(Presented at Playful Learning Summit, Ohio University, April 10, 2014)

Carnegie Mellon University
Entertainment Technology Center

Science Games for Pre-K through Grade 3

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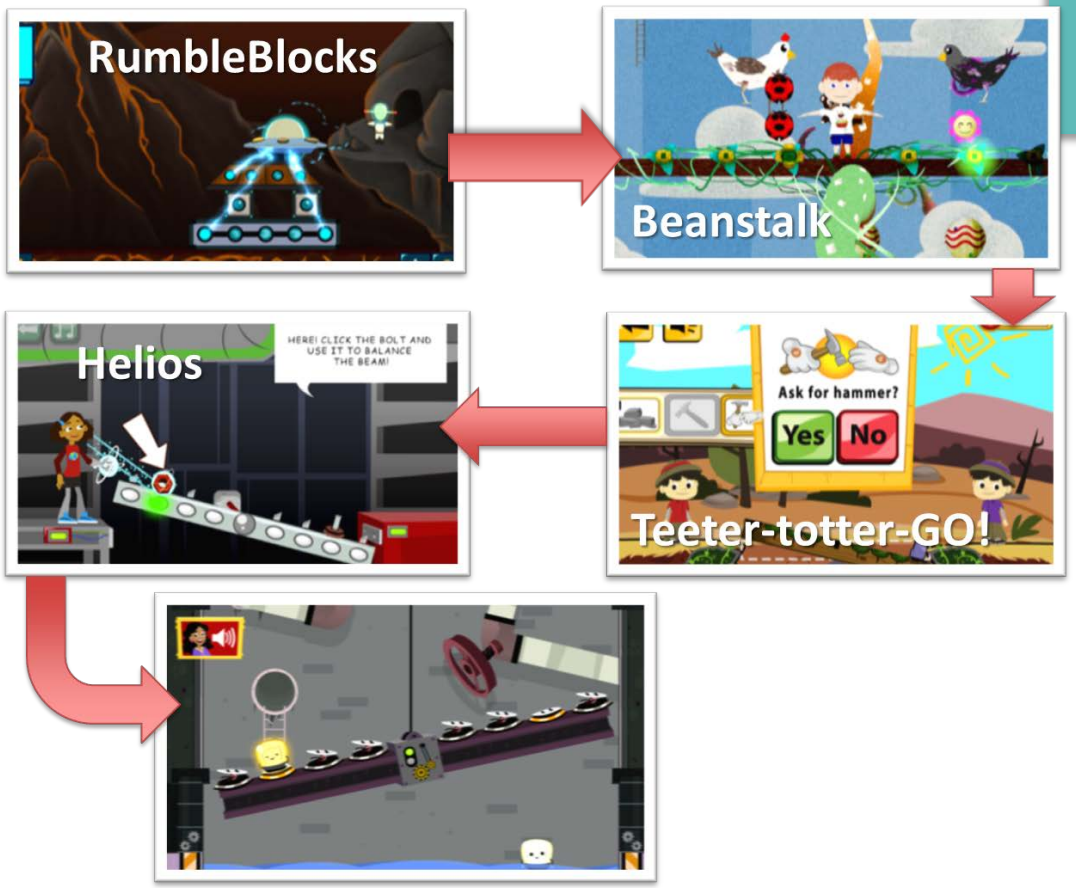
LEARN
WORK
PLAY

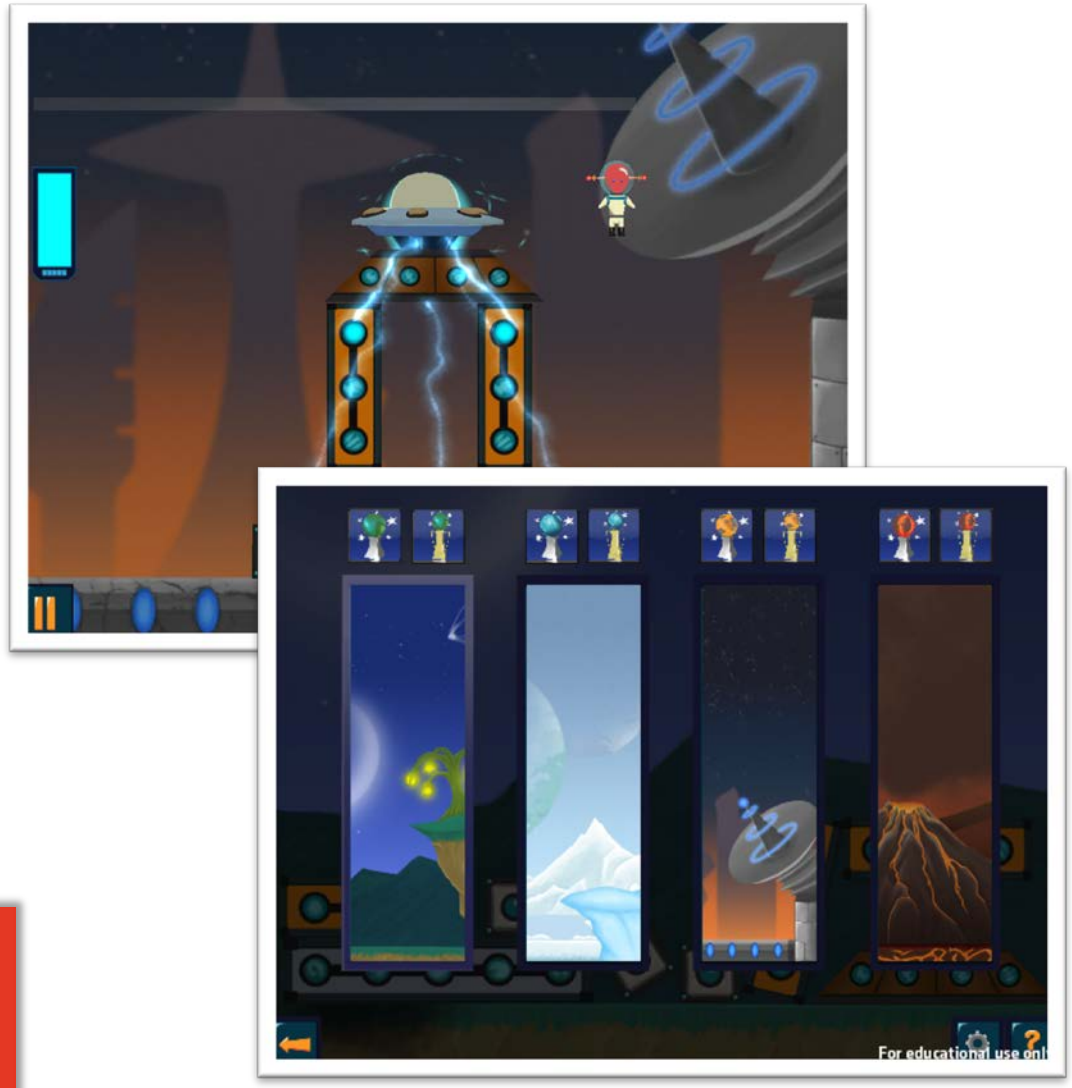
In the Beginning

DARPA's ENGAGE program seeks to develop interactive game-based technologies for pre-k through grade three students to inspire them to become future innovators by educating them in STEM skills.

