Randomness revisited

What if we want a characters distribution to resemble demographics of Cal undgrads?

<table>
<thead>
<tr>
<th>Gender</th>
<th>Ethnicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>46% Male</td>
<td>American Indian</td>
</tr>
<tr>
<td>54% Male</td>
<td>Asian</td>
</tr>
<tr>
<td>2% African-American</td>
<td>Caucasian</td>
</tr>
<tr>
<td>0% Hispanic</td>
<td>Other</td>
</tr>
<tr>
<td>2% Other</td>
<td>No Data</td>
</tr>
<tr>
<td>0% No Data</td>
<td>International</td>
</tr>
</tbody>
</table>

How can we use `random()`?

Simple, slice up (0, 1)!

- Just use range = to that of distribution!
  - `>>> g = random() # [0, 1) gender`
  - `>>> e = random() # [0, 1) ethnic`
- And then use if ... else from data!
  - `>>> if g < .46: # 46% male`
    - `... MakeCharacter(male)`
  - `... else:`
    - `... MakeCharacter(female)`
- ... and similarly for ethnicity, height, etc

Particle systems

- Typically used to simulate fuzzy phenomena
  - Smoke, Explosions, Water, Sparks, Dust, Stars
- Emitter controls particle generation, simulation
- What is involved with the geometry?
  - Typically output as textured billboard quad
  - Or, single pixel
  - Or, metaball (for gooey materials)
Genetic Algorithms

Karl Sims blew away his colleagues with his 1994 seminal work on evolved creatures.

Genetic Algorithms

- Genotype is the genetic information that codes the creation of an individual.
- Phenotype is the individual.
- Selection is the process by which fitness of phenotypes is determined.
- Reproduction is the process by which new genotypes are generated from existing ones.
- There must be probabilistic mutations with some frequency.

Set Dressing

“The process of selecting, designing, adapting to, or modifying the performance space for a given purpose. This includes the use of stagecraft elements as well as the structure of the stage and its components.”
**Procedural Tree Set Dressing I**

- Consider the problem of placing trees in a forest in a natural way
  - How would you place them so that they don’t overlap?
  - What are some ideas?

**Procedural Tree Set Dressing II**

- Random Trees
  - Pick random points and remove if new tree is too close to existing tree
  - Start with trees regularly spaced and then perturb (wriggle)
  - Add “relax” step which treats each point as having “negative gravity” to push away nearby points
  - Find out what “right” answer is (check forestry research) or by looking at real forests and simulate

**Procedural Character Generation**

- Create a procedural character model that has enough parameters to capture what you want
- Find out what distribution you would like (see first slide) of the parameters
- Populate your world (for each character, assign the properties, including location)

**Hair and Fur**

- Used to be a hard problem
- Algorithms now exist to allow animators to either let dynamics control it completely OR to animate “control hairs” (which control a patch)
  - It’s even built into Maya!
- See the work in Monsters, Inc and Narnia

**Conclusion**

- Set dressing grounds scene in believable surroundings
- Crowds need lots randomness with character selection
- Next week:
  - Skeletons & Rigging