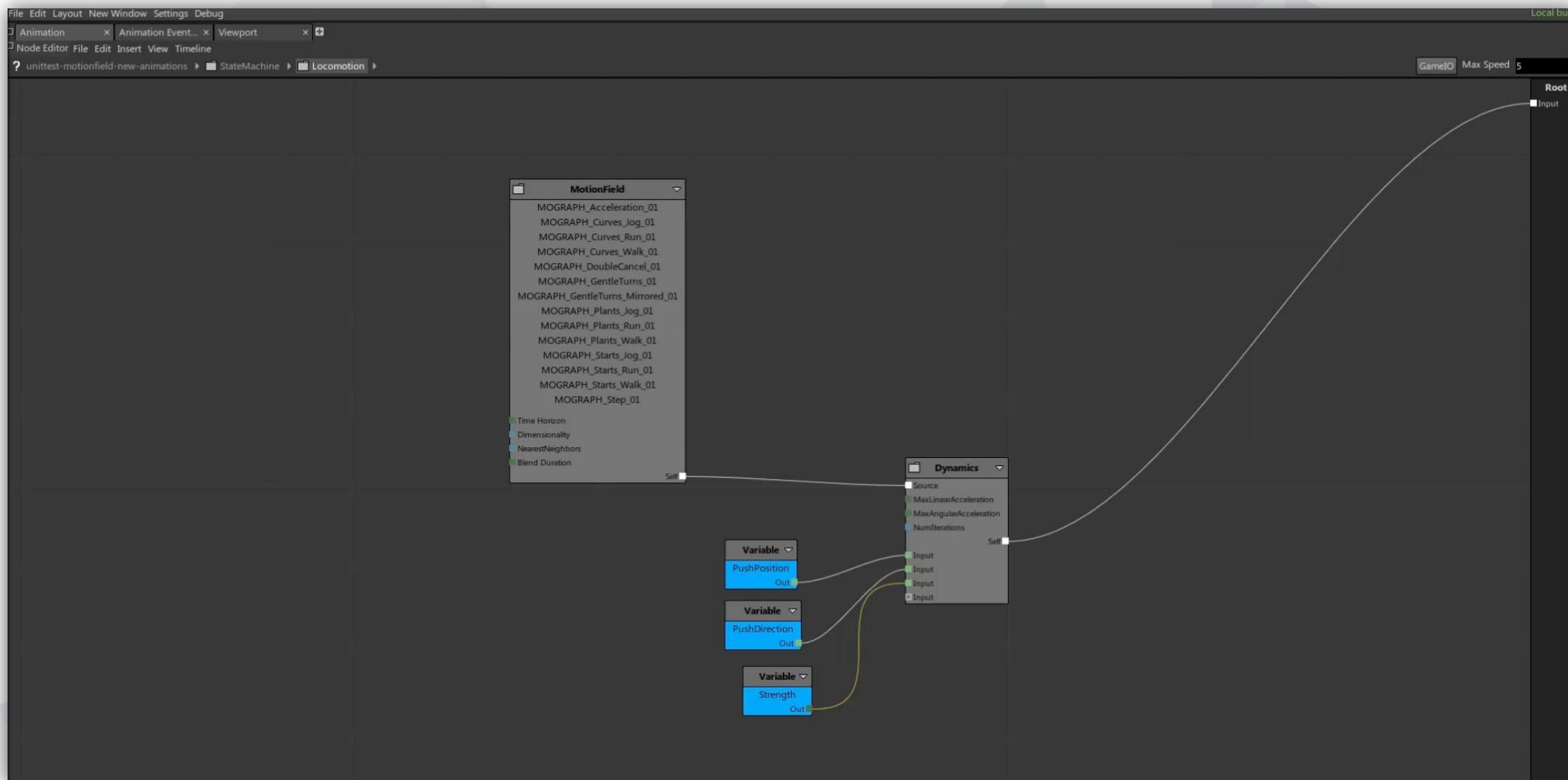


➤ Manipulation – Tagging





Manipulation — Motion Shaders

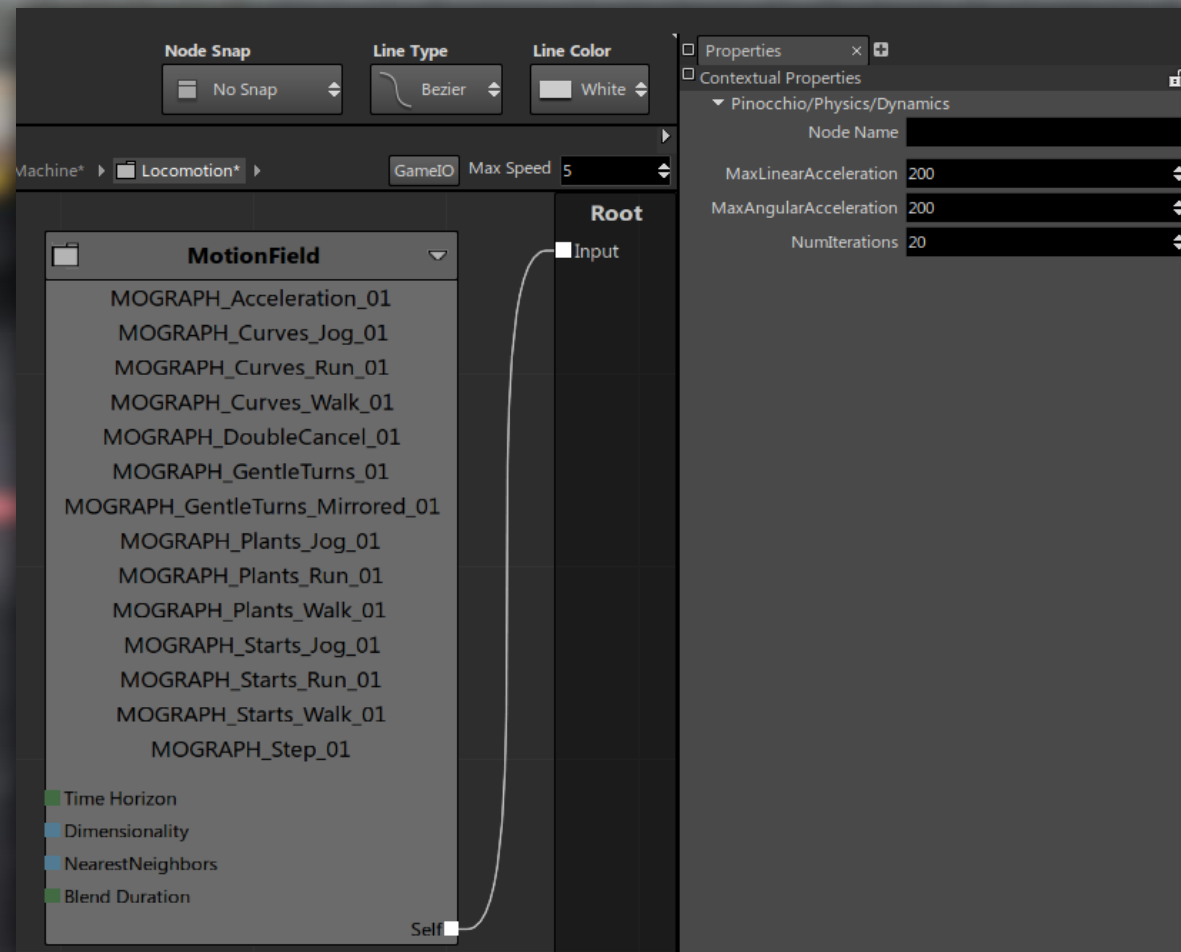




Hybrid System



- Motion Matching as Animation Node
- Great for transitions
- Replacement for entire movement systems