The goal is to create games that improve over time by analyzing play across a large population of anonymous users.



RumbleBlocks

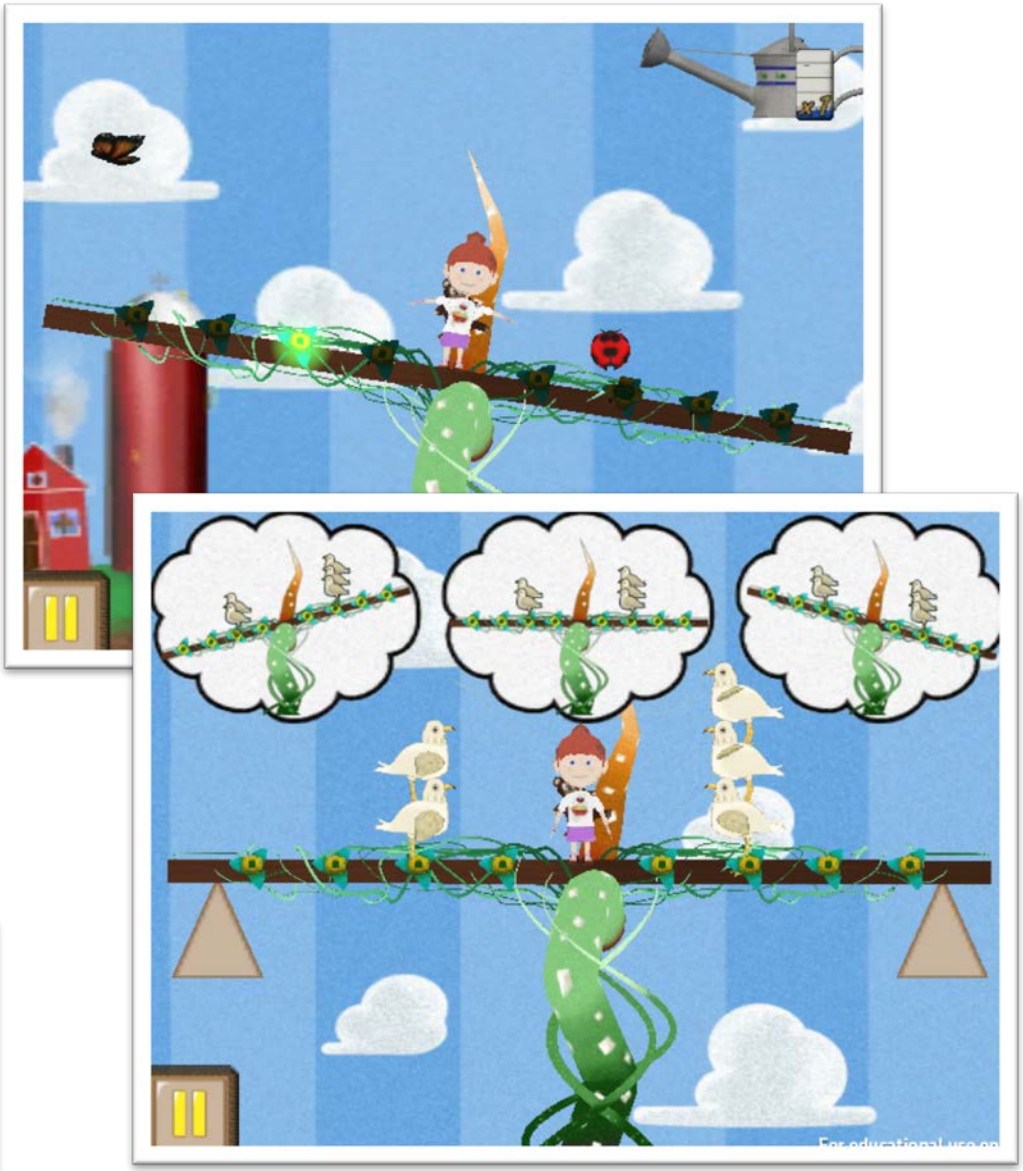


RumbleBlocks

is a game about saving several aliens by building stable structures in a sandbox environment.

This game is designed to teach children ages 4-11 how to build and identify stable structures.

Beanstalk

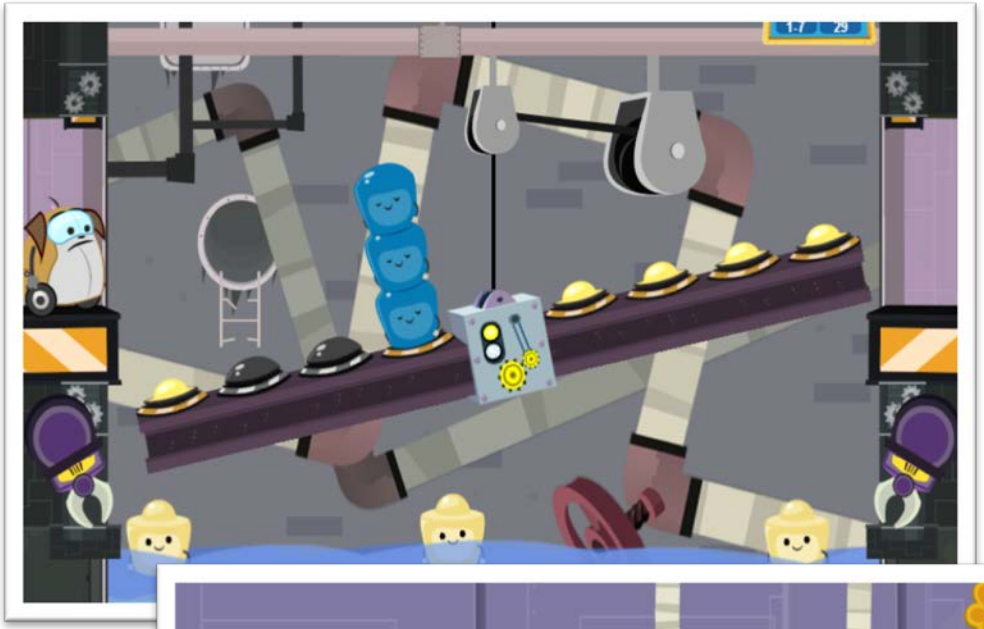


Beanstalk

Is a game about balancing a beam at the tip of an ever-growing vine to return a teddy bear to the monster on the moon.

This game was built to teach children 5-7 physics topics regarding stability and center of mass, scientific reasoning skills, and socio-emotional tasks.

PuppyBot RESCUE



PuppyBot RESCUE

is a game about a robot puppy that gets trapped in the sewer and its up to the player to help him back to the surface by balancing a beam to create a bridge.

