To Do: (see this link for recently fixed issues that may not yet be deployed)

2nd tab called “Buoyancy Playground”
Ability to show values on the vectors
Ability to turn off mass readouts on objects

KP: Let’s add non-cubic rectangles.

SR: Can’t work on this until we are more clear about if/how the user can change the w/h/l

JO: easy to add rectangles, but slightly more expensive if user can control dimensions

KP: don’t work on this now until further discussion

KP: Recommendation from Christine: put labeled tick marks with numeric readouts underneath the density slider so they can see the numbers as the density changes, and be able to compare it to 1.00 kg/L easier.

JO: How about putting a numeric label mirrored underneath the ticks for the item labels?

Make it so students can add salt into the water? It would be neat to have a salt shaker, and they can see how the density changes on the density slider readout.

Salt changes the density by at most 3%, which is difficult to distinguish even for ice, which is very floaty. Having the user shake the salt shaker

Using sprites and box2d, limit amount of salt, sprite for shaker

estimated time: 5-10 hours

KL: Kathy noted that we need to do color-blind test - she thinks the pool may need more contrast. She also said she wished there was a way to hide the labels on the blocks - it would come in handy when teachers write an activity around the sim.

SR: Kathy also said we may want to make it more B/W printer friendly.

KP: Lighten the grass, lighter green

KP: Cement color around the pool

MD: should have gradients for the earth and sky

Go for it.

Add total force to buoyancy sim?

SR: probably shouldn’t be horizontally aligned with other vectors, or it will look like it sums with them

SR: not in the design doc, of dubious value, maybe shouldn’t do it for now

KP: don’t add total force

3. Should we put numeric tick labels under the slider (to mirror the material labels) in the density sliders (for fluids and objects); this is something Christine suggested. This could take 1-3 hours.

KP: needs more discussion first, so it looks more like a readout than a control

4. Should we add a salt shaker? It would take about 5-10 hours.

Not now.

Refactoring

Module / Canvas distinction is not clear.

Change ArrowModel to be VectorProperty and extend Observable

Factor out duplicated checkbox creation code around 117 of BuoyancyCanvas

Delete dead code in ArrowNode constructor

Factor out dupliacted code in Buoyancy Canvas

Refactor RadioButtons in Canvas subclasses

Rewrite modes to not be tricky with respect to scales and differences between buoyancy and density

Scale constructor takes DensityModel? Maybe rename DensityModel.

Convert fields in DensityObject to function get and function set paradigm

Low Priority

Ability to modify multiple objects?
    KP: don't do this.

Add water balloon?
    KP: sounds good, will this help have other fun object shapes?
    KP: don't work on it now

What about English/Metric units checkbox. English units can be lbs/cubic foot
    KP: not high priority now

Scrollbars showing up on HTML in latest Chrome in Windows

Pushing on a wide block causes a thin block on top of it to move

JO: Move radio buttons to tabs
    SR: Let's discuss this first
    KP: Works okay with radio buttons, makes it easy to go between modes.

SR: It would be nice to keep object configuration when switching away and back to a Mode (whether implemented in tabs or radio buttons). Currently this is impossible since there is only one Model shared by all Modes
    KP: it should remember what you were doing
    SR: 2-6 hours expected
    KP: lower priority then

Sliders do not receive focus on tab traversal any more

Consider different difficulty levels for the mystery objects

Choose mass and volume numbers so that division is easy for some objects.

Tom: 4. In the "mystery" version if the blocks are dragged too far to the left, they sink through the scale.

SR: I'm not sure of a box2d way to solve this, but we could always solve it in client code: by detecting an incorrect position for one of the blocks, we could programmatically change its position, but this could be non-robust or introduce other (though maybe less severe) bugs (e.g. in object interactions).

SR/JO: Could take 2-8 hours to solve this, is it worth it? Time could depend on the quality and robustness of the solution.

Irregular shapes

CD: have you thought about using any irregular shapes to calculate volume on the sim? I know that the sim wasn't designed for this, but figuring out volume based on displacement is a big thing students learn in 5th grade, so I could see the mystery objects tab being used for that alone.

SR: Is this important because students were thinking the strategy of submersion was only good for cubes? Or because they could eyeball cubes to estimate their density?

SR: maybe it is sufficient to add spheres, since arbitrary shapes will be difficult to compute water depth

Add spheres for water balloons.

