# SWORD BROS POSTMORTEM: Making a small physics sword fighting game

Drew Wallace (@_drew_wallace)
Designer/Programmer

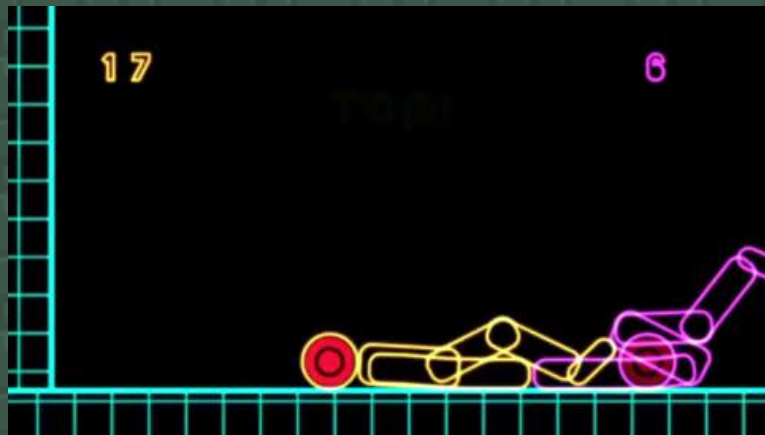Philly Game Mechanics 12/7/17

# SWORD BROS

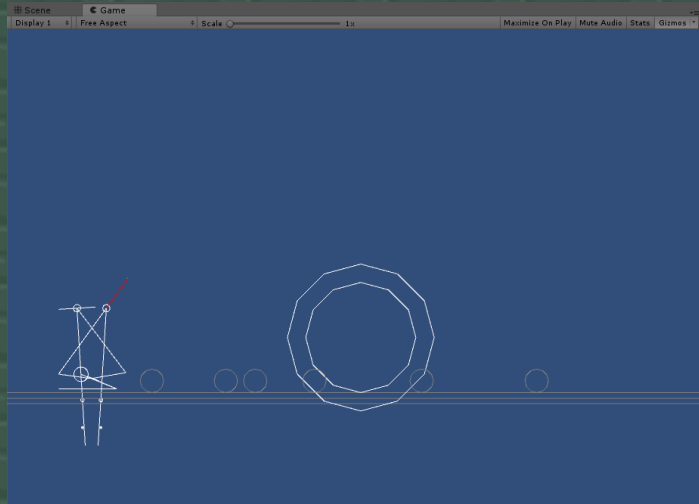is physics-based freeform sword fighting at breakneck speeds.

# the vision:
# "physics-based sword fighting"

2013: Get on Top (Bennett Foddy)



6/25/15: development begins on "Sword Puppet"

7/6/15:
- switched from Unity to Flint (Final Form Games engine)
- added slicing



7/9/15:
- added pvp
- added Warrior (Kesha track)
- demoed at dev night

August 2015: showed privately at PAX

October 2015: feature complete

(September 2015 – June 2017: College)