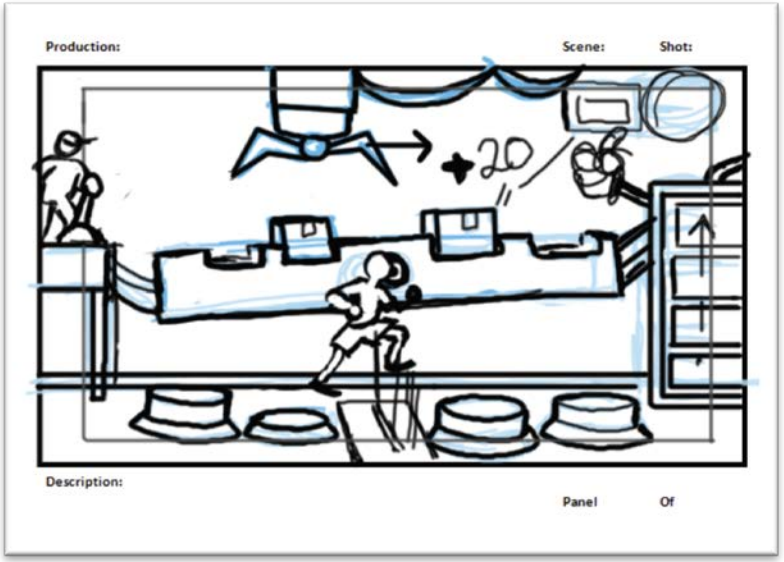
This game was built to teach children 5-7 physics topics regarding stability, center of mass and torque.

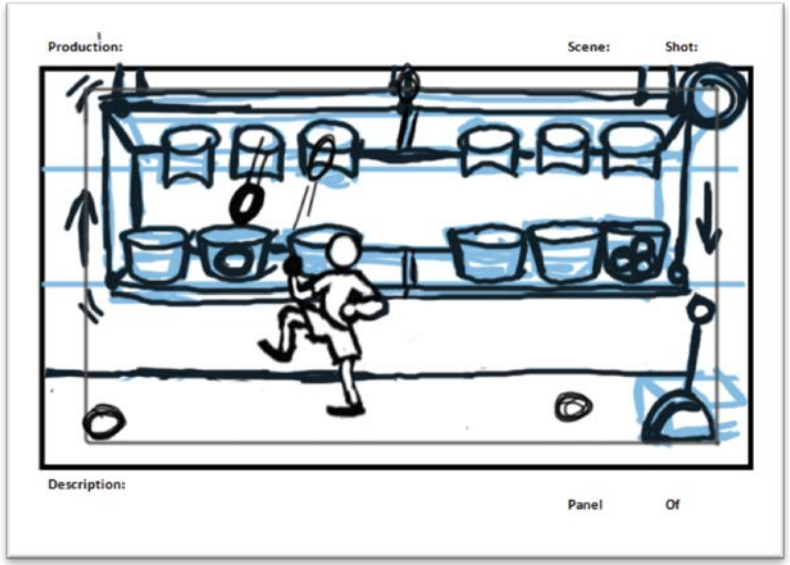
Where We Began

- First meeting: new direction for new game
  - Mini game feel
  - Focus on content
  - Fun interaction
  - More movement

Developing Concept

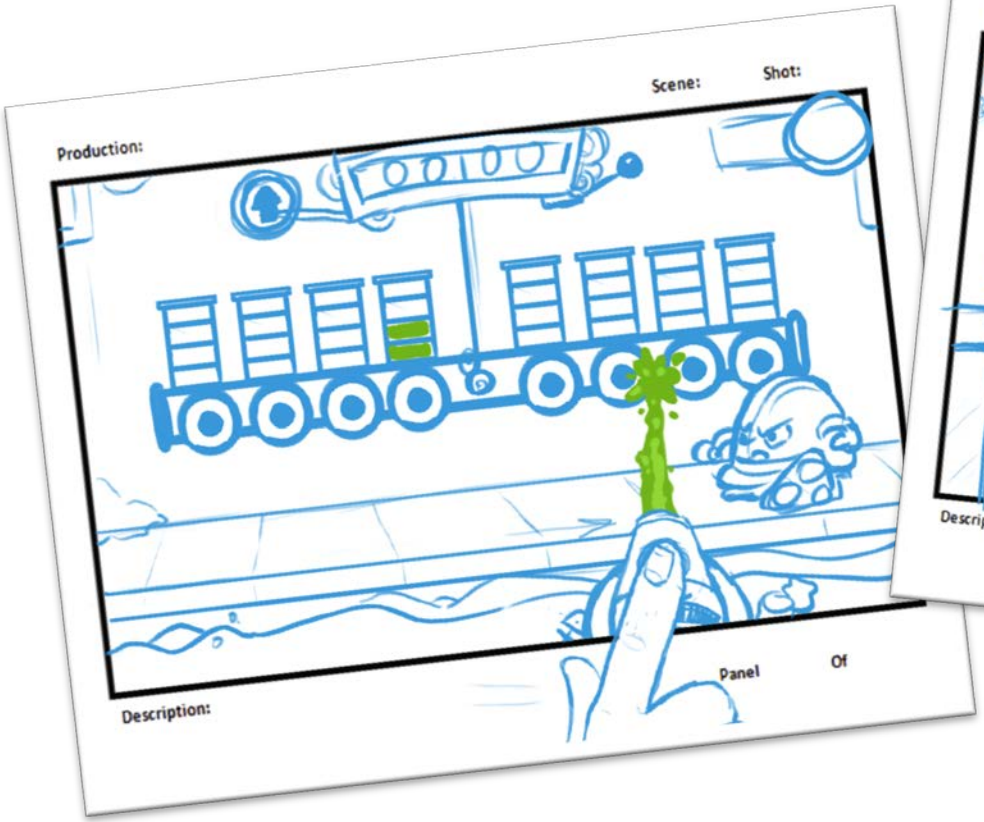
- Building a game design document
- Rough storyboards breaking down action

