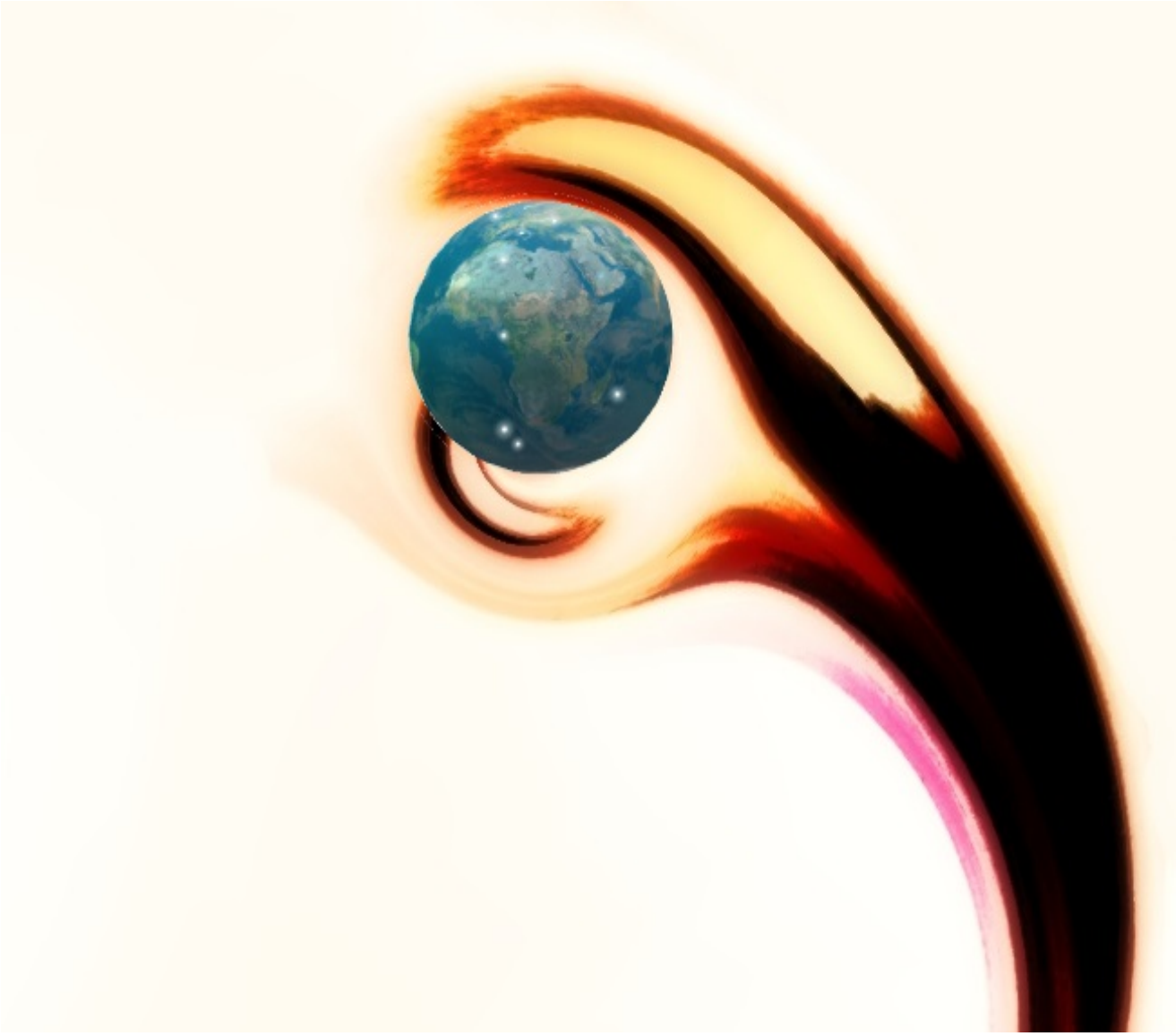
The Mixed-Reality Live Video System

SETUP AND USER GUIDE



www.sambiglyon.org

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Guide created by Fleet Goldenberg and Sambiglyon (www.sambiglyon.org)

INTRODUCTION

The non-profit educational company Sambiglyon (www.sambiglyon.org), of which this author is a co-founder, has designed and constructed a mixed-reality live video setup for Windows 7 and 8 PCs (Mac version hopefully coming at a future point) that combines an everyday computer and webcam with the hugely popular live web video service Twitch.

It provides the ability to extract avatars, objects and other digital content from virtual reality worlds such as Second Life and OpenSim as cut-outs, via a graphics technique known as chroma-keying, or “green-screen”, and overlay them seamlessly on live video footage of the real world as though they were a PNG image.

The combined video output can be seen via a live-updating Twitch channel page viewed with an Oculus Rift headset or on a web-browser page, and even recorded as a permanent FLV or MP4 video file.

Best of all, aside from the cost of a tablet and an Oculus Rift headset (and even the headset is optional with this mixed-reality system depending on how schools plan to utilize it), the grand total price of setting up your own version is zero. The two online services that provide the technology to make it function - Twitch and XSplit - are free and without time limit.

It is said that seeing is believing. So here as proof is just one example of the kind of end result that can be achieved, showing the live-video output of a Second Life avatar merged with a real-world car park on a Twitch channel page.

WHAT YOU NEED

Below is a full list of what is required for this project:

- A PC desktop or laptop for a student in the role of an “adviser” who will control the media that is being created and mixed together.

- An Android tablet for the Oculus headset wearer to carry that will be attached to the Oculus Rift via an HDMI cable and connected to the internet via wi-fi in order to receive the merged mixed-reality video from the Twitch video streaming account.

- A USB webcam or a digital camera for the adviser's PC that is capable of recording live video. A built-in webcam in a laptop may perform the same function. The camera should be pointed at whatever scene in real life that the adviser wants to be mixed in with the virtual media.

- Optional: a second screen to display a copy of the final merged video feed for the adviser controlling the avatar in Second Life / OpenSim (this video could not be shown on the adviser's main display, as that is the one being video-captured to provide the virtual reality image extracts).

- An Oculus Rift virtual reality headset (currently $350 USD for the Development Kit, but projected to be priced lower when the consumer version becomes available.) Find out more at www.oculusvr.com

The headset is not vital for this project to function, as the merged mixed-reality virtual and real-life video on the Twitch web channel can be viewed on a normal computer display or even a smartphone / tablet screen. It is however vital for providing the complete user immersion that a virtual-reality meta-gaming activity requires.

- Second Life or OpenSim viewer software (FREE). It does not have to be special Oculus Rift versions of the viewers (OculusRift Channel for SL or CtrlAltStudio for SL / OpenSim). This is because the student controlling the virtual environment – who is partnered with the Rift wearer - will not be wearing the Oculus headset but will instead be focused on generating the avatar actions, object manipulations and activities that will be combined in real-time with the real-life camera footage to create what the Rift wearer is seeing on its internal display.

- A Twitch web video streaming account (FREE). Sign up at www.twitch.tv

Important note: Twitch's Terms of Service (TOS) require that the majority of a broadcast transmitted via its service features content related to gaming / virtual worlds, with a minimal amount of footage of human presenters.

If you anticipate that this would not be the case for your mixed-reality project – for example, if you are going to use it for teacher professional development sessions with long-running webcam sessions with real people instead of digital avatars – then we recommend using an alternate online streaming platform that does not have this restriction.

See the 'Important Note About Twitch Terms of Service' section of this manual's contents page to read further information about selecting an alternate streaming platform that is compatible with the mixed reality system.

- An account with Twitch's recommended PC video editing software, 'XSplit Broadcaster' for Windows 7 and 8 (FREE). Download the software and register an account at www.xsplit.com

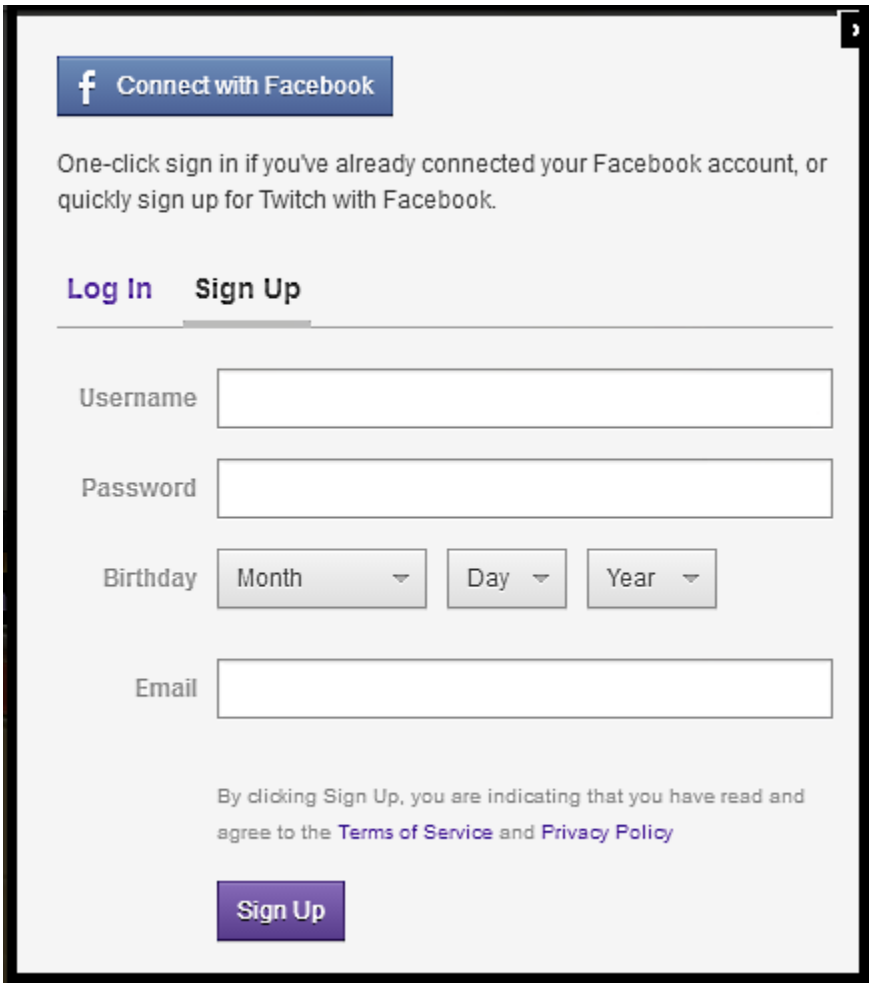
This system may be able to be used with Mac computers if one can find Mac video editing software that offers similar “green-screen” (chromakey) features to that of XSplit Broadcaster and will work with Twitch.

For the purposes of this guide, we use XSplit on PC because it is very simple to use and proven to work, and the author does not have a Mac to test alternative OSX-based software packages such as Camtasia For Mac (www.techsmith.com). We encourage Mac owners to experiment with their own setup and share their findings with the educational community.

GETTING STARTED: BUILDING THE MIXED REALITY SYSTEM

Step 1
Ensure that your USB webcam or digital camera is attached to your computer. If you have a built-in webcam that you wish to use instead, check that it is working.

Step 2
Sign up for a Twitch account at www.twitch.tv or log in with an existing Facebook account.



Step 3
Visit the XSplit website at www.xsplit.com to sign up for a free account and then download and install the XSplit Broadcaster software for Windows 7 and 8 from the website.