SR: The main design decision we'll need to make here is when to take an object out of the play area. Currently there is one custom object, and changing its size, density or composition doesn't change its identity. However it is hard coded to work with cubic structures only. So we could use the paradigm that object only changes identity when changing from sphere to cube or vice versa, but that seems asymmetric. And having an object change its shape from cube to sphere may be more unwieldy, especially given the existing object hierarchy.

Add texture for water balloon.

How to show the box labels on a sphere?

SR: middle of sphere? floating on top like a sprite2d?

JO: Add a text label option for each node

>Kathy recommends delaying for now.

Discussion

Ruler

Kathy wonders how difficult a ruler would be.

NP: - If you did have a ruler, I would suggest a control to show / hide it.

SR: A horizontal or vertical ruler would be easy (2-3 hours) and we would have to decide whether it is always there, or enabled from a control panel (which one?), but more difficult if it is a ruler that can be rotated, or if it has to work in 3d.

Would you prefer horizontal or vertical?

JO suggests vertical because you can also measure the height of water, could measure percent submerged of an object

NP: But it's possible you might want to avoid this so that users focus on relative size rather than absolute?

KP: we are considering adding a ruler ... and it sounds like you would be in favor of this? I'm not sure of the programming/user interface considerations we will have to consider here because of the 3-D nature of the sim.

SR: A meter stick would be a good way to indicate scale, and it could be so thin that it doesn't take up any volume. This would only work for blocks, for spheres, you would need the measuring tool to cut through the center, or to use string to measure a circumference.

JO: We should make sure the Z-values of the blocks are centered, so that when we have spheres the ruler can intersect.

Maybe we should hear from the team about what to do about measuring spheres before working on this.

SR: Should the relationship between displaced fluid weight and submerged block weight (for a partially submerged block) be a learning goal of the density or buoyancy sim? The relationship is already very apparent with g=9.8 and the density of water = 1.00.

TH: In the "mystery" version it is possible to lose blocks behind the "objects" table on the right hand side.

SR: I don't find this very problematic because at the default screen resolution, the blocks should always be accessible; by dragging the bottom-most block, the next one up will fall.

TH: Could one more version be added? "Boat" in which boats could be made of styrofoam or wood or brick or aluminum? All of which would float...

Boats could be added, but would be a very expensive feature to add.

respond to melissa that readouts fixed in new version

To Do:

Need graphics (geometry and texture) for water balloon

JO: it would not be too hard to model a balloon

SR: I'm worried that introducing spheres or other object shapes will create unphysical behavior regarding stacking, or significant complexity that we may wish to avoid at this time.

SR: But in single object mode, there is no stacking. However, it could be awkward if the object changes shape when the user changes the density. It may seem like the volume is changing.

Project structure:

Make sure buoyancy and density sims are both deployable and translatable

SR: This should be done before deploying 1.00 so that we won't require changes that impact features like statistics, updates, other name-related features

JO: Still a TU problem, and Flash Launcher issue

see #2463: Translation Utility should be able to translate flashplayer projects with

multiple simulations

The work on the density side should be good to go as long as simulation.properties is being created. The rest of the work can be deferred

Mystery objects should be fun shapes

Torus/Sphere/Human/Tortoise

KP: Okay to use ellipsoid to approximate physics for other non-ellipsoid shapes.

SR: I'm not sure this is an essential feature, and it would have the following tricky ramifications: (a) computation of water level will be more complex, especially for nonspherical ellipsoid and (b) object stacking would seem unphysical

Textures and materials

Jon will experiment with textures and materials

http://www.geepers.co.uk/software/solid_textures.html

Here is a nice texture for metal: http://away3d.com/chrome-ball

Other nice materials here: http://away3d.com/category/materials

http://www.mail-archive.com/away3d-dev@googlegroups.com/msg01363.html

Density Slider Tick Marks

SR: It would be nice to have labels near the ticks of the density slider, but this is unsupported by flex components, and would have to be written from scratch at a cost of 6-15 hours up front + recurring costs for maintenance and increased complexity

KP: Change pool from water to oil/mercury/etc?

SR: What about a slider with tick marks for certain fluids

KP: Mystery fluid?

SR: We could put a combo box next to the slider with "mystery fluid a, b, c..."

Could also have a mode where you get rid of the pool.

KP: Agreed that this feature is not essential for Sept 1.

We can decide later whether it will be cost-effective to add a second tab with larger objects and different units. Alternatively, let us know whether having such a second tab will be essential for version 1.00 or for early Sept.

TL is a strong advocate for this. Haven't heard feedback from others.