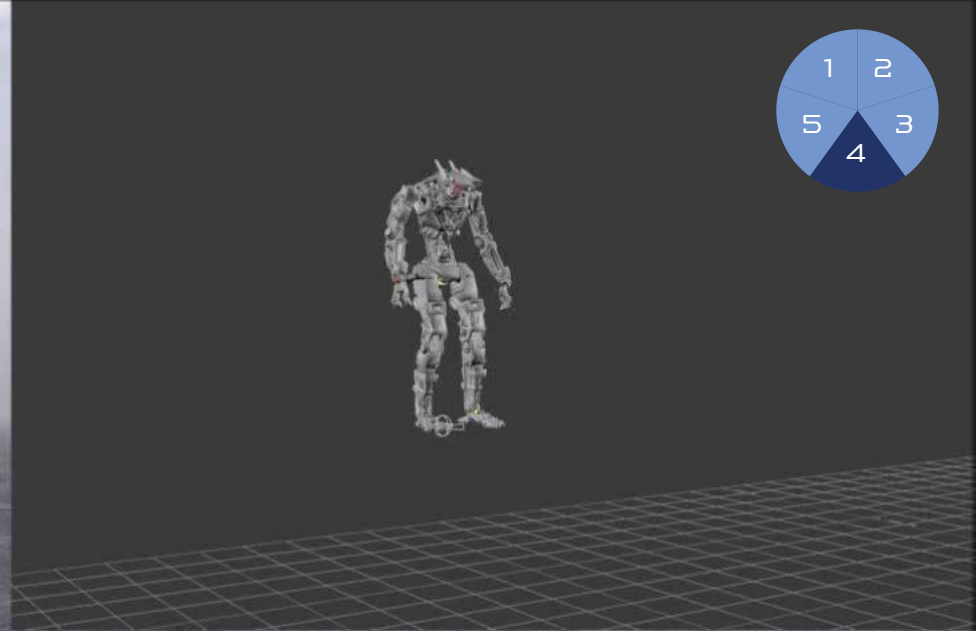
Tests





Tests - Variety - Stumble

If you can think of something as locomotion it will work
with Motion Matching...



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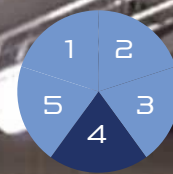
Tests - Variety - Impacts



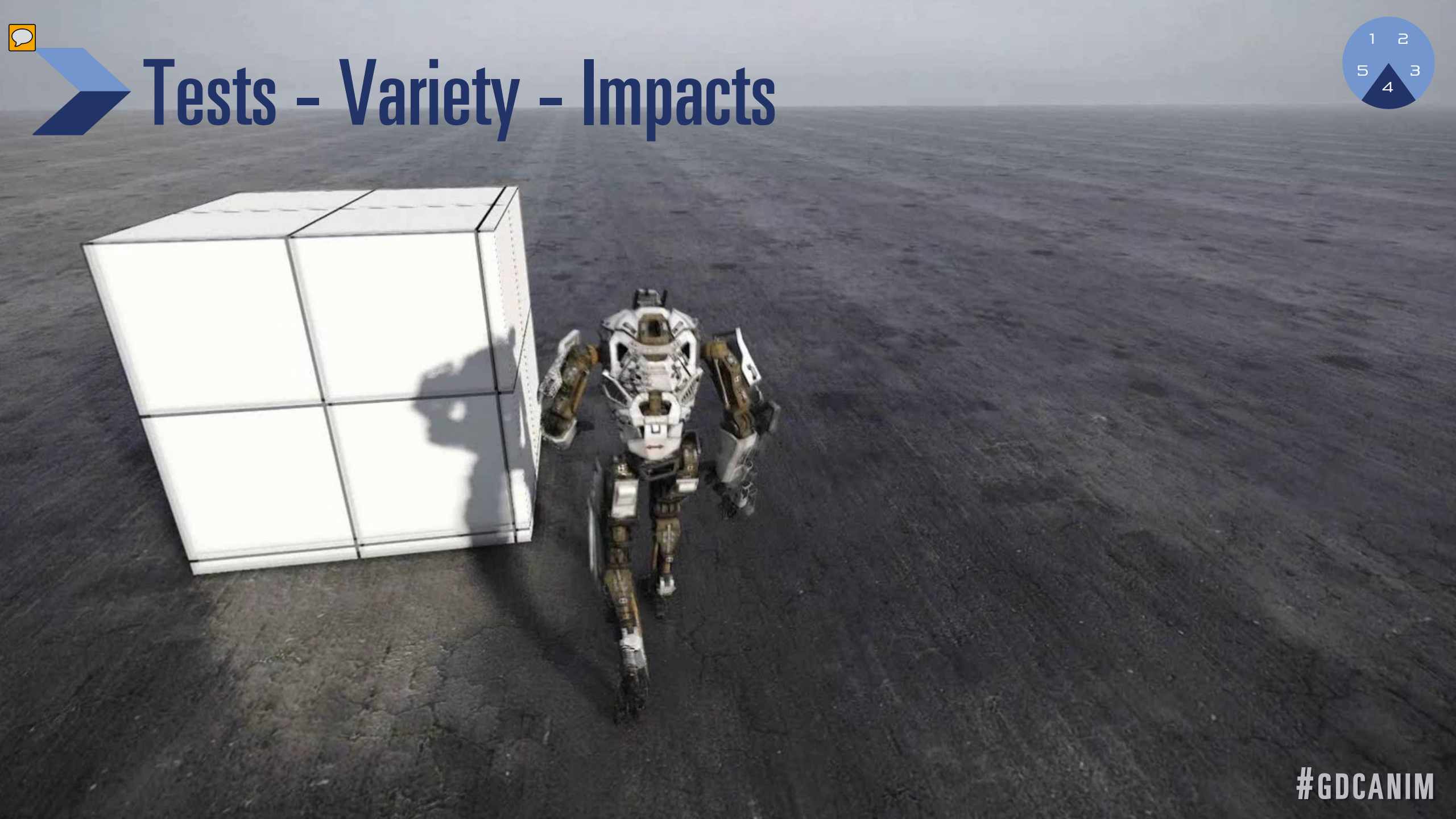
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Tests - Variety - Impacts