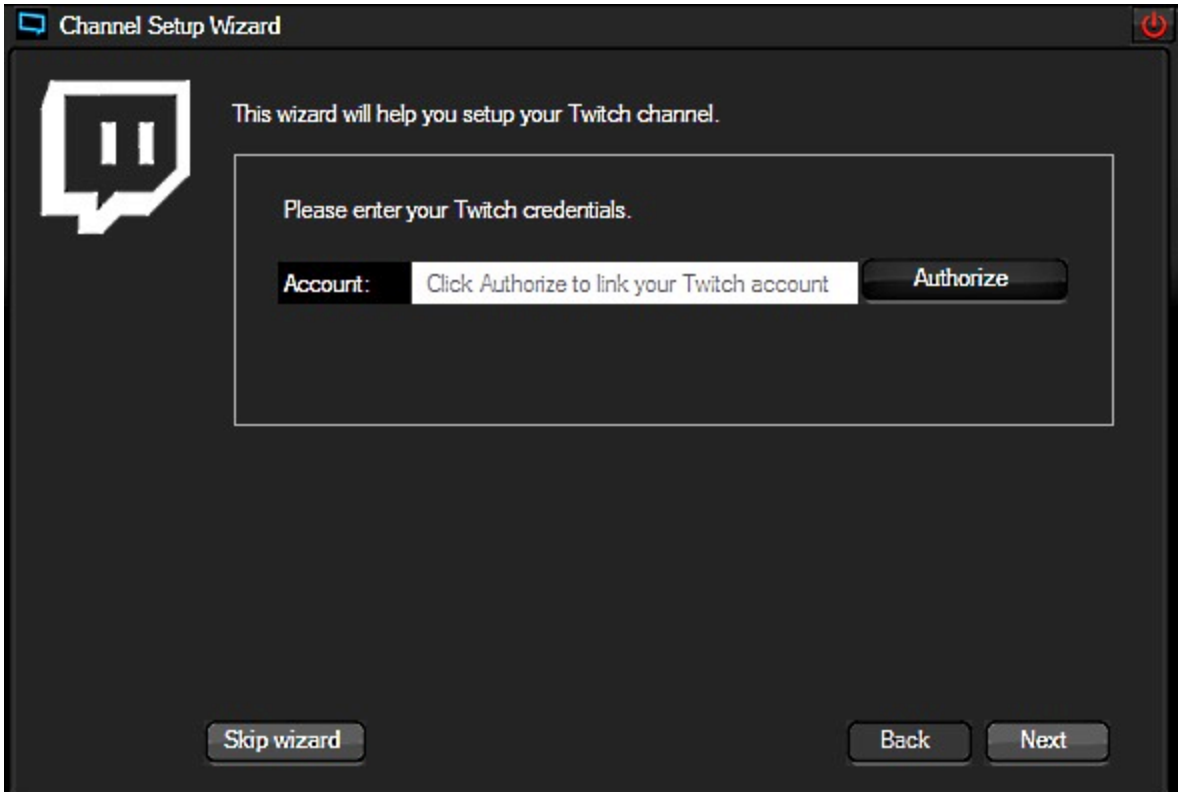
The free version of XSplit works very well and has no time limit, though upgrading to a paid account from just $14.95 for a 3 month subscription period provides many additional benefits such as unlimited frames-per-second streaming speed, recording videos in MP4 format, no watermark logo displayed on videos and capture of video footage from Skype.

Step 4
Start up the XSplit Broadcaster software and enter your XSplit account details into the pop-up login box that appears.

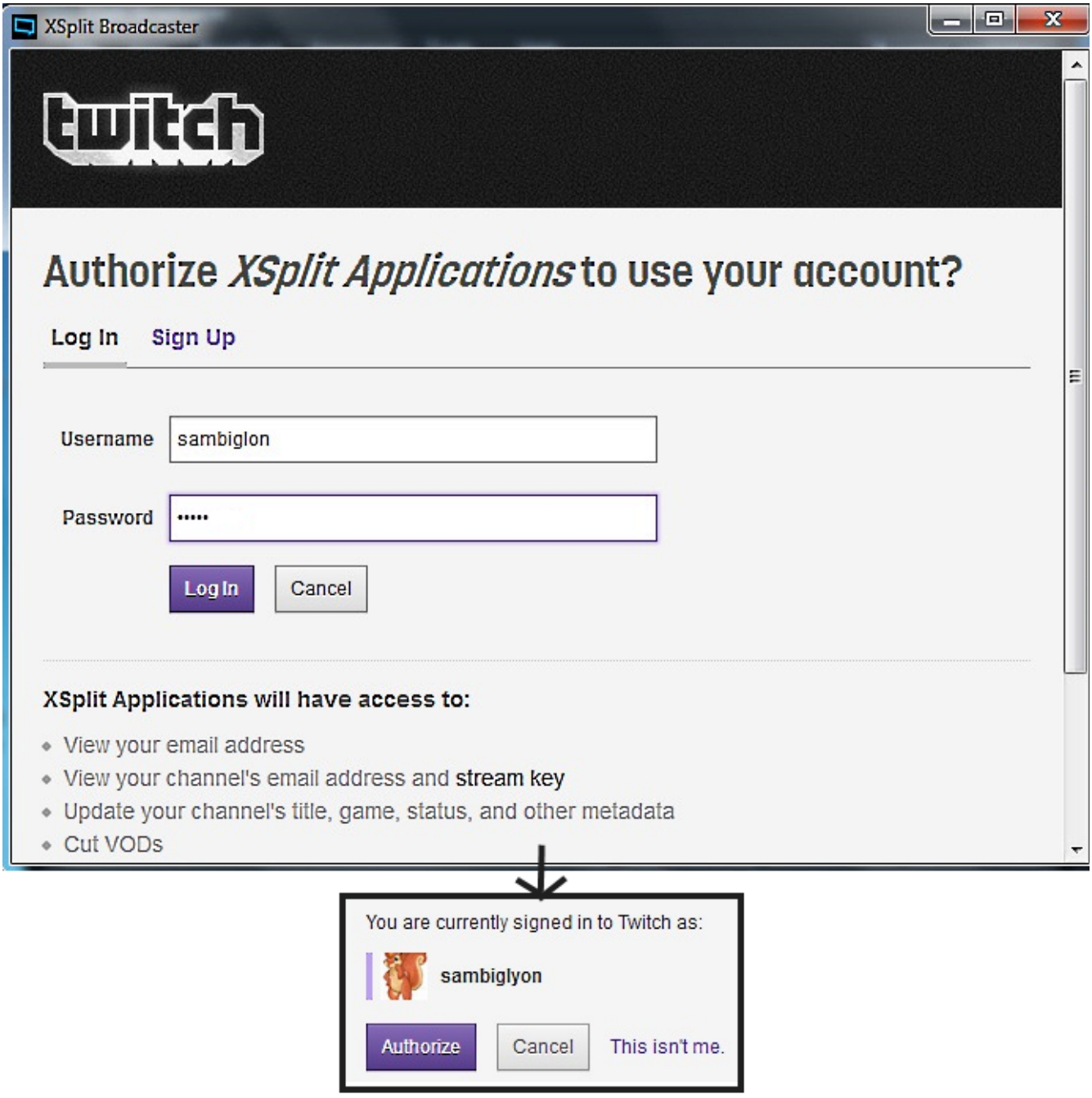
On the next page is an ad for the paid versions of XSplit, with a 10-second timer that counts down to zero before you can continue. When the timer reaches 0, click the 'continue' button to complete the login process.

Step 5
Go to the 'Broadcast' menu at the top of the XSplit window and select the 'Twitch' option. This will cause a “Channel Wizard” configuration interface to open.

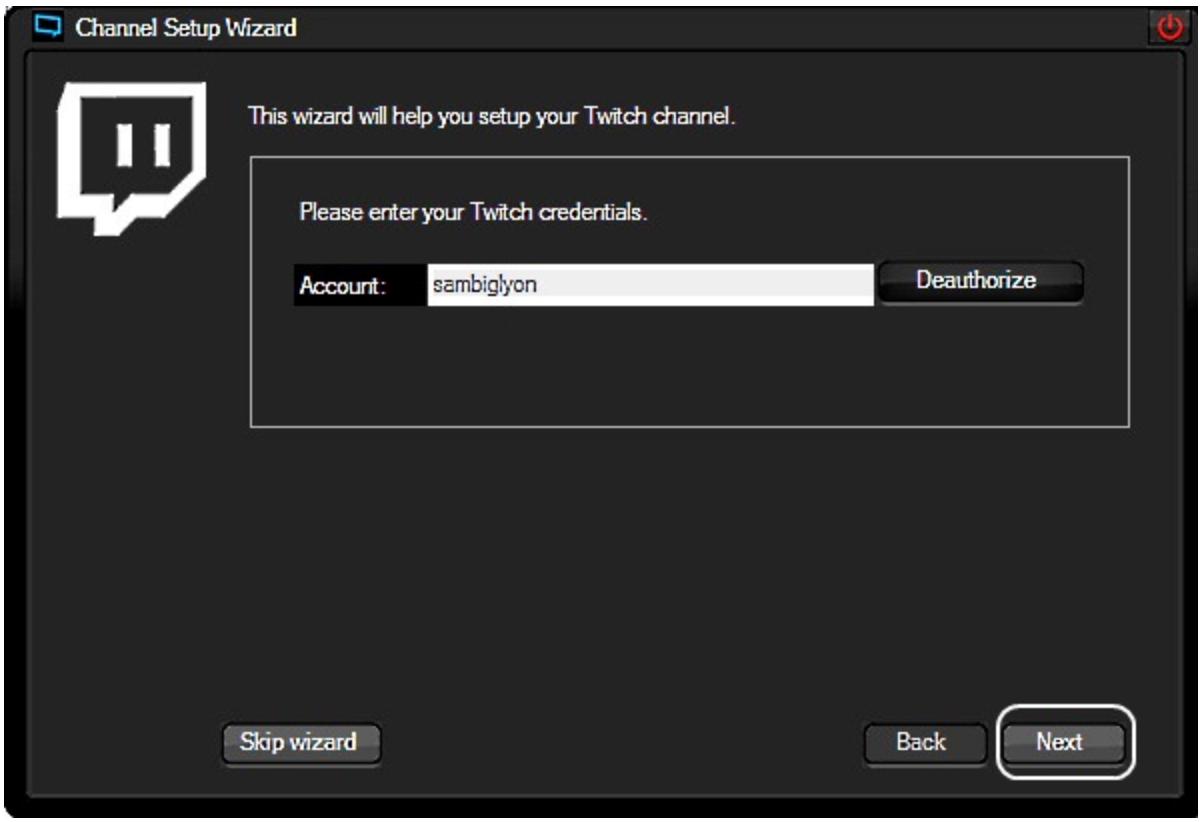
The first step of this setup wizard is to authorize XSplit to access your Twitch account. Click on the 'Authorize' button to begin the account linking process.



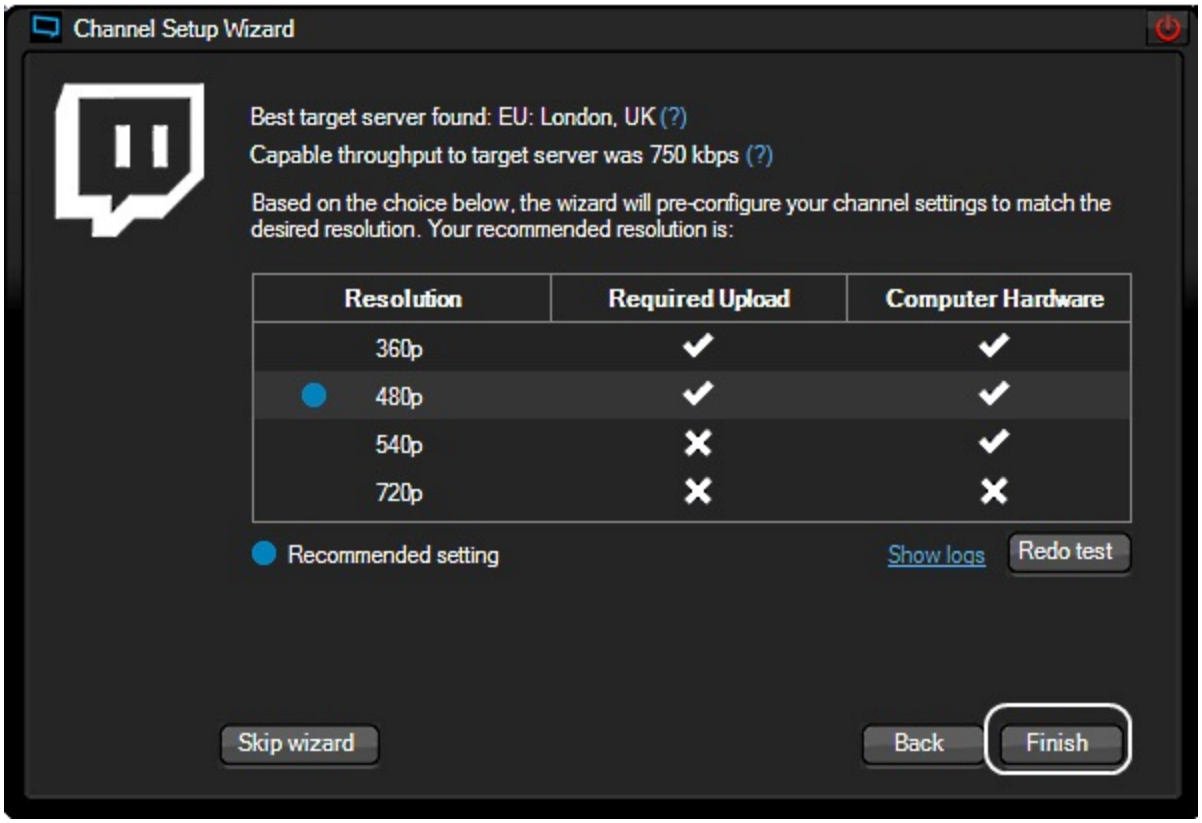
Enter your Twitch username and password and click the 'Login' button, then the 'Authorize' button to complete the account linking.