TL: I thought it sounded reasonable after we talked about how scales measure both inertia and force with just a flip of a switch. Maybe in a density sim, the scale should always read mass units and in the Buoyancy sim, they are in force units. If we go that way, personally I think it would be nice to have english vs SI units to switch from. I'll leave the decision to people who have done more interviewing and research paper writing than me.

You shouldn't be able to drag blocks through the pool or earth.

Sliders should be more inviting

Maybe different colors?

Maybe different backgrounds?

Lower Priority

One way to solve the intersecting regions problem (e.g. for vector outlines or blocks passing through each other) would be for us to modify the geometry; such as cutting holes in the surface of the water where blocks or arrows are known to pass through. But this could be arbitrarily complicated; I can't think of a nice general subdivision algorithm that would work for an arbitrary number of arrows, and even if there was a nice algorithm, it would be difficult to apply it to the away3d geometry.

Under Discussion
Are we updating box2d mass when object mass changes?
SR: Cuboid.as line 51 has: bodyDef.massData.mass = getMass() * DensityConstants.SCALE_BOX2D;

Timeline Notes
5. First priority is to work on the density sim, we'll come back to buoyancy later.
This new density sim is a new sim, but maybe the buoyancy sim would have some of these same features in a 1st introduction tab.
6. Kathy will check on deadline for density sim usage by MS teachers in Texas
a. Christine Denison is teaching density in the beginning of September

It is not intuitive that a yellow box is less dense than a red box. A texture may not be any more intuitive. How about indicating density by degree of saturation? For example, light red = less dense, dark red = more dense? Just an idea.

Box2D Flash Reference:
http://www.box2dflash.org/docs/2.1a/reference/

Should we show forces on the scales? How about showing the gravity forces that penetrate through the ground?

Switch to orthographic projection?
Prepare a screenshot?

Remove border around the entire SWF?

Suggestions for 1st tab:
Add a balloon(s) that have same density as air (or less density)

A way to identify the quantitative volume of cubes in the 1st tab (block sizes or readouts)
Block doesn't have to be exactly cubic, could be depth of one block and varying height and width. That way the student can see and count all of the sub-blocks.

SR: This doesn't scale up, but we could do 2x1x1 or other arrangements

Questions for 2nd tab:
Do we need to show individual contact force vectors? For example: A stacked on B stacked on C. Do we just show contact force on B as a total?

SR thinks this may be less important for a buoyancy sim, but maybe revisit for a Newton's 3rd law sim.

Add pressure meter to density sim - Show pressure at top and bottom, and show difference

"Fluid Height" (see mockup) -- when selected, the height of the liquid is shown (with many significant figures for measuring fluid displacement of immersed objects)

Properties dialogs for objects

- units selection: all displays/controls will change to selected unit system
- "object labels"
  - drop down menu with the following choices:
    - none (default)
    - mass
    - volume
    - density
  - when something other than "none" is chosen, text labels appear on each object, displaying the value of the selected quantity
  - the labels appear as text on objects (like the text seen on objects in the first tab), the fluid will also be labelled (perhaps in the lower right corner)
- Adding new objects such as:
  - Log
  - Archimedes
  - Turtle

Internal Issues:

Fix buoyancy computation with air.

JO: Just checked and it doesn't take into account the density of air. (or the weight of the mass of air displaced)

Fix adding objects with arrow checkboxes deselected

Look into Drag3D support or improving existing drag implementation
http://groups.google.com/group/away3d-dev/browse_thread/thread/d6a8faa9d8cdc02

Could add outlines for vector arrows.

JO will work on this next.

SR: I tried working on this and couldn't get it to render without severe artifacts. I tried upgrading to 2.5.0 and had the same problem with Renderer.INTERSECTION_OBJECTS, but QuadrantRenderer was okay.

Does updating to 3.5.0 resolve these rendering problems?
SR: No, I tried updating to 3.5.0 and the same problems are present under INTERSECTION_OBJECTS renderer.

v-function in MyMesh should return an int, and be reused by the face function

Diagram for arrow and ground meshes would be helpful

Related sims
http://www.sciencejoywagon.com/explrsci/media/density.htm
Already in design doc - just to remind you

http://www.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=362
Not free, but you get a 5-min preview

http://www3.interscience.wiley.com:8100/legacy/college/skinner/0471152285/animations/animations/mod_2/simulation_density_min.html
Measure mass & volume; the sim calculates density for you

http://www.karlyoder.com/flash_density.html
Calculate the density, identify the metal

Density values

http://www.simetric.co.uk/si_metals.htm
For metals, liquids, and other materials. All values are given in kg/m3 - to convert to g/mL, divide by 1000