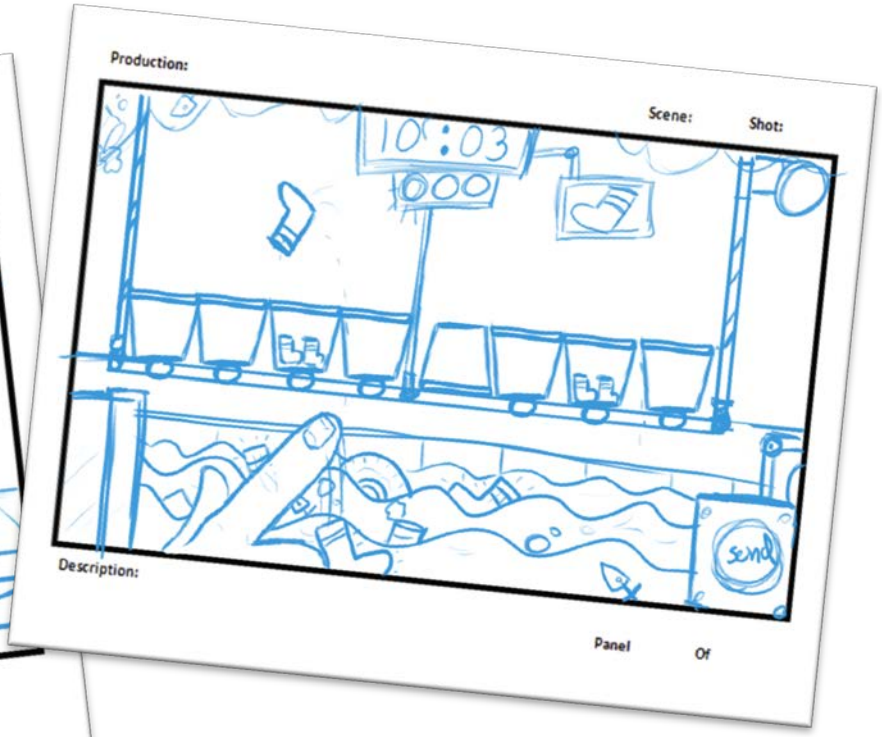




Developing Concept

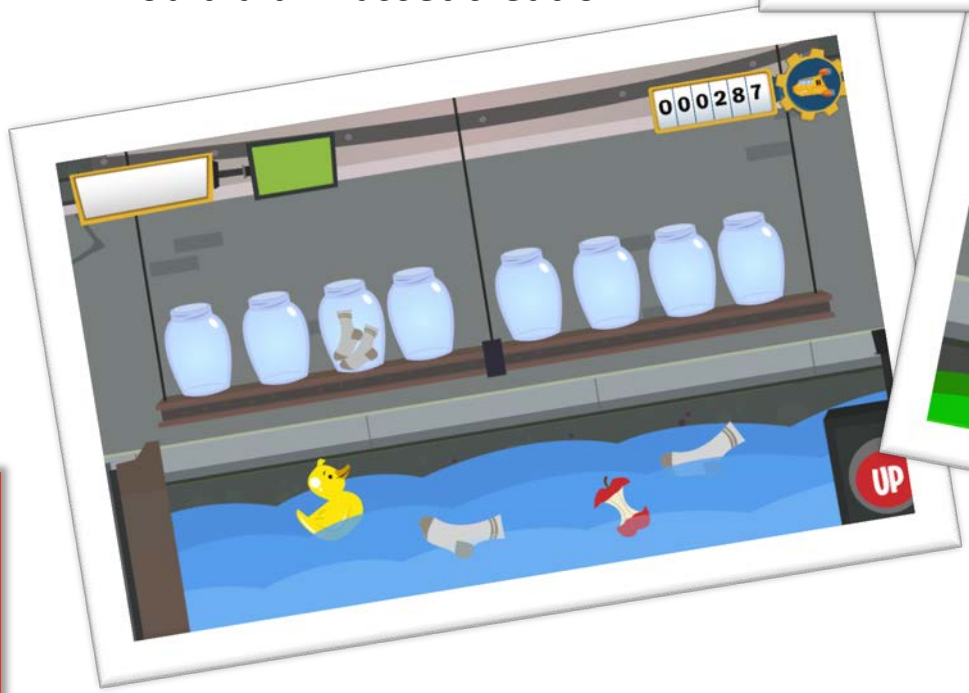
- Pick best ideas
- Refine ideas
- Flesh out art look





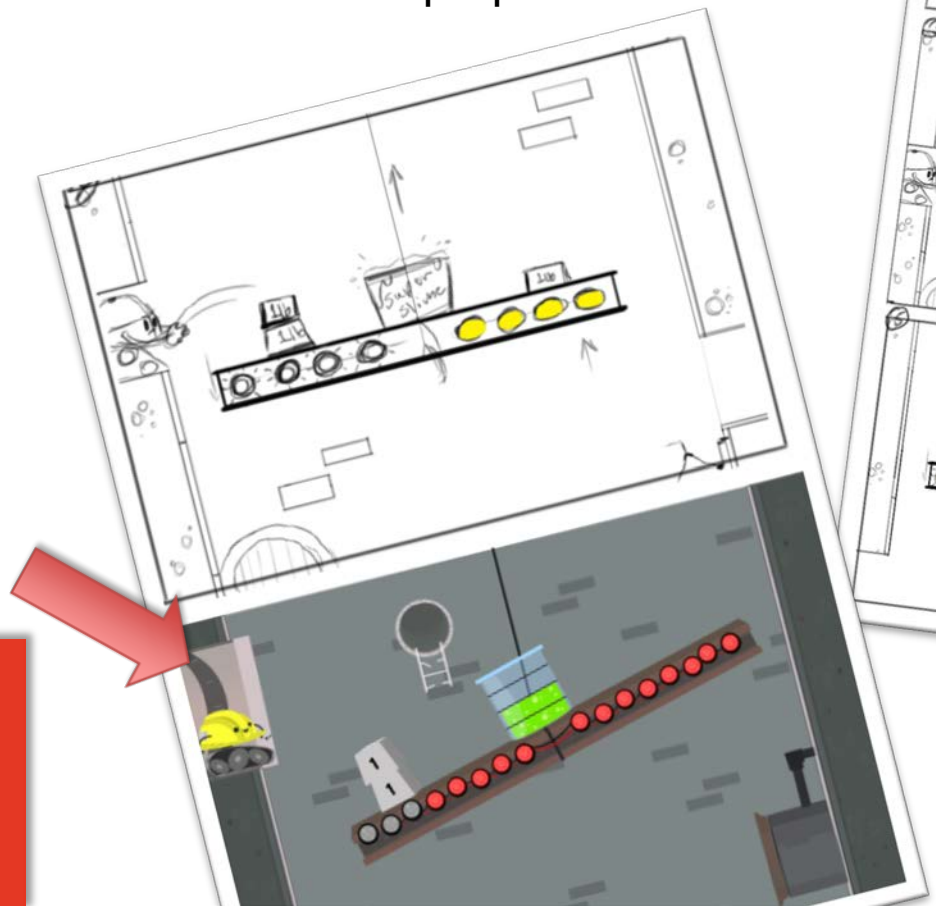
Cleaning Refining Concepts

- Need to be able to create a look that fits into the Prankster Planet world space
- Vivid rich graphics that get kids excited to play our games.
- Work out an art pipeline that would aid in asset creation.