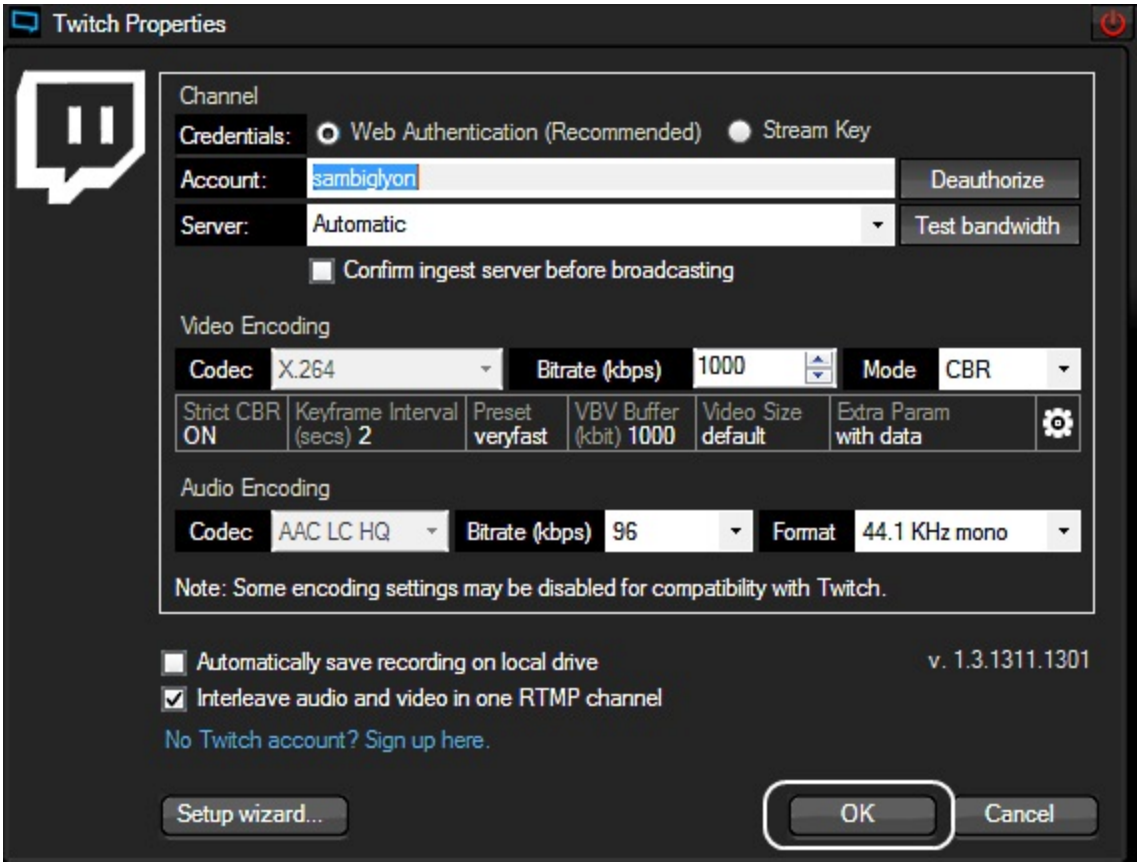
You will be returned to the Channel Wizard, where you will receive confirmation that XSplit has been linked to your Twitch account. Click the 'Next' button to progress to the next stage of XSplit setup.



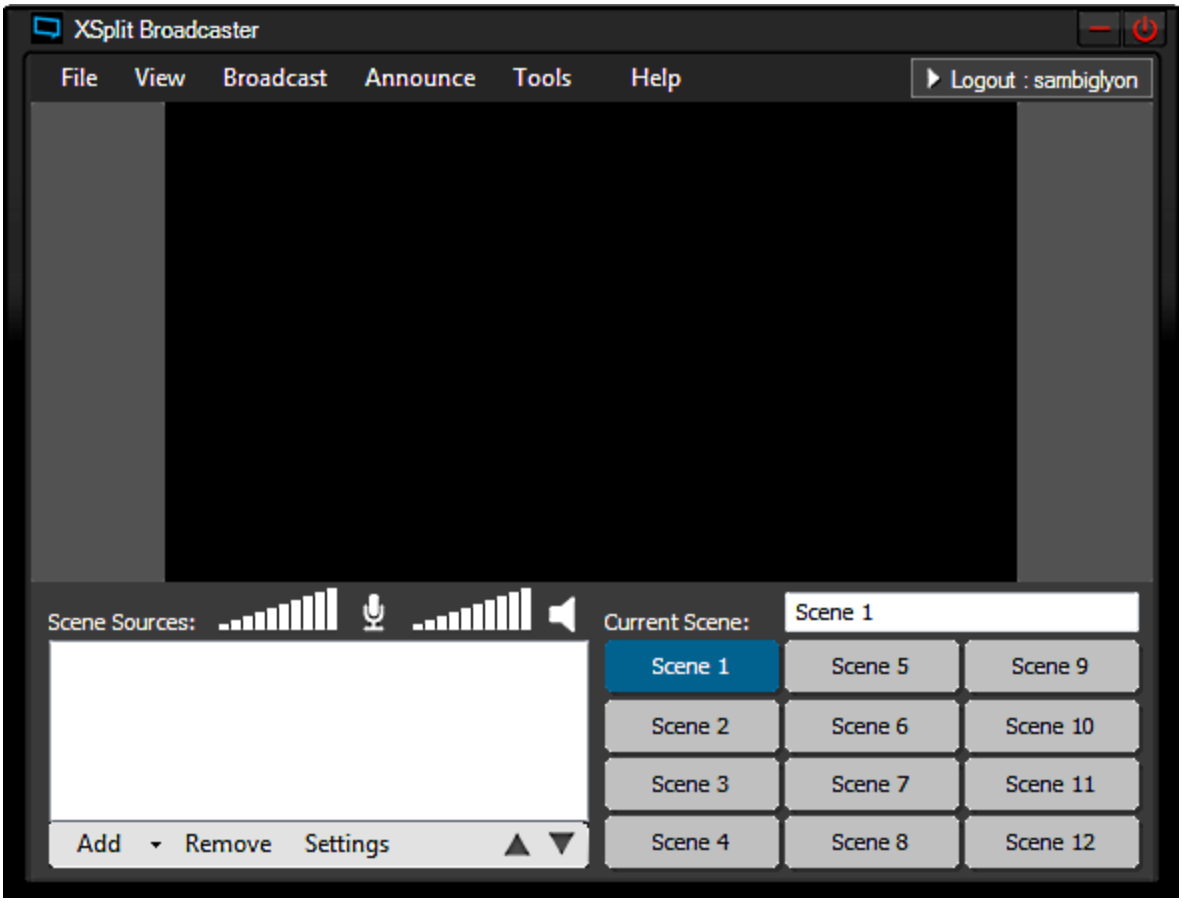
The wizard will now search for the optimum Twitch server for your location. In the example below, the wizard automatically selects the UK as the best choice of Twitch server because that is where the author of this article is located. Click the 'Finish' button when you are ready to move on.



On the final page of the wizard, you will be given the opportunity to tweak your Twitch settings. There is nothing here that the typical user will have to change, so just click the 'OK' button to skip past it and complete setup.



Step 6
You will now be returned to the main screen of XSplit, where you can begin to set up the merger of video feeds from Second Life / OpenSim (via live screen-capture) and from the real world (via the webcam / digital camera) and blend the two worlds seamlessly together into a single mixed-reality view that updates in real-time.

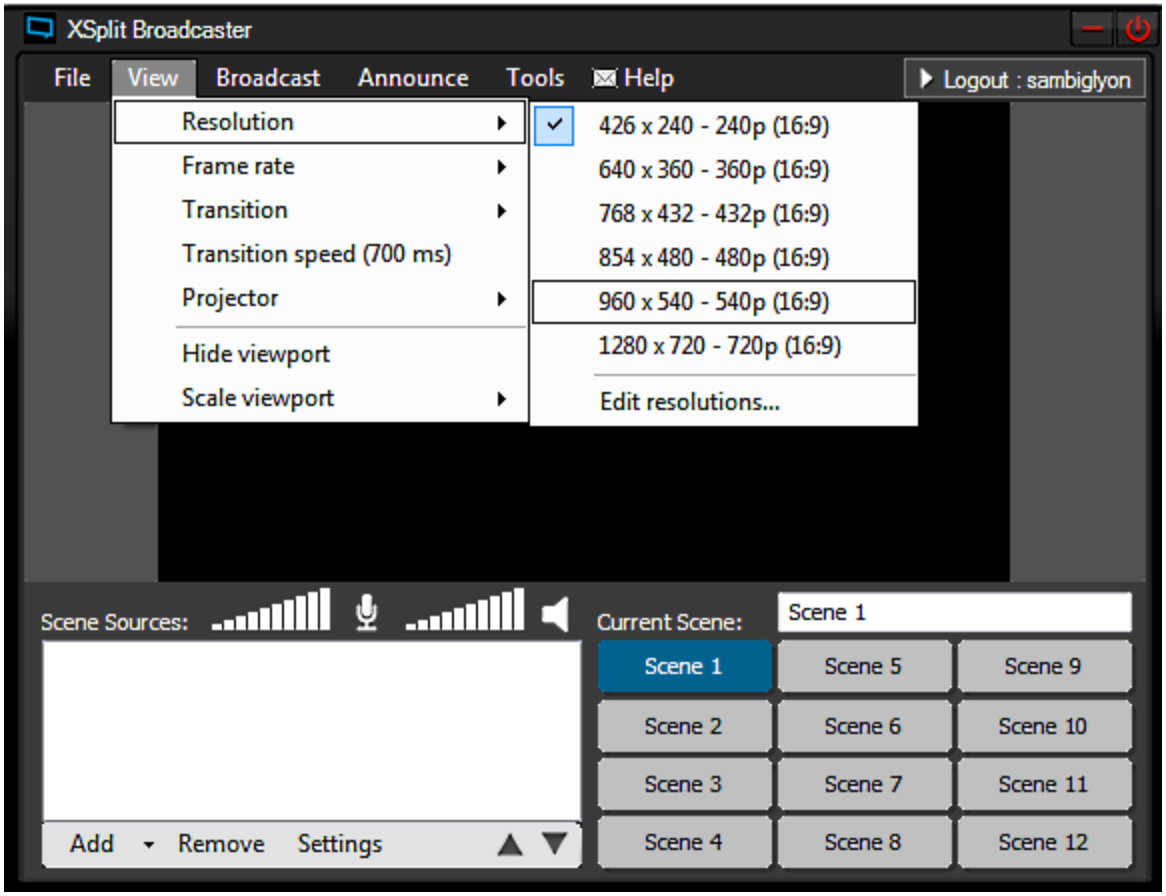


You will observe that there is a panel in the bottom right corner of the XSplit window with a series of 'Scene' buttons in. What this means is that you can configure multiple video mixing setups with different media sources in each and switch between them at will at the touch of a button.

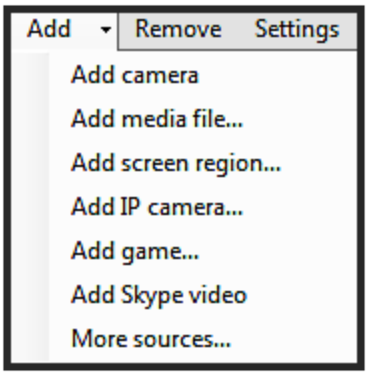
This is especially useful for producers administrating a live broadcast where they need to rapidly switch between different video streams and graphics. It also enables teachers to set up a wide range of configurations for their classes well in advance instead of wasting class time fiddling with settings.

For the moment though, we do not require any of that complexity and so we can leave the panel set on the default 'Scene 1' and ignore that part of the screen from here on.

If you need to enlarge the XSplit window before you begin putting together your mixed-reality production, you can do so by going to the 'View' menu option, selecting the 'Resolution' sub-option and picking a resolution that is comfortable for you.



Step 7
We are now ready to begin importing media onto the “mixing stage” in the center of the XSplit window. To do so, click on the 'Add' option at the base of the window.