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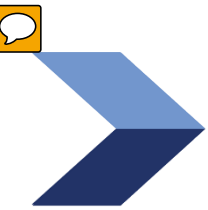
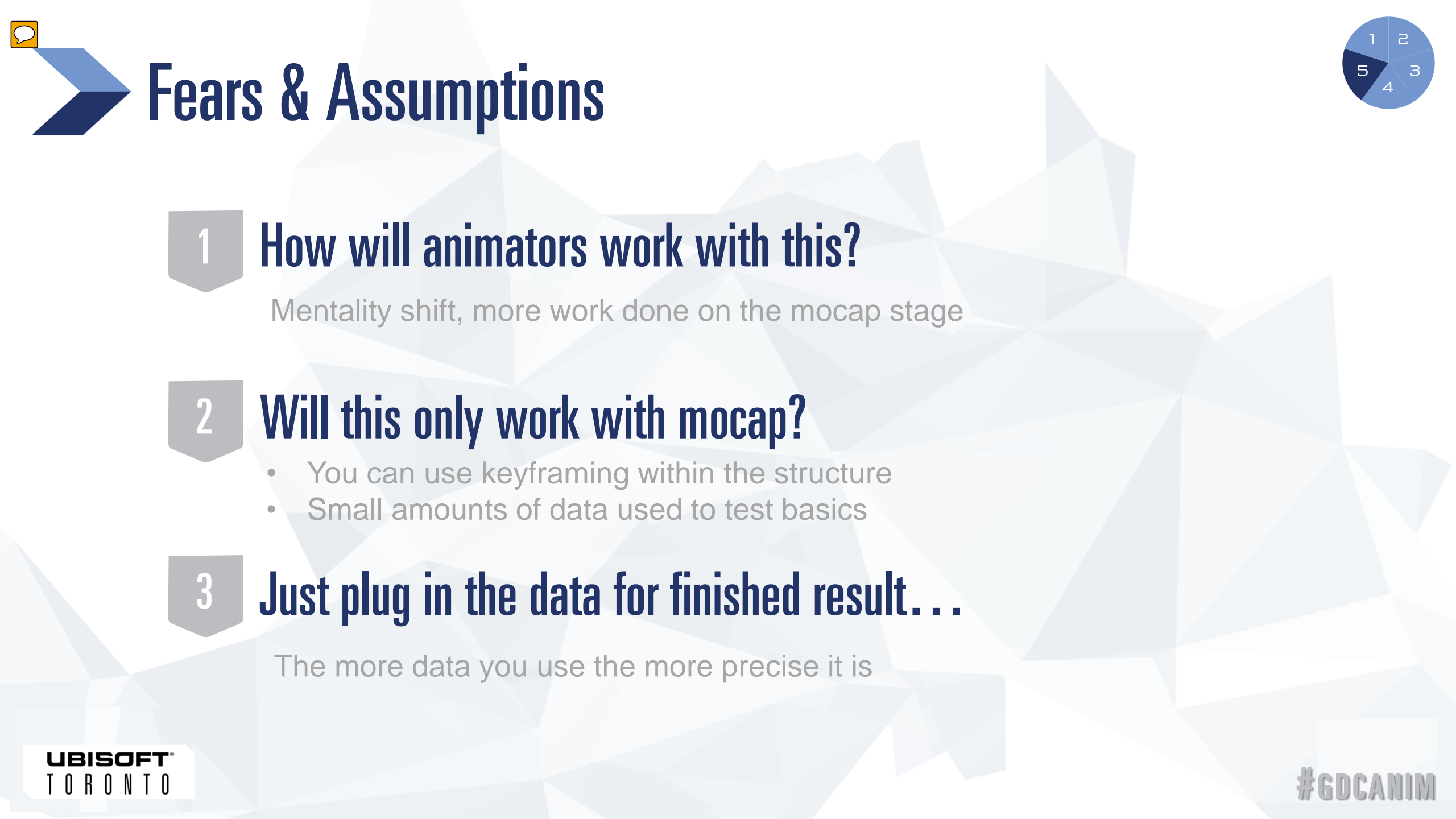