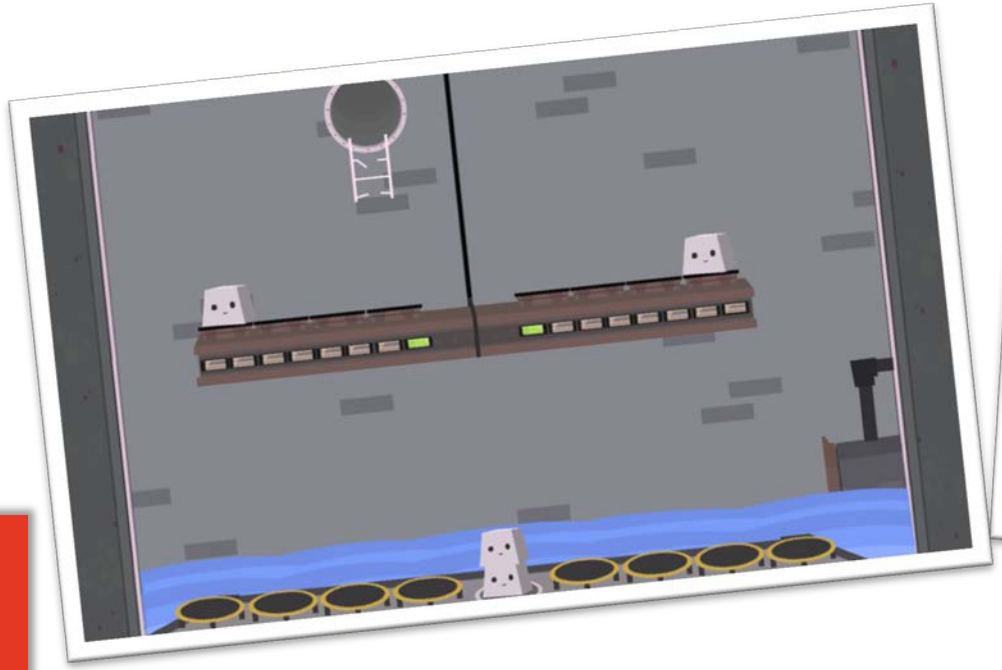
Reworking Concept

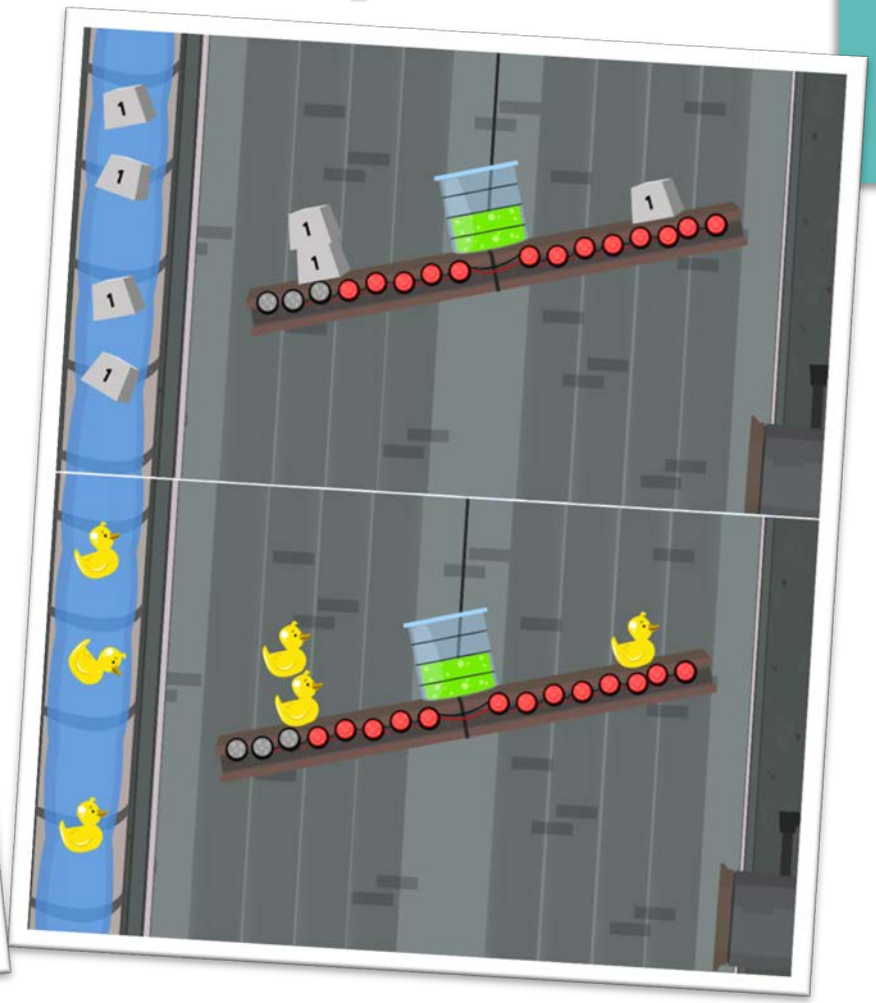
- Combine best features of designs
- Add more movement
- Have a clear purpose