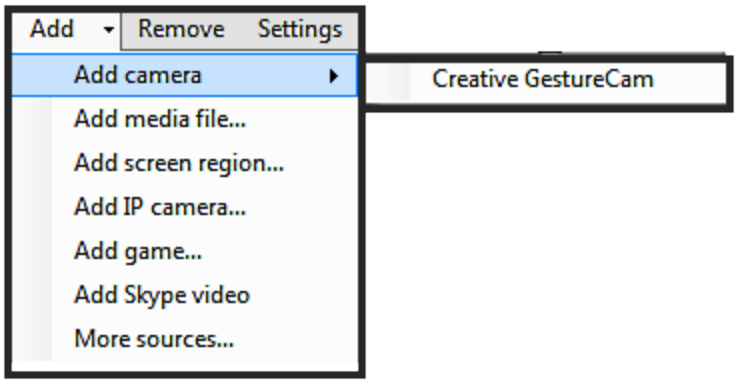
XSplit offers the ability to import or live-capture media from sources such as webcam / digital camera, static image files, computer games and whatever is displayed on the window that the user is currently looking at.

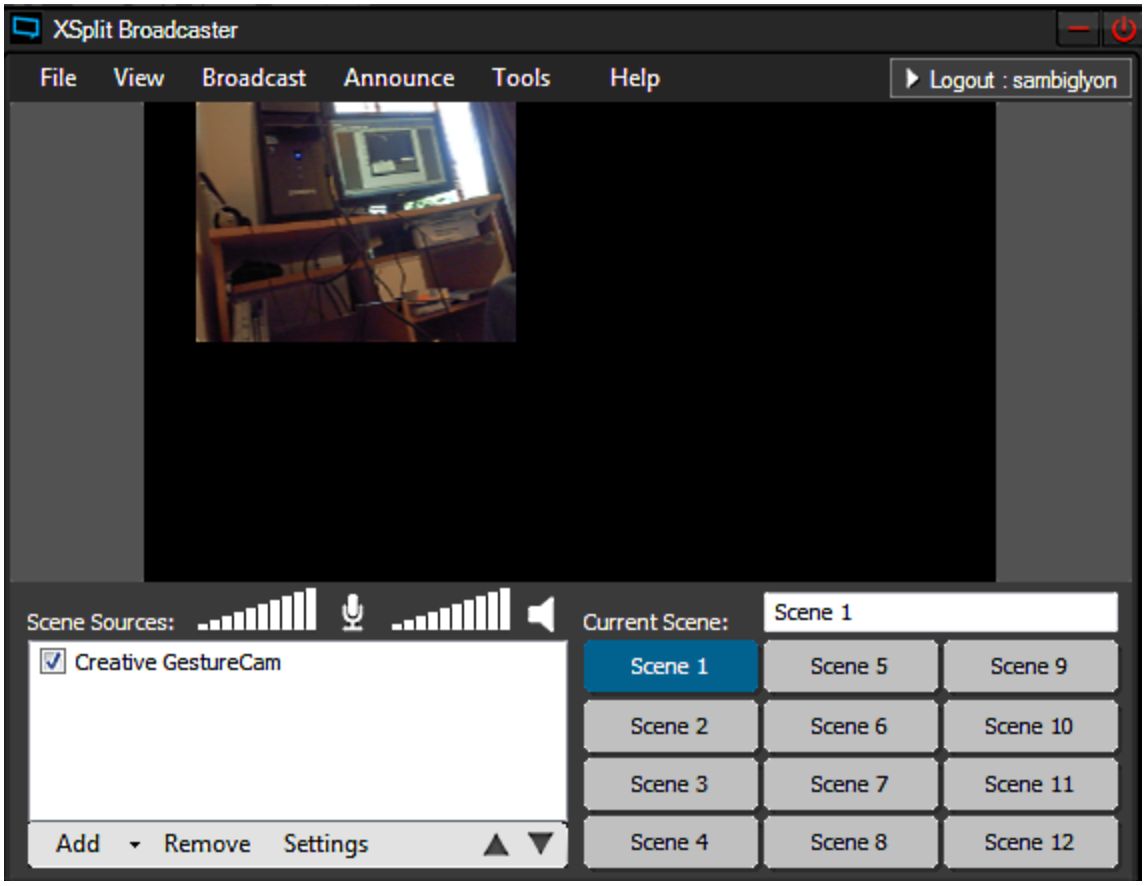
Other options, such as adding Skype video and those listed under 'More sources', are not available on the free version of XSplit and require a subscription upgrade or optional expansion module purchase.

For the purposes of this article, we are aiming to combine a video feed of the real world with extracted imagery from Second Life / OpenSim. We therefore only need concern ourselves with the Add menu

options 'Add camera' and 'Add screen region'. “Screen region” refers to the area of the computer screen that we want to capture and integrate into our video as a live-updating image that changes from moment to moment depending on what is happening on the computer desktop.)

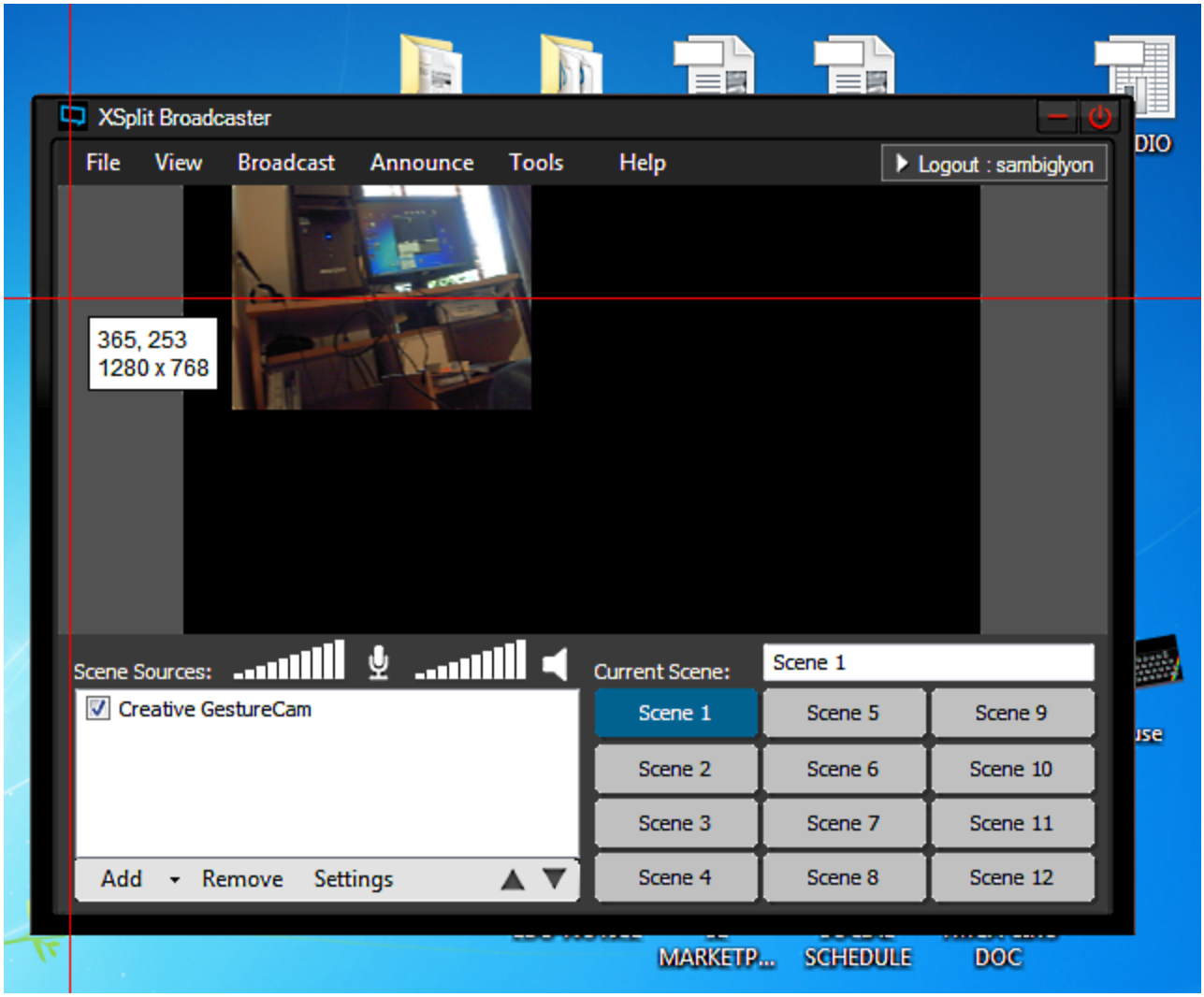
Firstly, we will add a live image of whatever the camera is looking at onto XSplit's center stage. To do this, we simply select the 'Add camera' option from the Add menu and click on the name of the camera that is attached to the computer.





Although the camera view is small by default, we can stretch it to a larger size that fills the stage by dragging on the corners of the media. Before we do so though, we will add the second of our two media components to the stage – live capture of whatever is on the currently active desktop window.

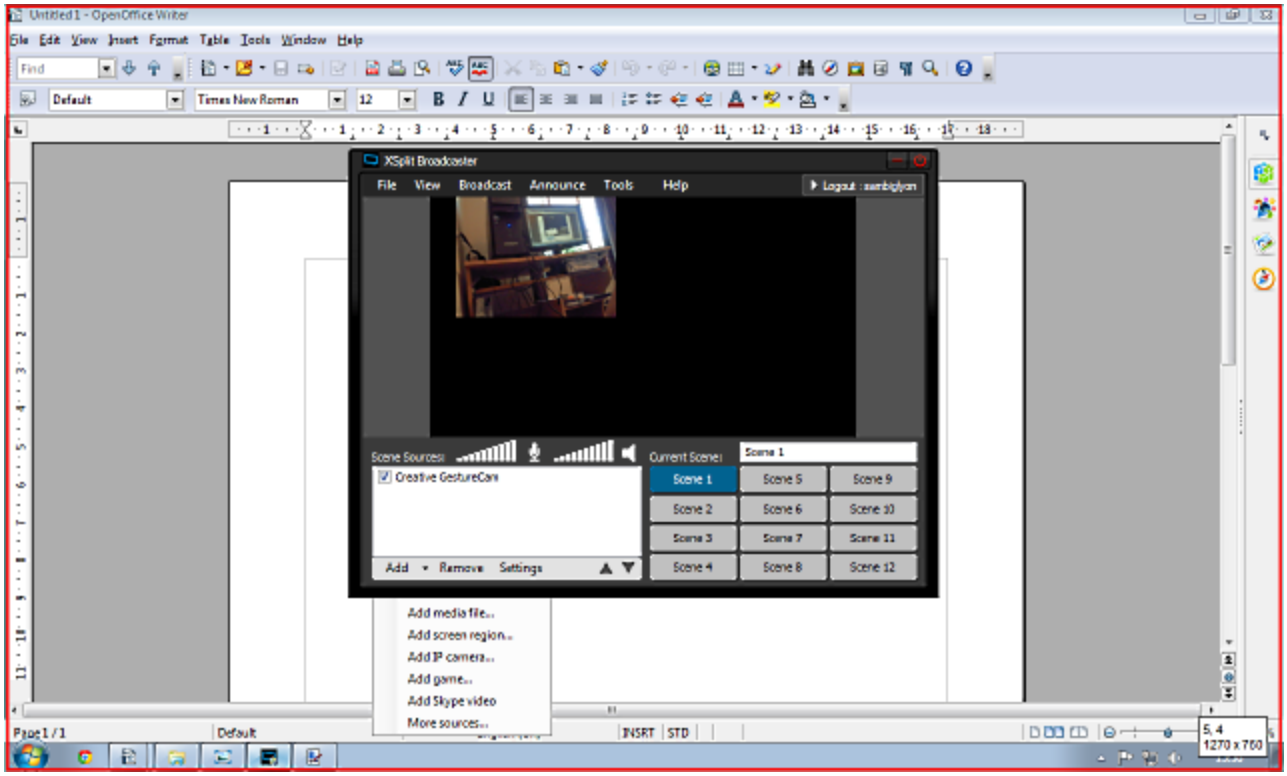
Step 8
Return to the Add menu and this time select the 'Add screen region' option. A large red cross-hairs will appear on the screen.



The cross-hairs is asking us to highlight the section of the screen that we want to capture as a live video stream.

At this point, it is useful to refer to the user interface design of whatever program you are planning on capturing. For example, if you do not want menus at the top and bottom of an application or menus / scroll bars at the side to be part of the video then you can draw about an inch away from the edge of the screen on all sides of it.