November 2017: released

# the vision:
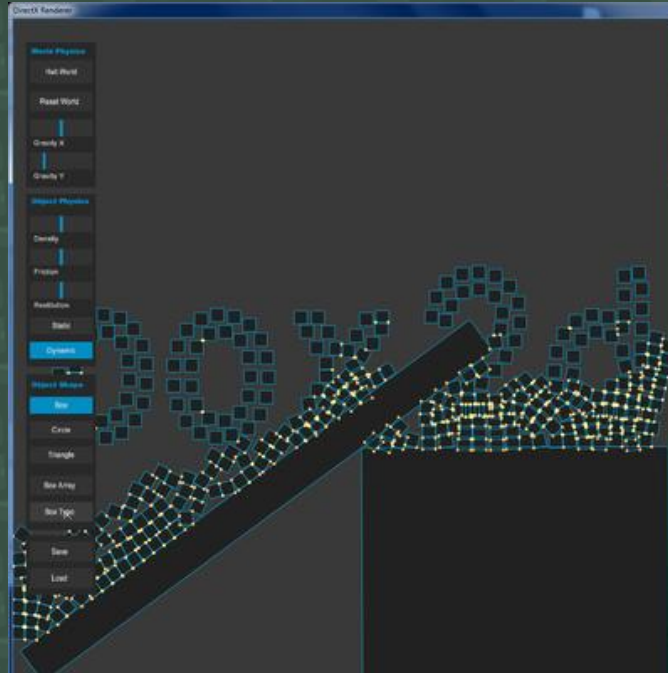# "physics-based sword fighting"

Swords must always…

A. collide with each other

B. seem to have weight
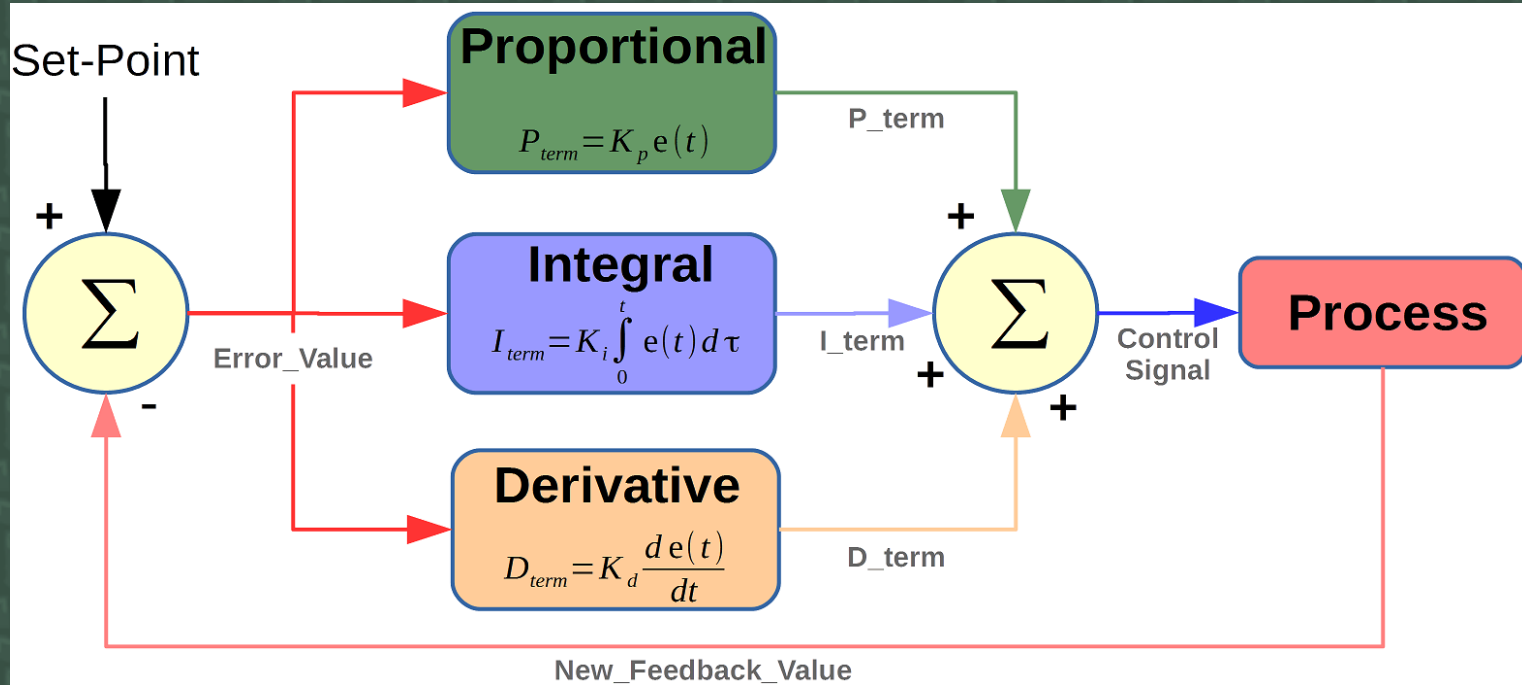
But also…

C. follow the analog stick

D. respond immediately to input

# Sword Collisions

# Sword controls: PID controller

# PID controller

force =

p*(signed distance) ⟵ spring

+ d*(relative velocity) ⟵ damping

+ i*(integral of signed distance) ⟵ extra correction

Swords must always…

A. collide with each other

B. seem to have weight

But also…

C. follow the analog stick

D. Respond immediately to input

Swords must always…
A. collide with each other
But also…
C. follow the analog stick

