Possible Subject Stream

Start

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Tutorial: 5 Subjects. Same ones for all users?

Level 1: 10 Subjects. 50% Lenses, 25% Duds, 25% Real. Instant feedback given - using Tutorial technology?

... ⬛ x ⬛ ⬛ ⬛ C ⬛ ⬛ ⬛ ⬛ ... **continue** ...

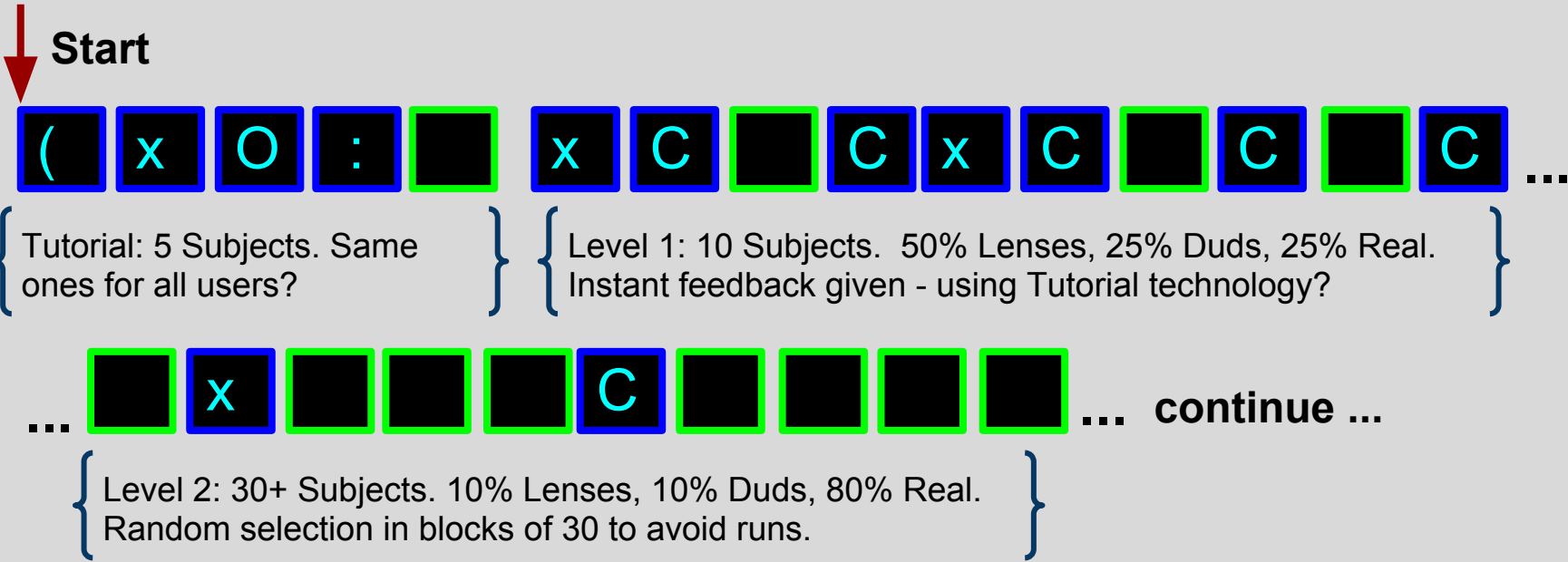Level 2: 30+ Subjects. 10% Lenses, 10% Duds, 80% Real. Random selection in blocks of 30 to avoid runs.

Key: **Blue** = Training, **Green** = Real

: Double or quad lensed quasar

(Single arc near a massive galaxy

O System of arcs around a group or cluster

x No lens here (Training Dud, incl. FPs)

C Random Training Candidate, taking relative rates of arcs, doubles etc into account.

⬛ Random Survey Subject

Training Subjects all lead to instant feedback. Real ones too?

Notes on Stream Design

- Tutorial: show the same images for everyone? Nice to show some examples of different kinds of lenses, as this is the point when we have every User's attention.
- Lens frequency in the stream decreases as more Subjects are viewed, and is shown to the User, so their expectations are accurate. ("About 1 in every 10 images will contain a SpaceWarp" etc) This will manage the expectations of the Users, and also reduce the false positive rate. Real lenses are rare enough that to a good approximation we can just quote the simulated lens frequency. Where on the page could we do this?
- Tutorial could merge into Level 1 (50% lenses) seamlessly, except for a notification about lens frequency. Likewise with Level 2. Use Tutorial technology to give instant feedback?
- Within a Level, Training and Survey Subjects can be drawn at random, without replacement, in blocks of 30 (to avoid runs without a lens). Training Candidates should appear in expected proportions: 10% doubles, 10% quads, 50% single arcs, 30% groups?
- It's important to show Training Duds as well as Training Candidates (50-50 mix), to understand false positives. Always give feedback about Training Subjects: need a mechanism for doing this (while not slowing people down too much!) Duds are hard!
- Estimated typical workload: 45 Subjects. Is this high/low? Asymptotic Training fraction = 20% - too high? Reduce to 10% 5%? Have more levels, for more badges? Badges?