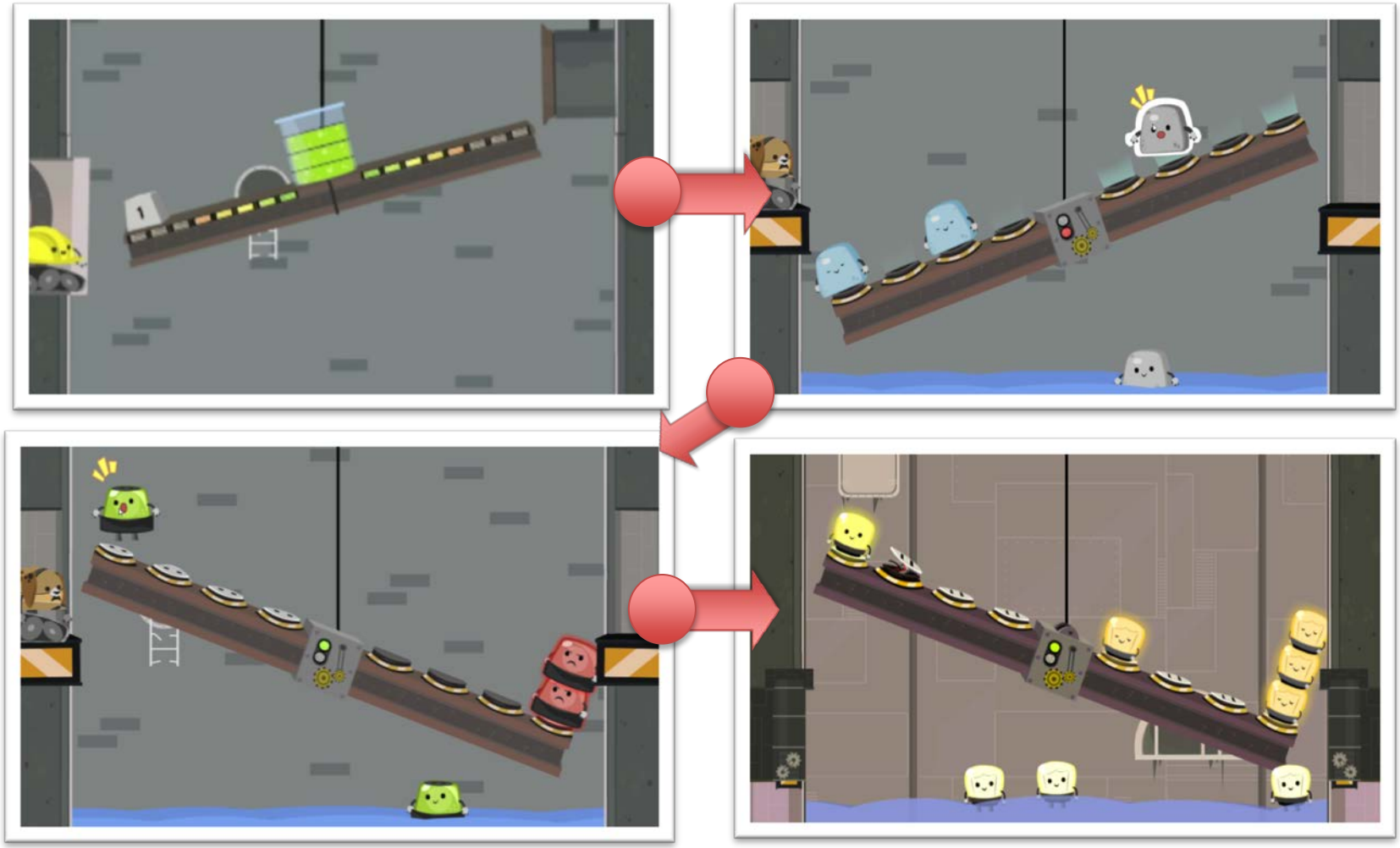
The Early Concept

- A lot if iteration went into designing the beam for our game.
- As the main point of interaction, our beam need to be able to convey a lot of things to the player.



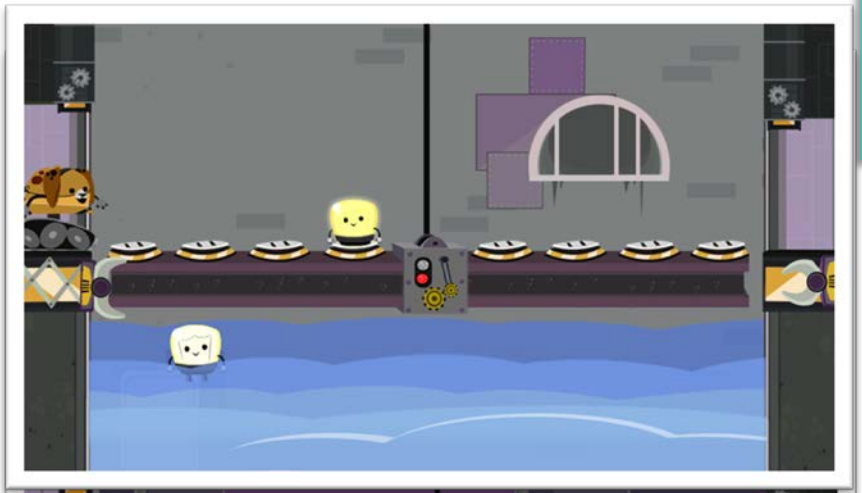


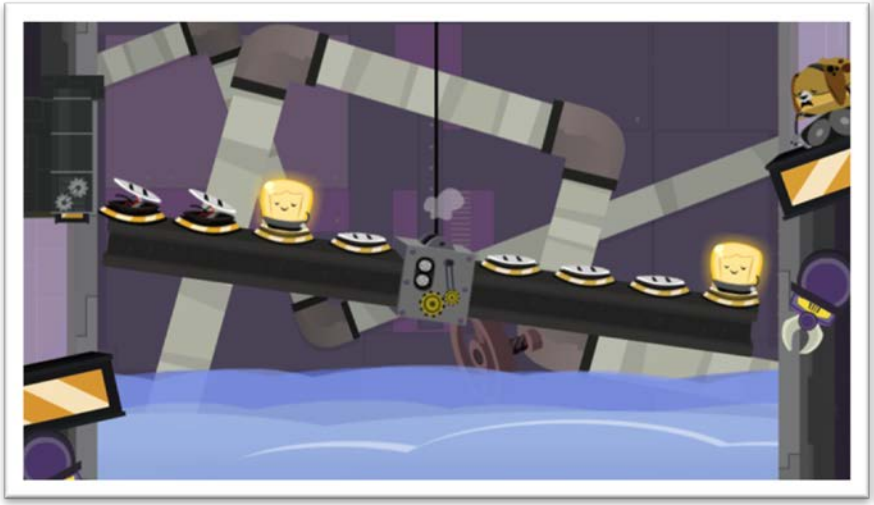
Changes We Made

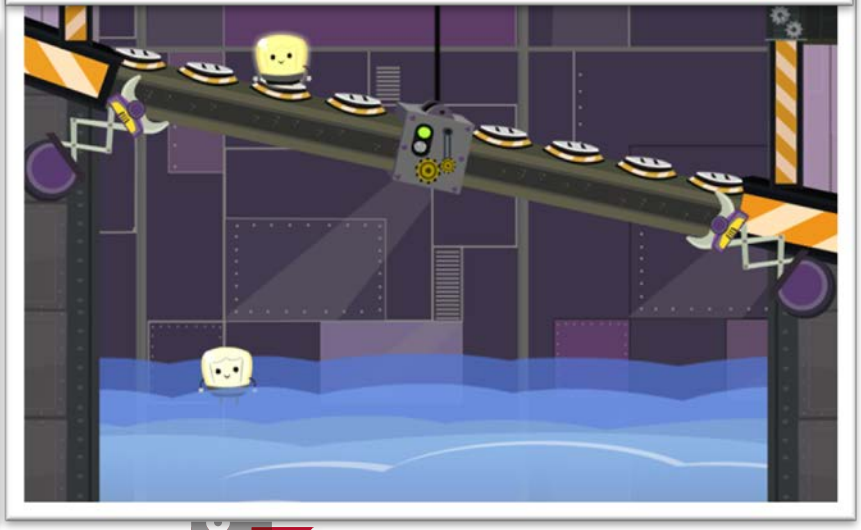


Our Alpha

- Changed beam interaction
- Add more levels
- Made clearer hinting
- More layers for depth
- Rich Audio