Tests - Variety - Impacts



Conclusion





Fears & Assumptions

1

How will animators work with this?

Mentality shift, more work done on the mocap stage

2

Will this only work with mocap?

- You can use keyframing within the structure
- Small amounts of data used to test basics

3

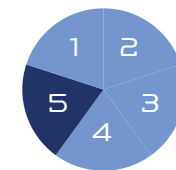
Just plug in the data for finished result...

The more data you use the more precise it is

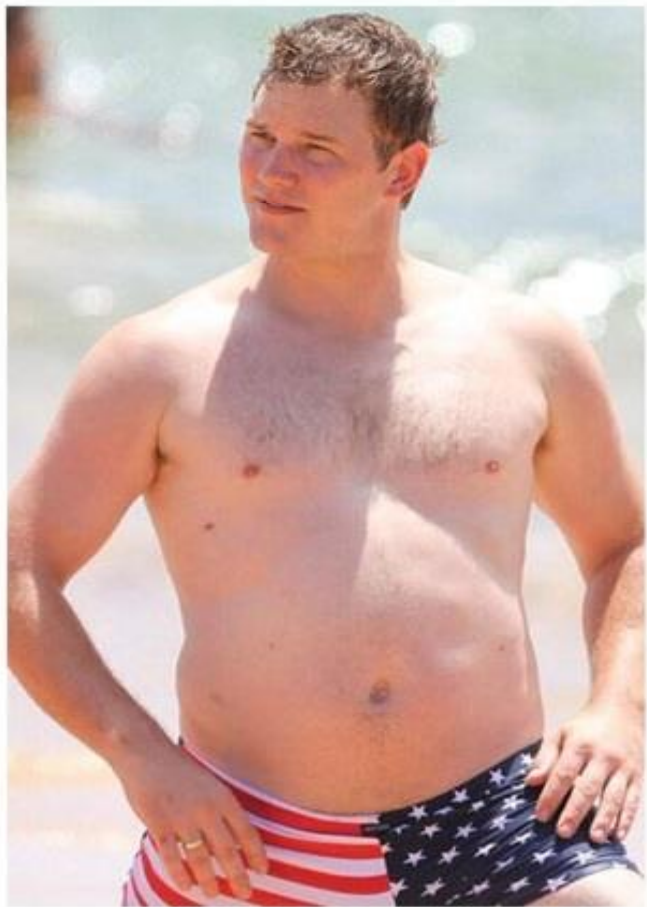


➤ Conclusion - Before and After



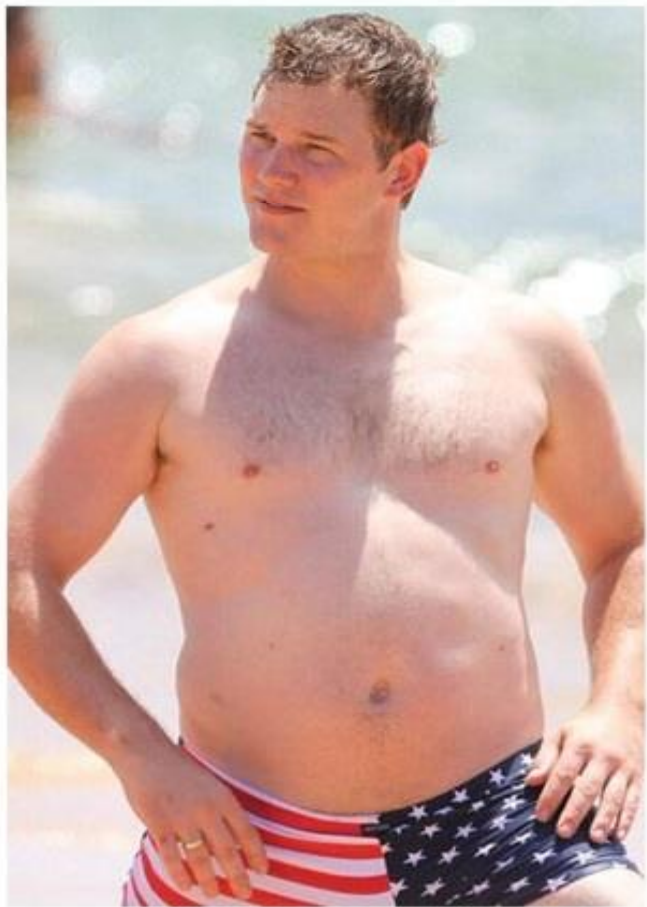


➤ Conclusion - Before and After





Conclusion - Before and After





Conclusion - Successes



1

Simplified Implementation

Rapid prototyping, no need for state machines

2

Higher Quality

Biomechanically correct movement, retaining player control at all times

3

Dance Cards

Clear recipe for getting the most out of the data

4

Variety of Motion

Adding stumbles and impacts



Conclusion - Failures



1

Editing can be Labour Intensive

- Large amounts editing could provide unpredictable results
- Keyframing entire locomotion sets to test would take time

2

Data Heavy

- Large amounts of wasted data to begin with
- Cost and availability of mocap for realistic motion

3

Restricted to Human-like Rigs

- Everything had to use the same rig even in different locomotion states
- All animation full body