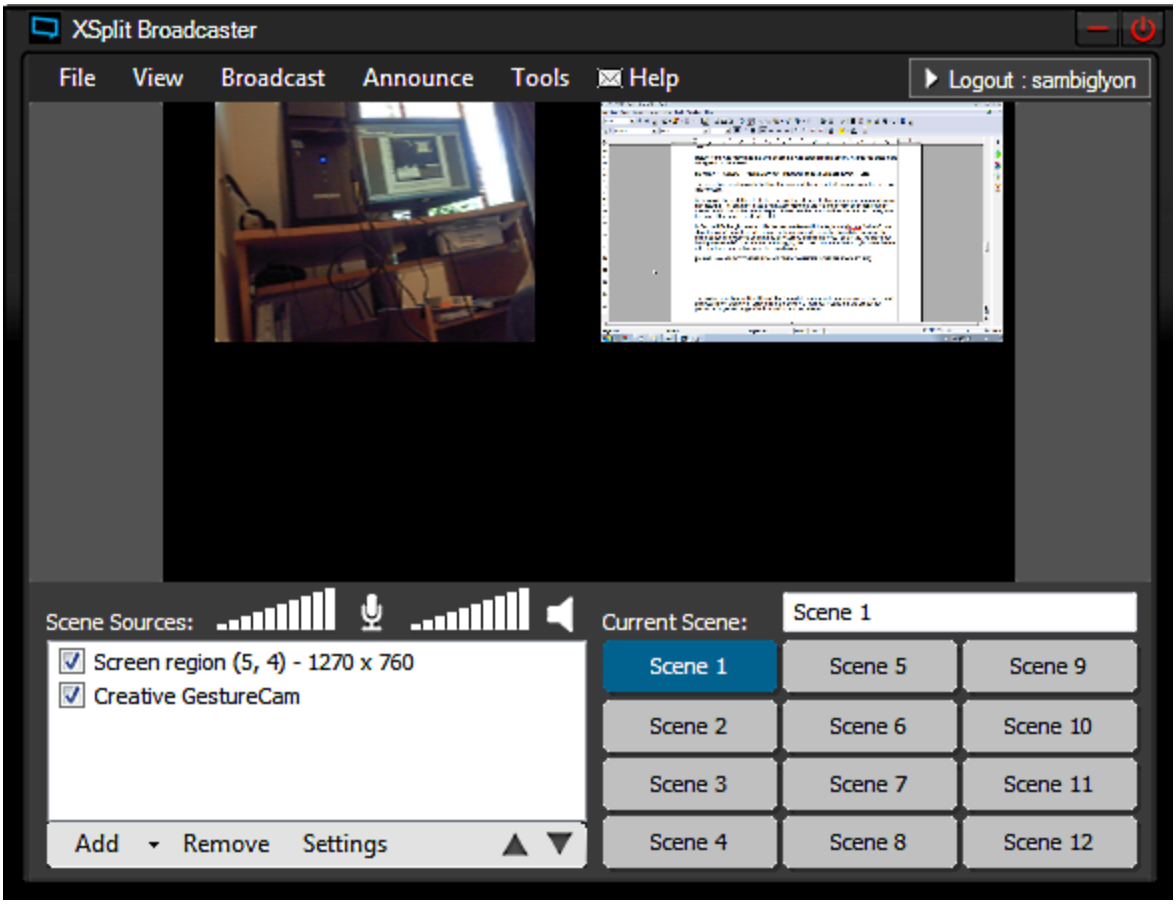
In Second Life though, one can hide the user interface with the keyboard shortcut Ctrl-Alt-F1 and show the world's visuals in full-screen. So for our example project in this article, we select the entire screen landscape to be captured by XSplit by placing the cross-hairs in the top left corner, holding down the left mouse button and dragging the cross-hairs to the bottom right corner.



When the mouse button is released, the X-Y coordinates of the screen area that will be captured are set. Confirmation of this appears beneath the Add menu, and a small preview of the screen-capture is added to XSplit's stage alongside the live camera feed.

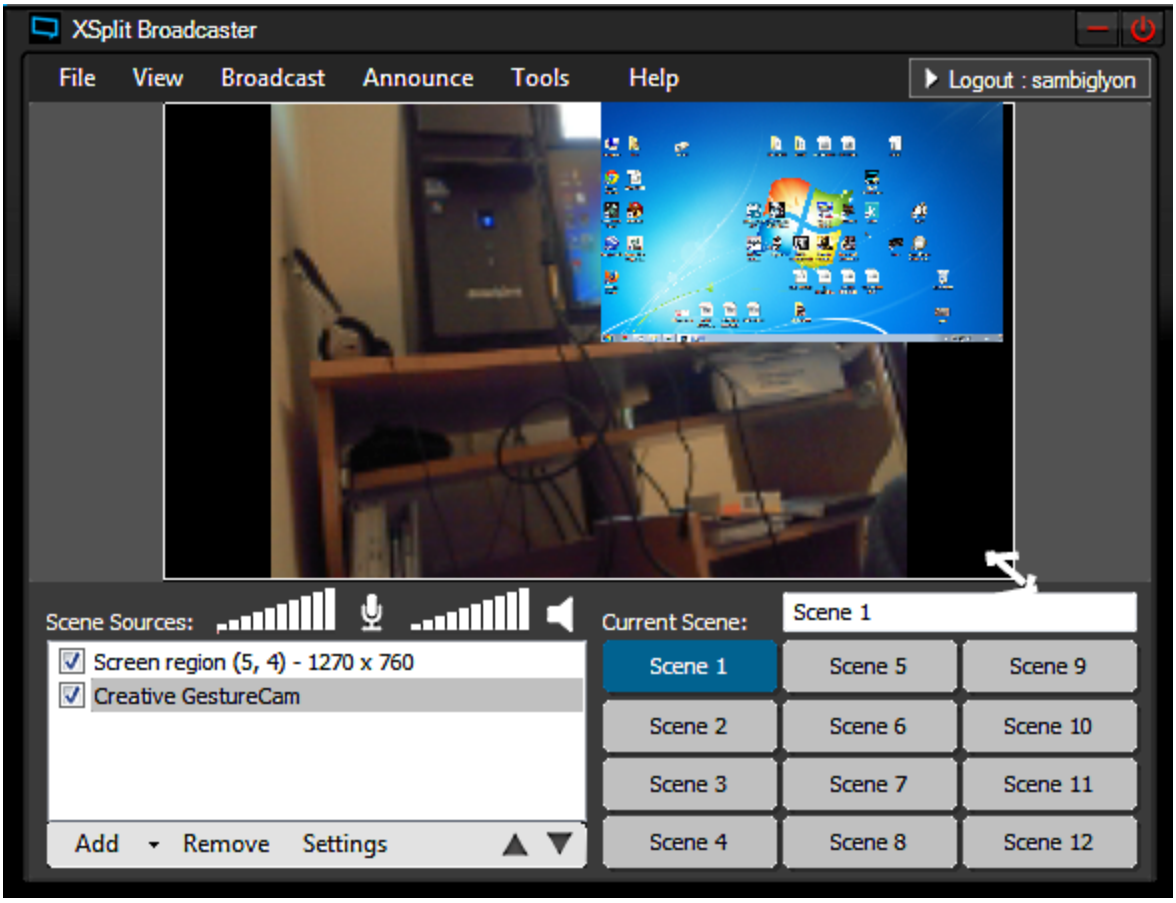
Important note: when you first see the preview of the screen-area capture on the stage, it may look weird – as though there are multiple copies of the captured image nested endlessly inside one another.

If this happens to you, you can correct the problem by going to the 'Tools' menu at the top of the XSplit window, selecting the 'General Settings' sub-option and, on the resulting configuration window that appears, placing a tick in the box labeled 'Hide from screen region' and clicking the 'Apply' button.



If we now look at a different desktop window then XSplit instantly recognizes this and updates the preview on the stage.

Step 9
The two video feeds are no use to us though at their present size. We want to expand them so that both of them completely fill the space on XSplit's stage, overlapping one another perfectly. To do this, place the mouse cursor on a corner of the preview to make the traditional double-arrowed window resizing icon appear and then hold the left mouse button down and drag the corner of the preview until it occupies all of the stage space. Repeat the procedure for the second panel as well.



One of the previews will now be completely obscured by the other.

There is no need to worry though. We are going to “cut out” part of the scenery of the screen-capture panel later so that the preview containing the live camera footage becomes visible behind it.

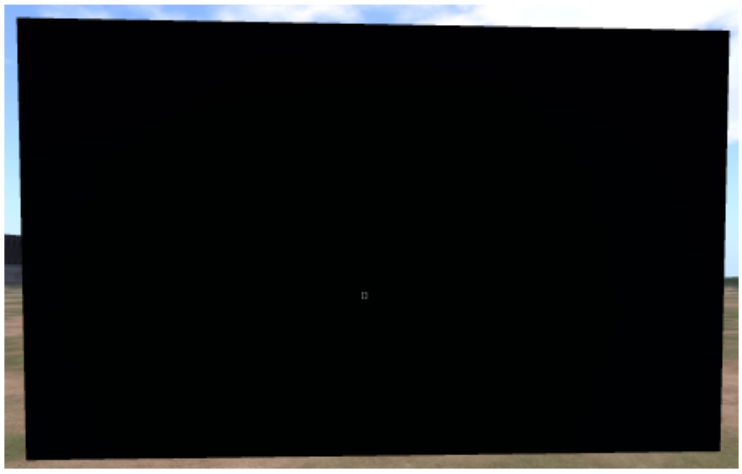
The preview containing the screen capture should be on top of the one with the live footage. If this is not the case, the 'under and over' position of the two previews can be switched just by holding the left mouse button down on the text description of one of the previews in the bottom-left 'Screen Sources' panel of XSplit and then dragging and dropping that highlighted preview on top of the text description of the other preview in that panel.

Individual preview feeds on the stage can also be turned on and off at any time by ticking and unticking the tick-box beside the descriptions.

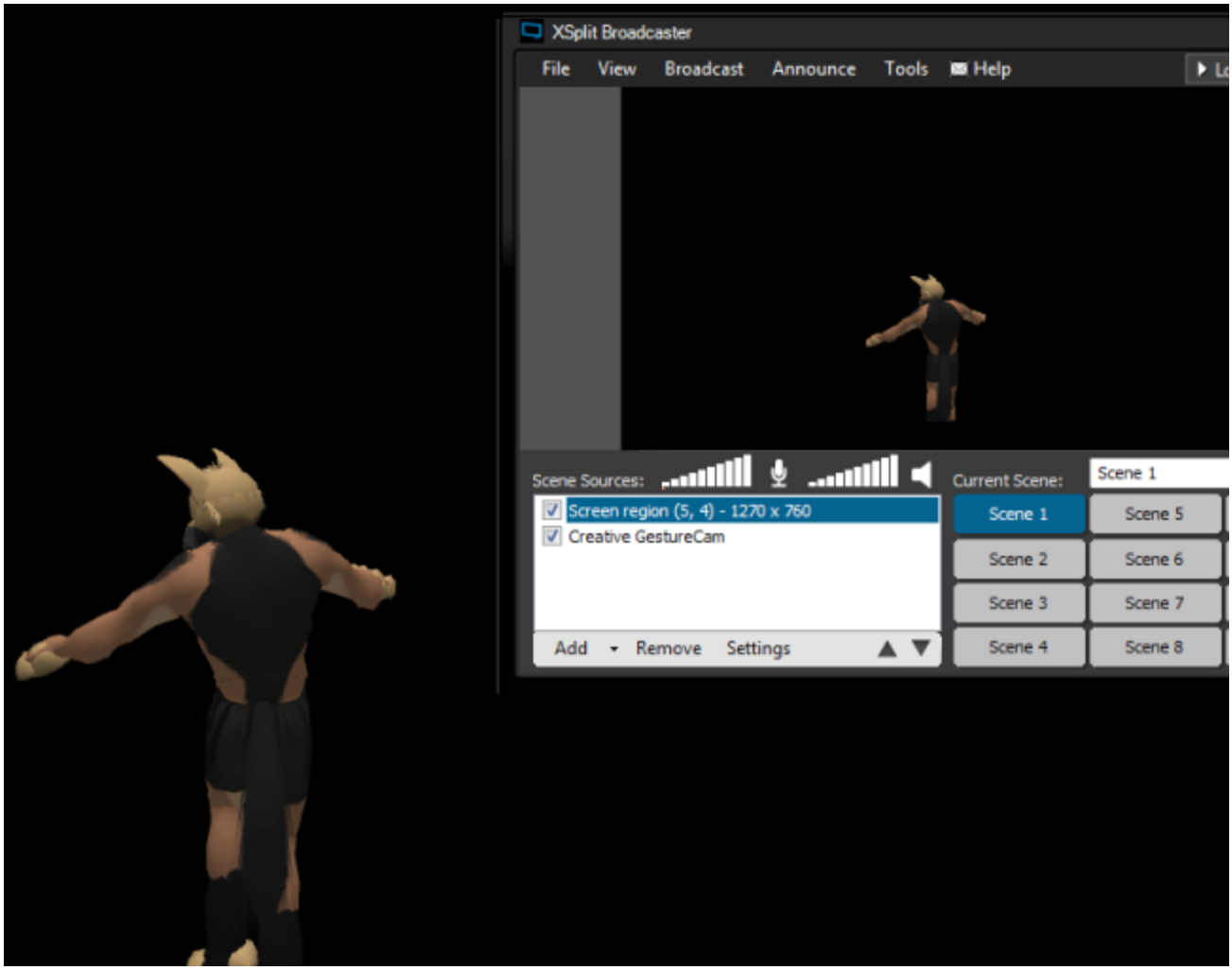
Step 10
With our camera feed and screen-feed set up, we are now ready for the really fun part – capturing live moving imagery from Second Life or OpenSim on our XSplit stage!