Sword center of mass in the hilt
Inelastic collisions

Swords must always…
B. seem to have weight
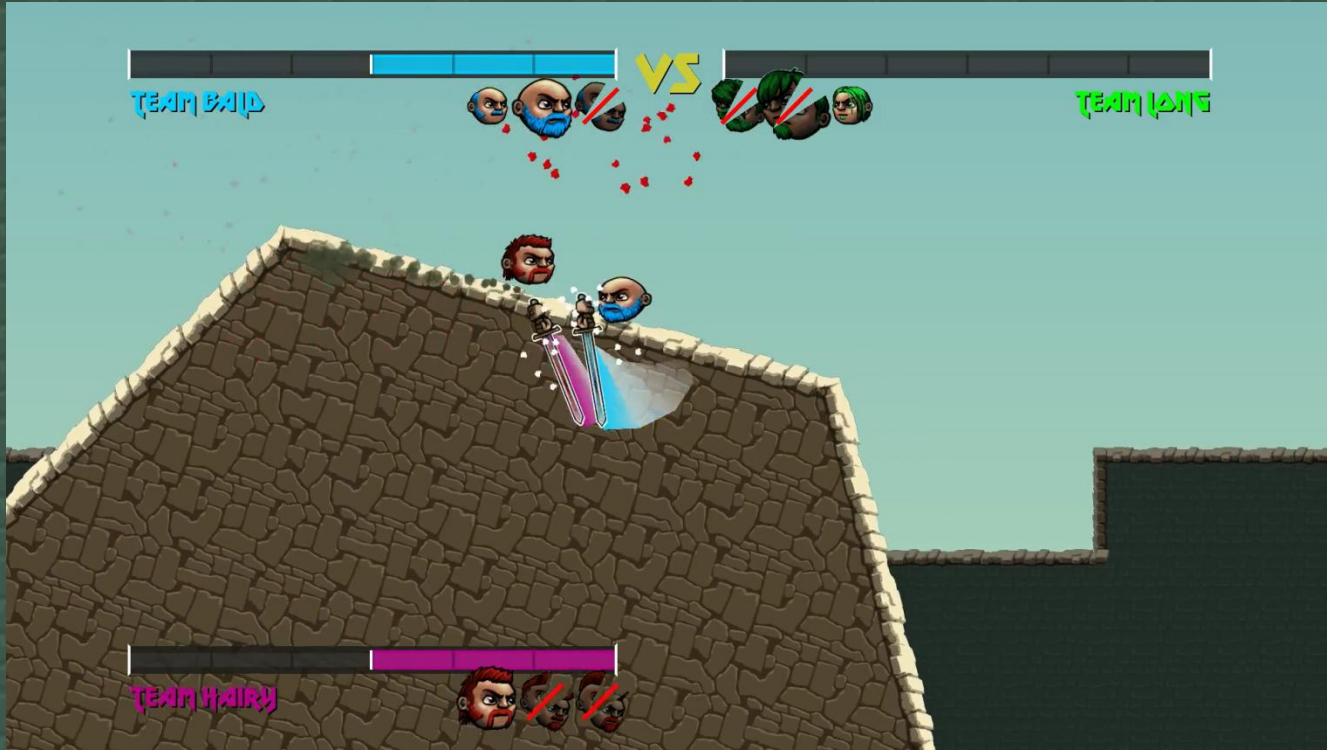But also…
D. respond immediately to input

Hands respond faster than blade

# Sword center of mass in the hilt

# Hands respond faster than blade

# Fantasy sword physics



Good: sword hits



Also good: sword locks



BAD: weak sword bounces

# Fantasy sword physics

A sword becomes 5x-10x heavier:

— during long swings

— when swinging fast

— when player is moving fast

— when far away from the joystick direction ("pushing harder")