Conclusion - Failures



4

Gameplay Constraints

- Quality versus precise player response
- Altering data to aggressively can result in undesirable results

5

Mirroring

- Attempted to increase foot precision with mirroring
- Too much data to make a clear choice

6

Only used for Locomotion so far

- Locomotion has been the main focus
- The goal is to find and implement more uses other than just locomotion



Conclusion - The Future is Now



1

Explore Uses Beyond Locomotion

Traversal / Cover / AI / Jumping etc

2

Hybrid System / Layering

Motion Matching + State Machine to act as a bridge between old and new

3

Further "Dance Card" Improvement

Improvements to the capture process

4

Implementation with Ubisoft Tech/Engines

Allows for improved re-use of data, uneven terrain and multiple rigs



Related Ubisoft Talks

IK RIG: PROCEDURAL POSE ANIMATION

ALEXANDER BEREZNYAK - TECHNICAL ART DIRECTOR, UBISOFT TORONTO

WEDNESDAY MARCH 16TH / 5.00PM — 6.00PM / ROOM 2016 / WEST HALL



MOTION MATCHING: THE ROAD TO NEXT-GEN ANIMATION

SIMON CLAVET — ANIMATION PROGRAMMER, UBISOFT MONTREAL

THURSDAY MARCH 17TH / 11.30AM — 12.30AM / ROOM 3016 / WEST HALL





It's just the beginning

Thank you!



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@KRISZADZIUK

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