Start up your SL or OpenSim viewer software. A normal non-Oculus viewer will suffice at this setup stage of the project. Find a location in-world where you have object construction, or “rezzing”, powers. This may be a piece of land that you own or a public 'sandbox' area of the virtual world where anybody can freely build.

Create a basic cube shape, stretch and flatten it into a large square board and change its color to black.



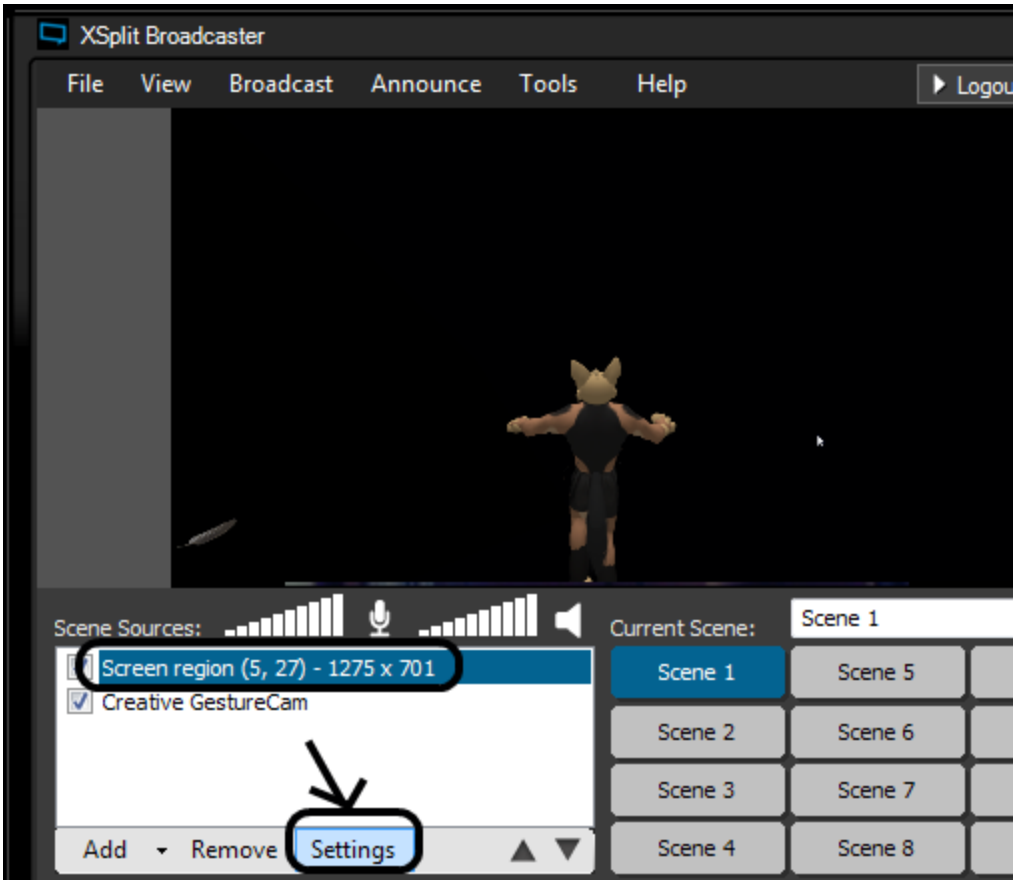
Position your SL / OpenSim avatar against the black backing-board you have created and bring up the XSplit window so that it is overlaid on top of the viewer window. This makes the viewer software the screen image that XSplit is capturing, and the screen-capture preview on its stage changes to a live copy of what is displayed in the viewer window at that moment.



Step 11
You may be wondering why we have placed the avatar against a single-color background. It is because we are going to use a graphics technique from television and movie production called Green-Screen (also known as chromakey).

The method, popularized by movies such as 'Who Framed Roger Rabbit' but actually existing since the Forties, isolates a specific color and renders it totally transparent so that any media laid underneath it – our camera feed of the real world, in this case – shows through and all that will be left remaining of the original image is a cut-out of the avatar, now a seamless part of the real-world scenery.

Selecting a color in XSplit to be chromakeyed out is very easy. First, we left-click on the text description of the preview panel that we want to perform the chromakey on and click on the 'Settings' option at the base of the XSplit window to open the color settings for that preview panel.

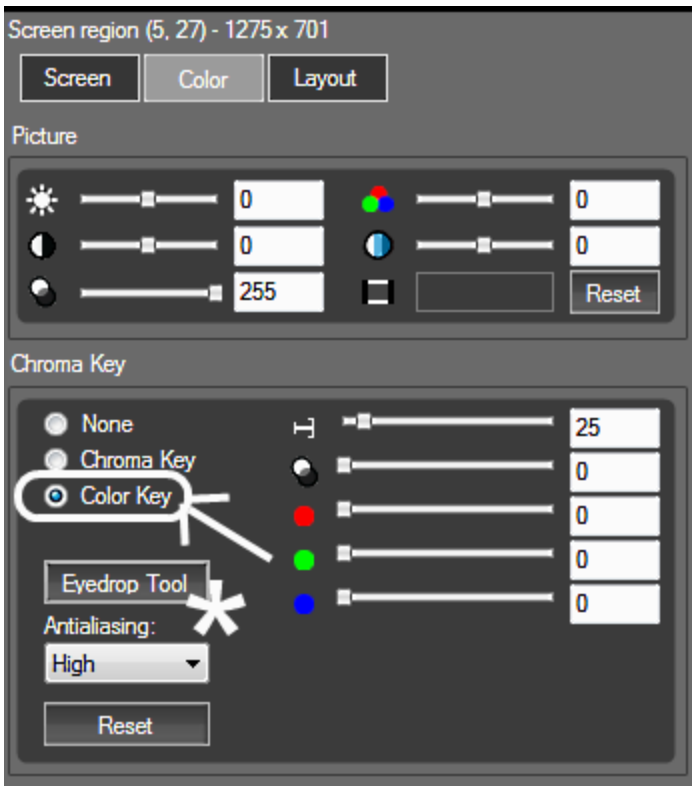


We want to select black as the color that we “cut out” from the scene, but the only colors supported by the 'Chroma Key' option are red, green and blue. That is no use to us, so we need to define a custom color to eliminate instead.

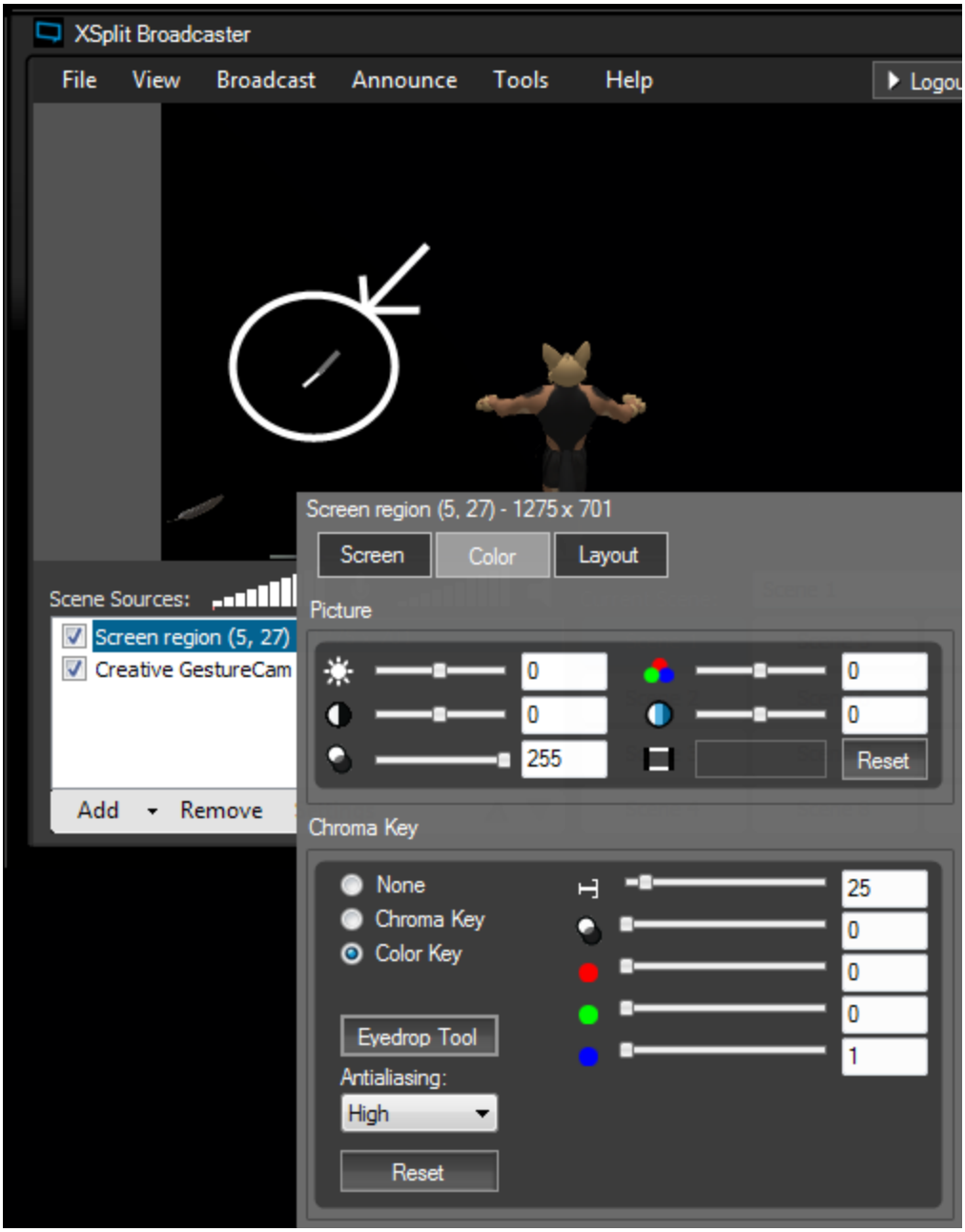
You may be wondering, then, why we did not color the board red, green or blue. One of the reasons for this is that there are different shades of those colors that the chromakey process may not be able to fully remove if the tone does not match up closely with the color settings pre-defined in XSplit. With pure black though, there is no – forgive the pun – gray area.

Pure black is always pure black, and so selecting that color for chromakeying guarantees that you will achieve an ideal cut-out where only the avatars and objects that you want to be visible in the real-life footage – i.e everything that does not contain any hint of black in its textures – displays perfectly against the background video footage generated by the camera.

So instead of using the 'Chroma Key' option, we instead define our custom cut-out color with the 'Color Key' option directly beneath it. Once that option is selected, a tool called the 'Eyedrop Tool' becomes available.

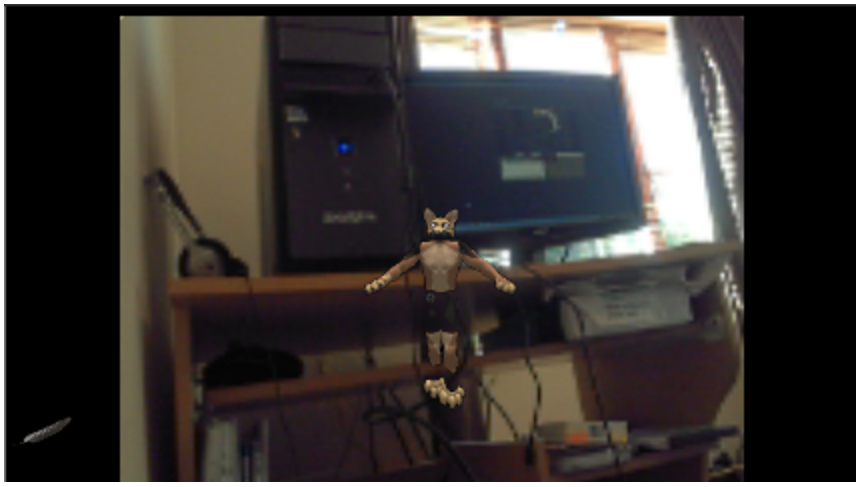


Left-clicking on the 'Eyedrop Tool' option turns the mouse cursor into a color-dropper icon like the one you might see in painting software when picking a specific hue from the surface of an image to make it the current color in use.