# Fantasy sword physics

```lua
1   Classes.Weapon = Class(LevelObject)
2
3   -- mass/moment
4   Weapon.baseMoment = 210
5   Weapon.maxMoment = 1210
6   Weapon.baseMass = 4
7   Weapon.maxMass = 40
8
9   -- general controls
10  Weapon.baseMaxSwingTorque = 0
11  Weapon.maxSwingTorque = 4000
12  Weapon.maxSwingStopTorque = 2000
13  Weapon.maxSwingForce = 2500
14
15  -- PID control variables
16  Weapon.rotPGain = 180
17  Weapon.rotIGain = 0
18  Weapon.rotDGain = 15
19
20  Weapon.posPGain = 3000
21  Weapon.posIGain = 0
22  Weapon.posDGain = 75
23
24  Weapon.torqueMult = 0.3
25
26  -- general controls
27  Weapon.maxPosRotSpeed = math.pi*2 * 0.9
28
29  -- force response on pawn
30  Weapon.swordResponseForceMult = 15
31  Weapon.maxSwordResponseForce = 0
32  Weapon.maxSwordResponseAwayForce = 68354
33  Weapon.onGroundSwordResponseForceMult = 0.7
34
```

# Sword controls work... what now?

# Yomi, RPS, and Fighting Games

# Yomi

"Yomi" is the Japanese word for "reading," as in reading the mind of the opponent.

If you have a powerful move and use it against an unskilled opponent, I call that Yomi Layer 0, meaning neither player is even bothering with trying to know what the opponent will do.

At Layer 1, your opponent does the counter to your move because they expect it.

At Layer 2, you do the counter to their counter.


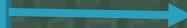- David Sirlin, **Balancing Multiplayer Games**

# Yomi 0



Direct attack

# Yomi 1

Arrow: "is countered by"