Level	Subjects	Lenses	Duds	Training	Real
T	5	3	1	4	1
1	10	5	3	8	2
2	30	3	3	6	24
2	Inf	10%	10%	20%	80%

Tutorial Frame 1 **A field containing a "typical" lensed arc**

header: 'Welcome to SpaceWarps!'
content: 'This short tutorial will show you how to identify gravitational lenses.'

header: 'What are gravitational lenses?'
content: 'Gravitational lenses are massive astronomical objects -- such as galaxies -- that lie exactly in front of more distant galaxies. Light rays from the background galaxy traveling towards our telescope are bent by the gravity of the foreground galaxy. Just as the Earth's gravity keeps everyday objects (including us!) on the ground, the gravitational pull of massive galaxies also attracts light: they act like huge natural magnifying glasses, focusing the light of the background galaxy towards us.'

header: 'Identifying gravitational lenses'
content: 'In this image the gravitational lens is a small group of massive, luminous, yellow-ish galaxies. Far behind this group is a faint blue galaxy, that you see as a blue arc surrounding the group.
Lensed galaxies are often (but not always!) blue, and always **stretched and curved around the lens like this**.
Click the brightest part of the blue arc to mark this feature as having been lensed.'

header: 'Identifying gravitational lenses.'
content: "**Great, you've helped identify a gravitational lens!** Since lenses are rare and often difficult to spot, we've developed a few more tools to help you discover them."

header: 'Dashboard'
content: "Dashboard is a place to examine your data even further. You will find tools to visualize the images with more control, and to help us understand which objects are the lenses, and which just look a bit like them."

header: 'Talk'
content: "Talk is a place to discuss these images with the rest of the SpaceWarps community: together we aim to build a catalog of some of the rarest objects in the universe. If you have questions, the Science Team and other astronomers will help answer them. If you find something that looks interesting, come and show it to the group!'

content: "Let's look at a few more examples of these amazing objects! Click 'Next image' please!"

A field containing a "typical" lensed quasar
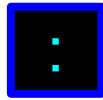
header: 'Multiple imaging'
content: "In some lens systems, you see several (2, 3 or 4) copies of the background object, **roughly arranged on a circle** around the massive foreground object. Can you spot two blue 'stars' with a massive yellow-ish galaxy between them?"

content: "Those aren't stars at all - it's a quasar, halfway across the universe, being gravitationally lensed! Click on the brightest one of the pair."

content: "Cool! We expect lensed quasars to be about 10 times rarer than lensed galaxies, but they are really useful. You can read more about what we use gravitational lenses for on the Science page. Next!"

header: 'Lenses are rare'
content: "The chances of a massive galaxy or group acting as a gravitational lens are very small - about 1 in a thousand. There are no lenses in this image - even though you might think you see something that looks a bit like a lens..."

header: 'Its easy to be confused'
content: "Spiral galaxies, merging galaxies, ring galaxies, binary stars, there are many things that can look like gravitational lenses. To help you learn what is a lens and what is not, we've made you a <em>Spotter's Guide<em> for you to look things up in."

header: 'More practice'
content: "To give you some more practice, and to help us estimate exactly how rare lenses are, we will occasionally show you images where we have either hidden a simulated lens, or where we know there are no lenses. We'll tell you if you spotted the simulation! Maybe there's one in the Next image?"
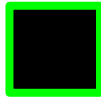
O **A field containing a "typical" ring**

After a successful marker drop:

content: "Yes! That was a simulated lens. Well spotted!"

or, if they click next instead:

content: "Ooh - you missed a simulated lens. It was quite a small one, but maybe you can see the curved blue arc around the yellow galaxy?"

A random subject field drawn from the survey

content: "This image has been randomly selected from the database, and may or may not contain a simulated lens."

content: "The chances of any image containing any kind of gravitational lens is shown above the frame - about 1 in 10 for this one. Thanks for helping out in this rare object search!"