Now that the dropper tool is active, moving it to the color on the screen capture preview that we want to make transparent and left-clicking on it removes it completely and shows what is underneath. Our virtual reality avatar has made it into our world!

Because XSplit is capturing the virtual-world imagery live, every single movement that the avatar makes is updated immediately on the merged video feed in the XSplit window. It is as though an animated movie is being created on the fly by the avatar's human controller instead of having to craft the movie by hand laboriously and expensively, frame by frame over days and weeks.



He's a bit small though. This is not a problem, however. To enlarge an avatar or object in the virtual world to match the size that they should be in the real world, all you have to do is scale up their size in the virtual realm.

With objects, this is accomplished by stretching them with the object editing tools. With avatars it is a little more complicated. You can resize them upwards to a certain extent with the viewer software's 'Appearance' settings, but if a truly huge avatar is needed then it is much easier just to build a giant avatar using prim pieces attached to its body or purchase a pre-made giant from an online object store such as the Second Life Marketplace.

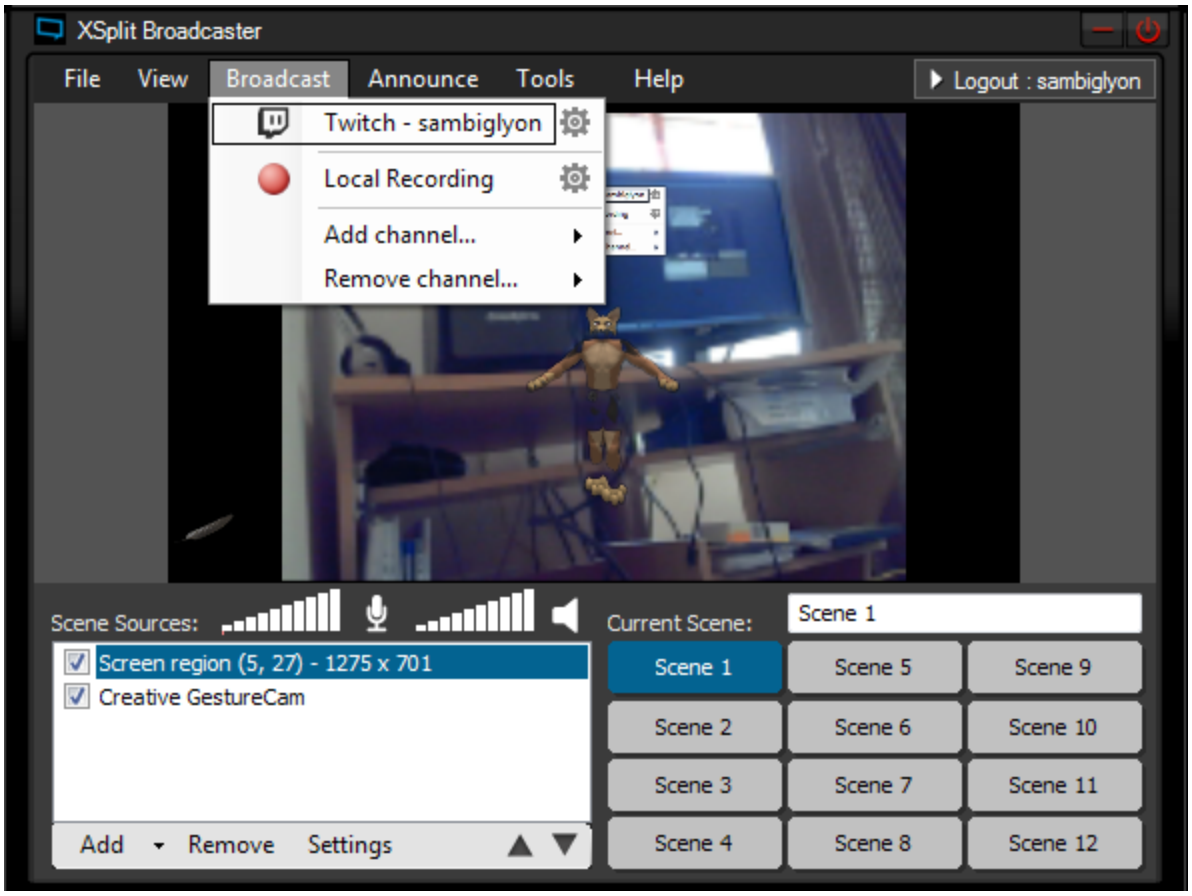
Here is an example image, taken during development of this project, of a Second Life truck model that was scaled up greatly in Second Life against a totally black backdrop and overlaid via chromakeying onto a real-world car park. The background removal process is so accurate that you can see every detail of the model in the real-world setting in perfect clarity, including animated components inside the wheels.

And here is our enlarged mouse avatar friend again, overlaid in 1:1 scale glory on the same car park location. It is incredibly easy to imagine him walking over to one of those cars, opening the driver's door and stepping inside. This is the immersive power of mixed reality.

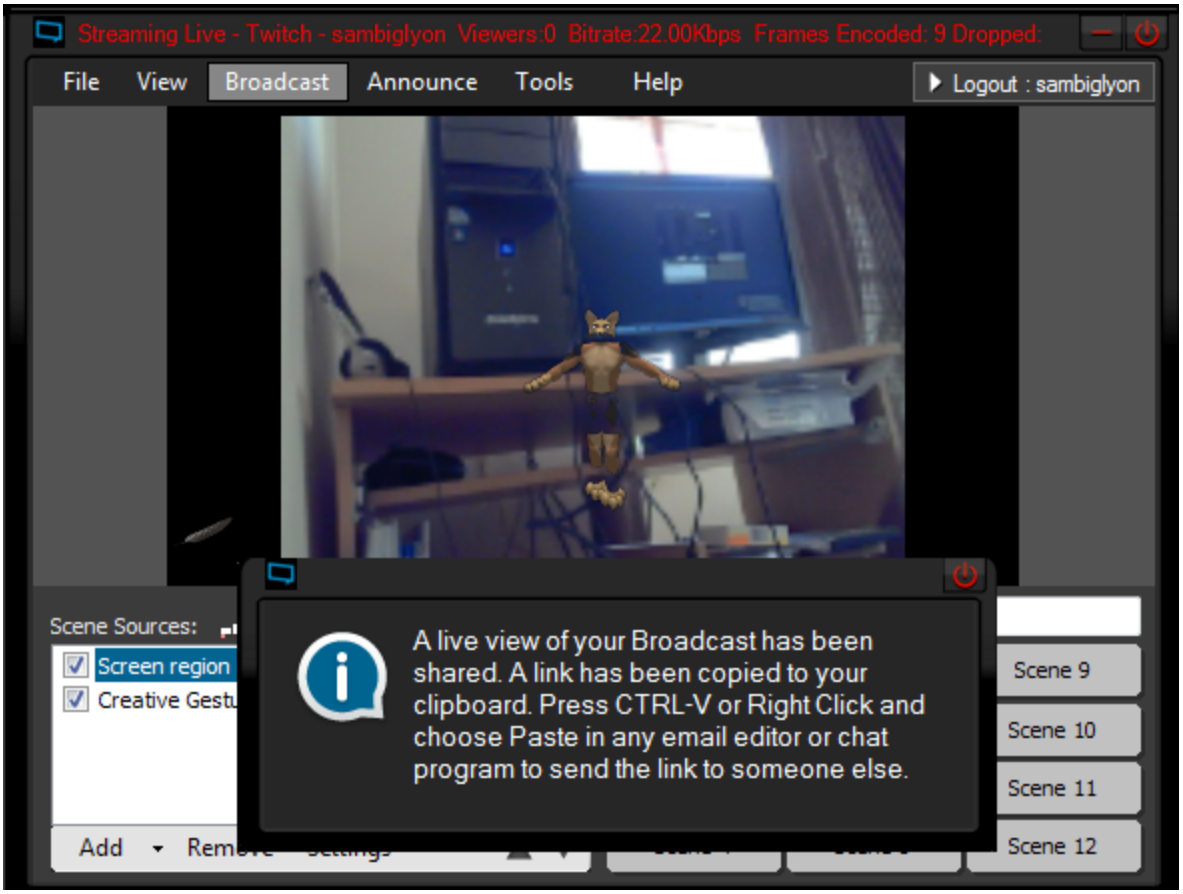
Any audio that is playing in the virtual environment during the screen-capture – such as the rising and dipping of the truck engine's noise output as it moves through the gears – is also transferred automatically onto the mixed-reality video and heard in the real-world setting.

Step 12
But what use is this mixed-reality technology if only the person controlling the avatar could see it? The excellent news is that thanks to the integration of Twitch video streaming technology, *everyone* with an internet connection and a device with a web browser can see it!

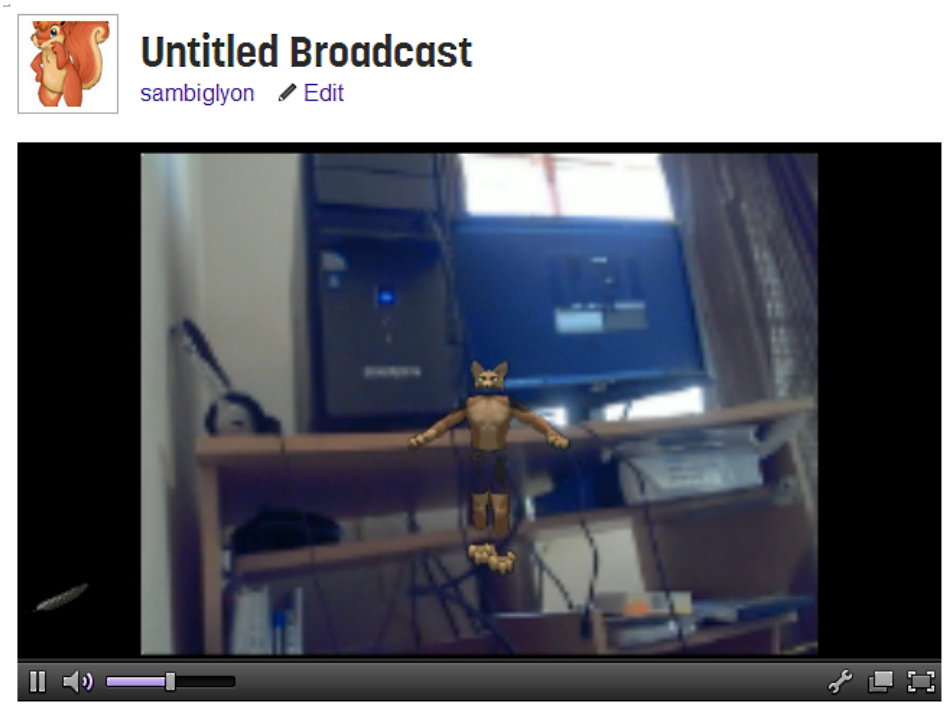
Going live on Twitch with your production is simplicity itself. When you are ready to broadcast to the world, all you have to do is go to the 'Broadcast' menu at the top of the XSplit window and click on the 'Twitch' option, and whatever you are seeing in the XSplit window is sent to your Twitch channel web-page.



XSplit locates your Twitch server, sends your video stream to your channel in moments and informs you that your transmission is online. To stop broadcasting to your channel, just left-click on the 'Twitch' option again to un-tick it.



Step 13
Hop over to your Twitch account's personal channel page and, after a 30 second delay as you're shown a compulsory advert (the price of free services!), you're a mixed-reality world wide web star!



Final Step – from Twitch to Oculus
We haven't forgotten that this article is focused on using this project with an Oculus Rift virtual reality headset. As we stated earlier, this is entirely optional but once one has the chance to, you may never go back to viewing mixed-reality on a monitor or mobile!

Once your live movie is streaming on Twitch, the wearer of the Rift headset can view the movie in an Oculus-enhanced application such as a movie player, observing the merged real and virtual environment in stunning widescreen 3D whilst a student partner – and even teachers and other class-mates log in to Second Life or OpenSim from computers or mobiles and provide the wearer with virtual-augmented information and interactions that helps them to carry out and succeed at important tasks.

Avatar projections in the headset could also act like a 'ghost' for the wearer to imitate and replicate, race-car game style – a presence that can be helpful or pose challenges to overcome..