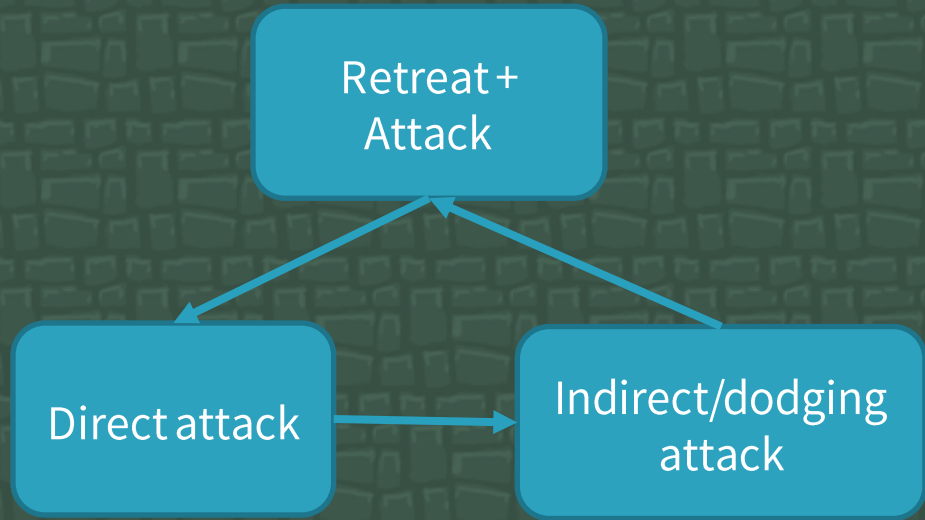Direct attack → Indirect/dodging attack

# Yomi 2

Retreat + Attack

Direct attack

Indirect/dodging attack
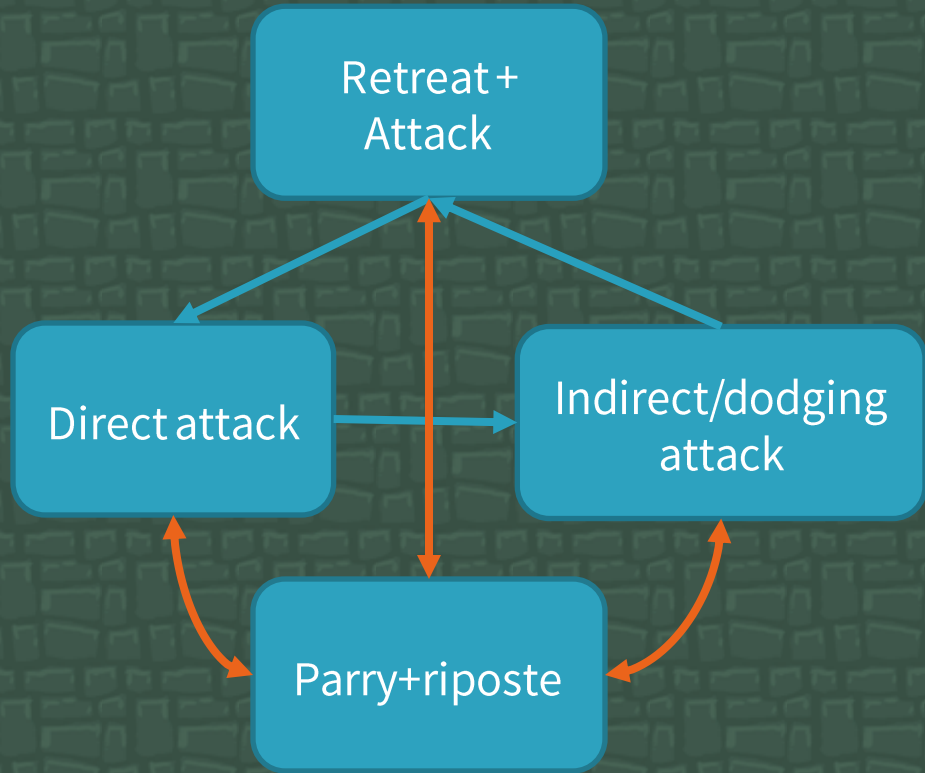
Arrow: "is countered by"

# Rock Paper Scissors

"There are noticeable patterns based on the outcome of the previous round – there is a slight tendency to keep the same move after winning, and to pick a new move after losing (win-stay/lose-shift).

My real goal is to efficiently discover what I'm up against – a complete fish who always plays rock, a standard donkey playing w-s/l-s, a medium sized shark playing (w-s/l-s)' or a killer with the capacity of identifying my own gear-changing strategy and adapting to *me*."

- Frank Lantz, Nothing Beats Rock

# Yomi ???



Retreat + Attack

Direct attack

Indirect/dodging attack

Parry+riposte

**Arrow: "is countered by"**
**Double arrow:**
   **high ground advantage**

I'm a way better dev now.

~~I should start over.~~

I should improve what's important.

# Small changes that matter

# Movement polish



October 2015

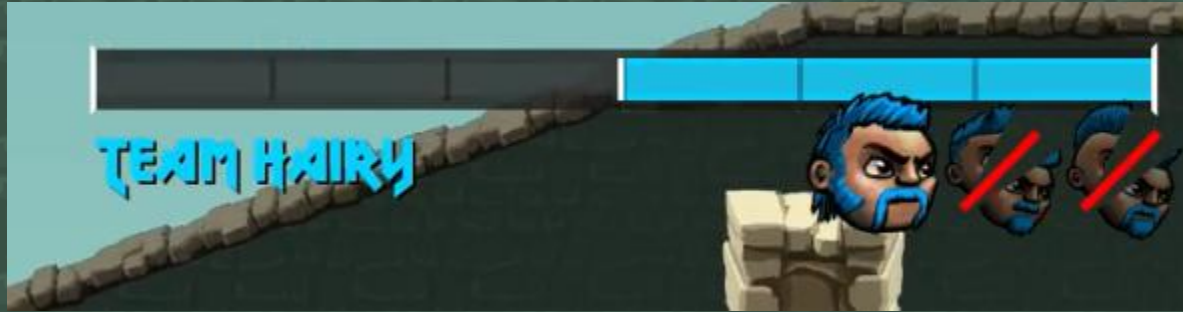November 2017

# Sword below body



October 2015

November 2017

# Doubled health totals

October 2015

November 2017

# Big changes that failed

Sword controller rewrite -> not as good!

Single-player -> not as fun!


Also:

hats, other weapons, other modes, etc etc etc

# Recommended Stuff

Get On Top (Sportsfriends version) - Bennett Foddy

A Tale of Two Jousts: Multimedia, Game Feel, and Imagination - Douglas Wilson

Nothing Beats Rock - Frank Lantz

Life and Death and Middle Pair - Frank Lantz

Balancing Multiplayer Games - David Sirlin

2-player games - Michael Brough

Banned and Restricted Lists - Magic: The Gathering Team

# Super huge thanks

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