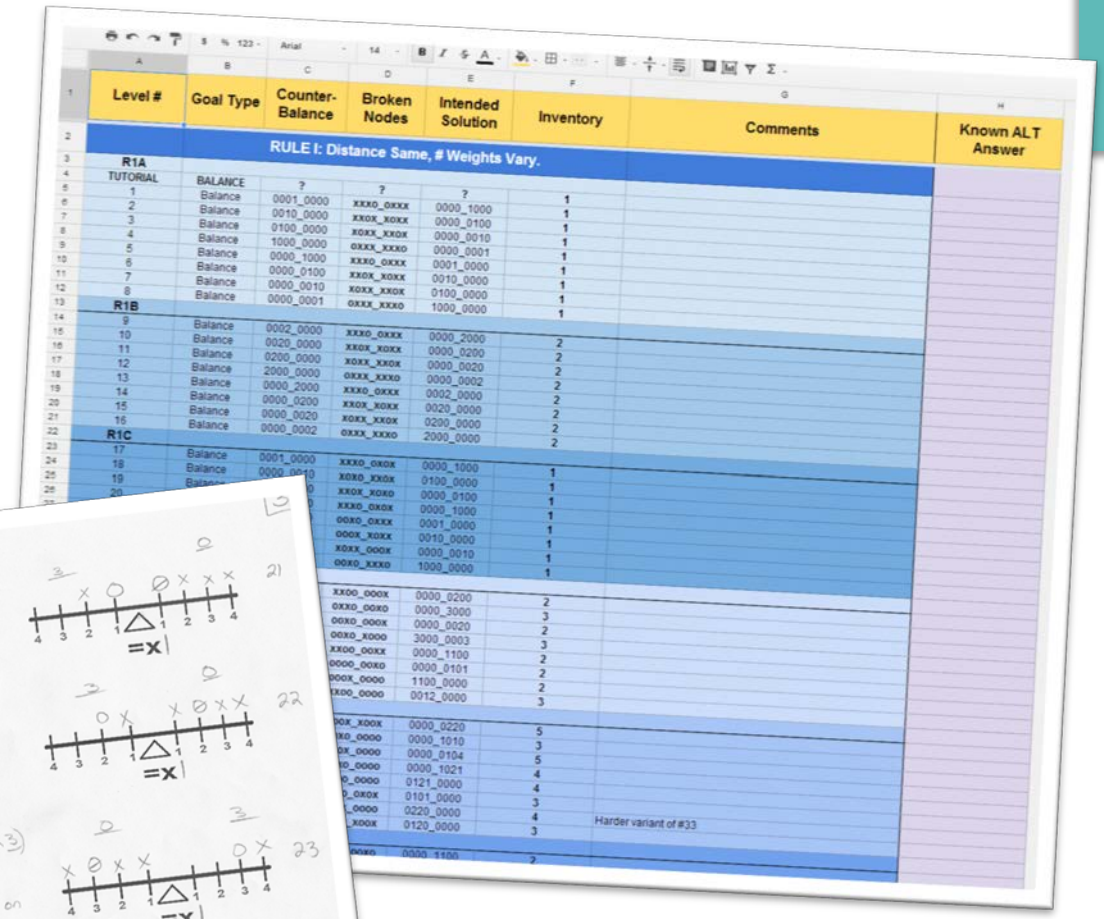






Adaptive Learning

- Rules broken into Buckets
- Randomly picked
- Rules broken up difficulty



Level #	Goal Type	Counter-Balance	Broken Nodes	Intended Solution	Inventory	Comments	Known ALT Answer
RULE I: Distance Same, # Weights Vary.							
R1A							
TUTORIAL	BALANCE	?	?	?			
1	Balance	0001_0000	XXXO_OXXX	0000_1000	1		
2	Balance	0010_0000	XXOX_XOXX	0000_0100	1		
3	Balance	0100_0000	XOXX_XXOX	0000_0010	1		
4	Balance	1000_0000	OXXX_XXXO	0000_0001	1		
5	Balance	0000_1000	XXXO_OXXX	0001_0000	1		
6	Balance	0000_0100	XXOX_XOXX	0010_0000	1		
7	Balance	0000_0010	XOXX_XXOX	0100_0000	1		
8	Balance	0000_0001	OXXX_XXXO	1000_0000	1		
R1B							
9	Balance	0002_0000	XXXO_OXXX	0000_2000	2		
10	Balance	0020_0000	XXOX_XOXX	0000_0200	2		
11	Balance	0200_0000	XOXX_XXOX	0000_0020	2		
12	Balance	2000_0000	OXXX_XXXO	0000_0002	2		
13	Balance	0000_2000	XXXO_OXXX	0002_0000	2		
14	Balance	0000_0200	XXOX_XOXX	0020_0000	2		
15	Balance	0000_0020	XOXX_XXOX	0200_0000	2		
16	Balance	0000_0002	OXXX_XXXO	2000_0000	2		
R1C							
17	Balance	0001_0000	XXXO_OXOX	0000_1000	1		
18	Balance	0000_0010	XOXO_XXOX	0100_0000	1		
19	Balance	[illegible]	XXOX_XOXO	0000_0100	1		
[illegible]	[illegible]	[illegible]	XXXO_OXOX	0000_1000	1		
[illegible]	[illegible]	[illegible]	OOXO_OXXX	0001_0000	1		
[illegible]	[illegible]	[illegible]	OOOX_XOXX	0010_0000	1		
[illegible]	[illegible]	[illegible]	XOXX_OOOX	0000_0010	1		
[illegible]	[illegible]	[illegible]	OOXO_XXXO	1000_0000	1		
[illegible]	[illegible]	[illegible]	XXOO_OOOX	0000_0200	2		
[illegible]	[illegible]	[illegible]	OXXO_OOXO	0000_3000	3		
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[illegible]	[illegible]	[illegible]	OOXO_XOOO	3000_0003	3		
[illegible]	[illegible]	[illegible]	XXOO_OOXX	0000_1100	2		
[illegible]	[illegible]	[illegible]	OOOO_OOXO	0000_0101	2		
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[illegible]	[illegible]	[illegible]	XXOO_OOOO	0012_0000	3		
[illegible]	[illegible]	[illegible]	OOX_XOOX	0000_0220	5		
[illegible]	[illegible]	[illegible]	XXO_OOOO	0000_1010	3		
[illegible]	[illegible]	[illegible]	OX_OOOO	0000_0104	5		
[illegible]	[illegible]	[illegible]	XO_OOOO	0000_1021	4		
[illegible]	[illegible]	[illegible]	O_OOOO	0121_0000	4		
[illegible]	[illegible]	[illegible]	O_OXOX	0101_0000	3		
[illegible]	[illegible]	[illegible]	_OOOO	0220_0000	4	Harder variant of #33	
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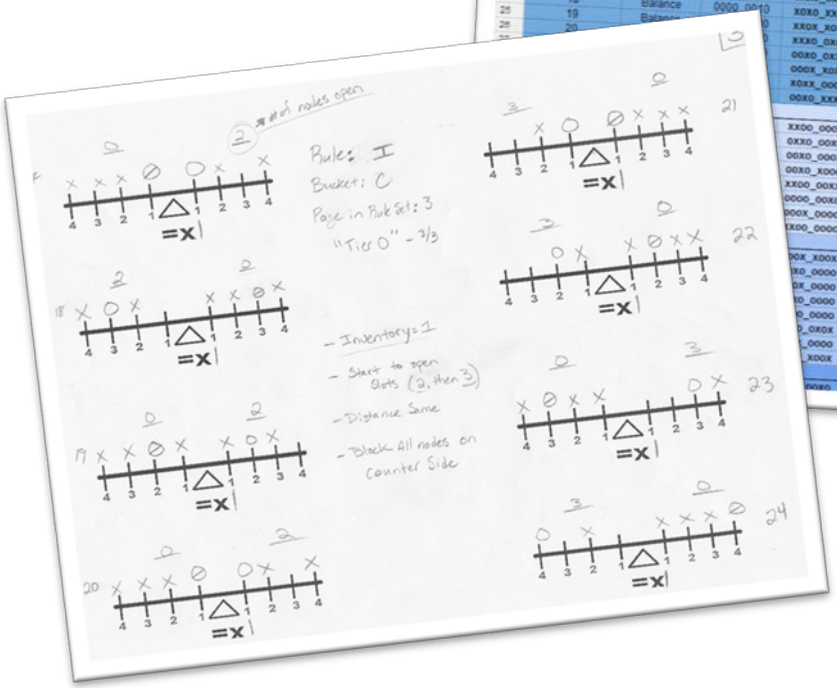
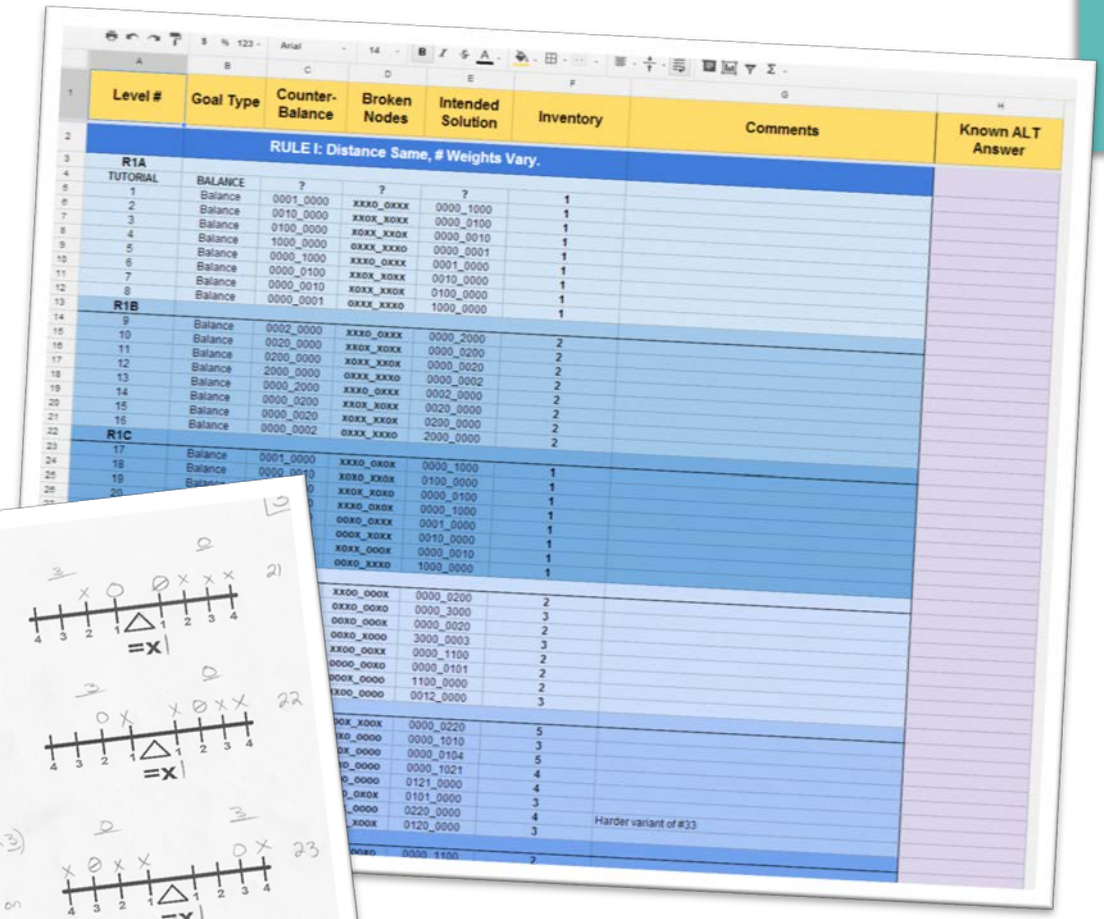


Currently

- Fully functioning game play
- Early implementation of adaptive play
- Story implemented in the form of comics and voice over.
- Reward mini game during transitions.



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[illegible]	[illegible]	[illegible]	XXOO_OOXX	0000_1100	2		
[illegible]	[illegible]	[illegible]	OOOO_OOXO	0000_0101	2		
[illegible]	[illegible]	[illegible]	OOOX_OOOO	1100_0000	2		
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[illegible]	[illegible]	[illegible]	XXO_OOOO	0000_1010	3		
[illegible]	[illegible]	[illegible]	OX_OOOO	0000_0104	5		
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[illegible]	[illegible]	[illegible]	O_OOOO	0121_0000	4		
[illegible]	[illegible]	[illegible]	O_OXOX	0101_0000	3		
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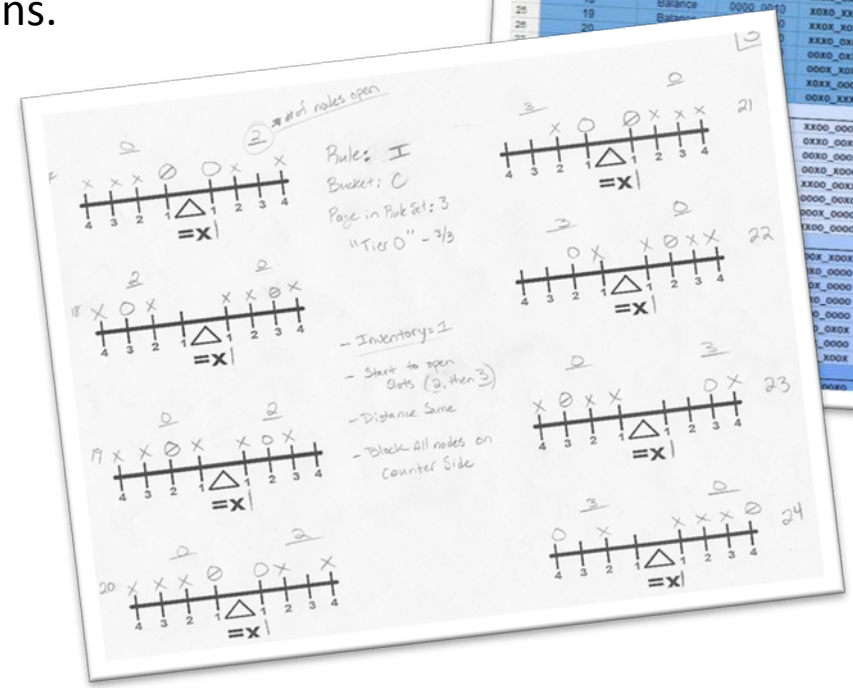

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- *PuppyBot Rescue* (can be played on newer tablets, phones and HTML5 compatible browsers PCs)
  - http://pbrescue.etc.cmu.edu/

- *Beanstalk* (can be played PCs, requires Unity3D Plugin)
  - beanstalk.etc.cmu.edu

- *RumbleBlocks* (can be played on PCs , requires Unity3D Plugin)
  - rumbleblocks.etc.cmu.edu

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