We recommend that teachers research on Google and Google Play what the best Oculus-compatible way will be to view the video on the Rift via the Android tablet attached to the Rift via HDMI cable, using the search term "oculus rift video player." 'VR Player' would seem to be a good choice of Oculus video player for the Android. If you want to view videos on the Rift via a computer, the new open-source player eleVR (http://elevr.com) is also worth looking at.

So what else could you do with the system? Read on …

ADVANCED USE

A. SCALING PROJECTS UP FROM PAIRS TO LARGE CLASS GROUPS

Any avatar that enters the area of the computer screen that is being captured becomes a cut-out and is mixed in seamlessly with the real-life video footage in the background. This makes it possible for multiple students to simultaneously interact with the student who is wearing the Oculus Rift headset instead of just a two-person pairing of the Rift wearer and the computer-operating adviser, just by visiting the area of Second Life that the adviser's avatar is located at and walking in front of their avatar's camera view.

Adding additional participants to a session has the potential to be a recipe for chaos though unless all members of the group are working to a common goal. For inspiration about how to arrange this, we can look to the 1970s, where the British boys action comics 'Warlord' and 'Bullet' created a powerful sense of purpose among their young readers by encouraging them to form 'secret agent clubs' with other kids in their street and their neighborhood.

Club members built club-houses and carried out activities such as charity work, exercising (to become fitter secret agents), going exploring, investigating and solving local minor crimes, helping people in trouble and giving first aid. The comics supported the clubs by publishing accounts of their heroic adventures on the letters page (some of which were likely fictional) and rewarding contributors with practical prizes like a pennant to hang on their club-house wall or a pendant to carry with to inspire courage.

A teen reader who wore a pendant whilst they tackled an army assault course reported that they felt that their pendant gave them extra strength to climb over 14 foot walls easily. Another pendant-wearer attributed greater success at school sports to it. These instances of heightened performance were likely a form of Neuro Linguistic Programming (NLP) in which absolute belief in the metaphysical

properties of an inanimate object or the values that it represented translated into a greater release of dormant physical and mental potential.

Another key tenet of the clubs was information security. The comics suggested to its young agents that each club use secret passwords and make up its own message encryption code so that their communications could not be cracked if intercepted by non-agents (usually brothers and sisters who weren't in the club!)

Clubs also often found their own solutions for problems that the comic editors never anticipated. Members who reached their mid-teens and felt that they were too old and grown-up for their club and should quit instead became leaders of the club and acted as the “boss” who coordinated activities and arranged missions for the younger members. Some clubs even charged a small weekly fee that was pooled to purchase equipment and uniform for members, such as compasses, first-ad materials and wet-weather boots.

It is no longer the Seventies though and society has changed greatly, for the worse in some respects. Kids no longer care about health as much as they used to and the risk of child endangerment in public places is higher (or perhaps just more commonly reported in the news.) So whilst it is not realistic to closely emulate that era, there are lessons provided by it that can be adapted for the present day.

Schools can use these insights to expand an Oculus-empowered program where only one student at a time can use the Rift (unless the school can afford more than one headset and attached tablet) into a project that involves the entire class in a way that means they are excitedly assisting whomever is 'leading the group' at the time by taking their turn to wear it. Some examples include the following:

- Documenting students' progress on a blog or social network, similar to how clubs reported their news to each other via the letters pages of the comics.

- Group members could access mission details and logs online and upload collected evidence related to investigations for other team members to sort and process into actionable information, and the current Rift wearer to act upon as group leader.

- Emulate the courage-boosting pendants with additional internet-connected wearables like fitness bands that actually have a scientifically provable and easily measurable effect on the wearer and give them incentive through gamification to live a healthier lifestyle.

- Adapt the password and code-creating practices into an educational message for students in the present about taking care of their online safety and security.

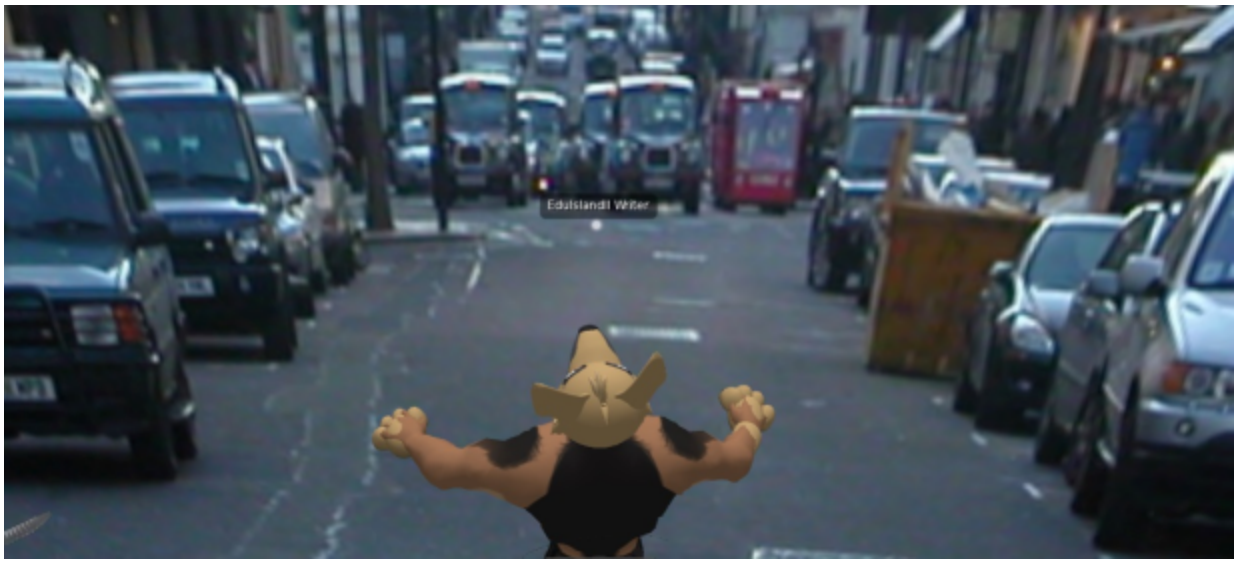
B. THE WORLD IS YOUR MOVIE SET

Once you have mastered the basics of this system, you can attempt much more ambitious productions. Instead of a simple board backdrop, you could create a huge hollow black cube and use it as a movie studio set to capture anything on the set – even multiple avatars and vehicles in motion - and chromakey them onto a real-life video.

Bear in mind when designing a production that the avatar of the person controlling the XSplit workstation will be positioned at the front of the screen no matter where the avatar walks to, because the Second Life / OpenSim camera always follows directly behind it.

This does not apply to the avatars of others in the virtual environment who are in the local vicinity though: if they approach the primary avatar from a distance then they will be initially visible as small shapes in the background of the real-life video footage and steadily grow larger as they walk towards

the front of the screen, in the same way that an approaching person in the real world would be perceived.



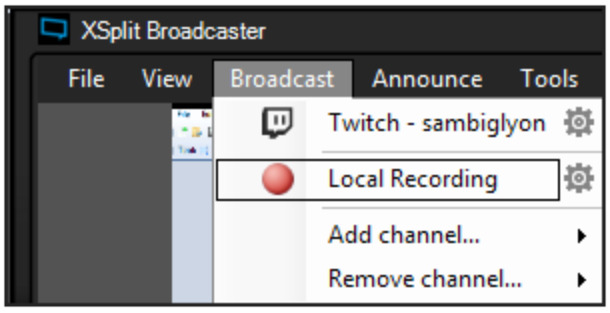
C. RECORDING YOUR PRODUCTIONS AS OFFLINE VIDEOS

Speaking of movie-making, XSplit isn't just for live-streaming – you can record your live mixed-reality productions as permanent offline movie files as they happen!

Starting a recording is as easy as starting a broadcast. Go to the 'Broadcasting' menu and click on the 'Local Recording' option. Your movie will then begin automatically recording to a folder on your computer as a compact-sized FLV format video that can be uploaded in minutes to YouTube. Starting and stopping recording will not interrupt your live broadcast to your Twitch channel.

To stop recording, click on 'Local Recording' again to un-tick it. You can find your recordings quickly by going to the 'Tools' menu option at the top of the XSplit window and clicking on 'My Recordings' to open the folder where your FLV files are stored.

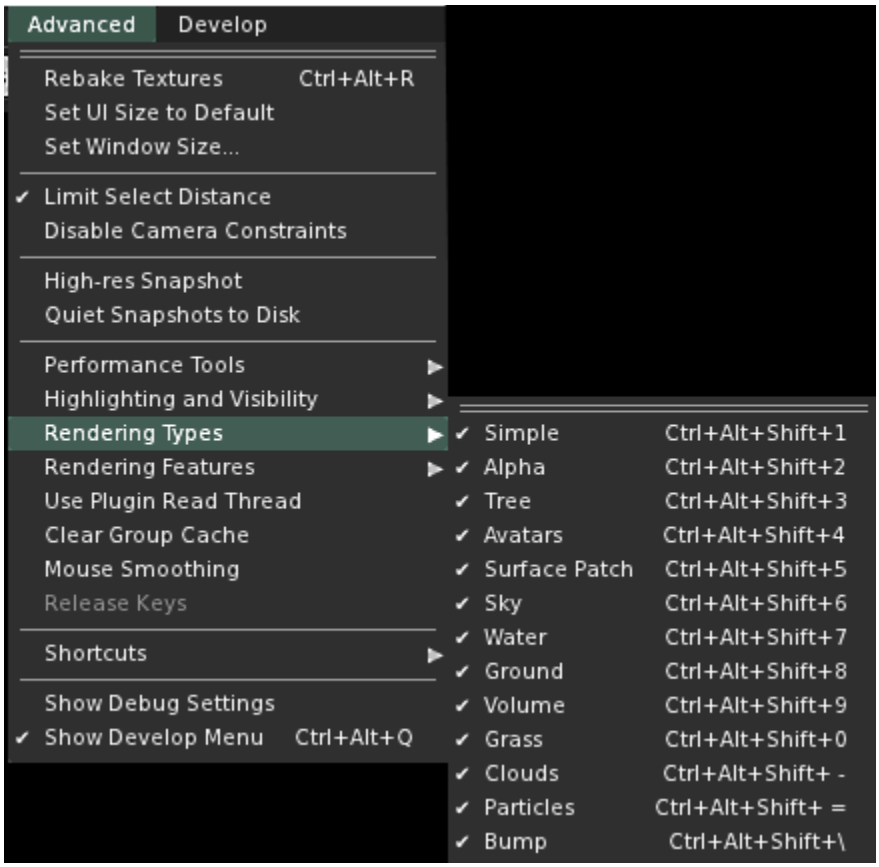
The paid-subscription 'Personal' and 'Premium' accounts for XSplit have the significant advantage for professional video producers of also allowing recording of videos in the high definition MP4 video format as well as the standard FLV format.



D. THE 'ADVANCED' AND 'DEVELOP' MENUS IN SECOND LIFE

If you are a user of Second Life and do not own any land to film productions on, there is a way to turn the entire world into a chromakey set!

The Second Life viewer software contains a series of options in its hidden 'Advanced' menu – accessible by using the keyboard shortcut Ctrl-Alt-D to make it visible at the top of your SL window – to turn off SL's graphics elements bit by bit (sky, water, ground, etc) until the avatar is left floating in a totally black void that is perfect for chromakey removal.



The above rendering options can be turned off and on quickly by using the shortcut Ctrl-Alt-Shift and the numeric keys 1 to 3 and 5 to 9 at the top of the keyboard. Using the number 4 should be avoided, as it makes the avatar invisible – but there may be productions where this is desired in order to focus on the other objects and avatars in the scene – like the director staying firmly behind the camera.

Any changes made with these shortcuts are non-permanent and mistakes can be fixed by closing the viewer down and re-launching it. This helps one to have the confidence to try out the options, assured that if they goof up then a restoration of the normal settings is just a viewer restart away.

The 'Advanced' menu is a completely legitimate part of Second Life and is documented extensively in the Second Life official wiki website, along with a further hidden menu called 'Develop' – also documented in the wiki - that enables customization of SL to an extreme degree.

Because the changes that you make to the Second Life environment with the 'Advanced' and Develop' menus are localized only to your specific installation of the viewer software on your computer and are not visible to any other users, you can configure a virtual film studio that can produce incredible productions for the tiniest fraction of the cost of animating such a production by traditional means.

Note that some of the settings in the more complex 'Develop' system *do* persist even after viewer close-down, though again, no other users are affected by the changes. Due to the relative user-unfriendliness of these options though compared to the 'Advanced' menu, anyone using them is likely to be competent at advanced Second Life use anyway.

F. MERGE REAL LIFE WITH OTHER GAMES AND VIRTUAL WORLDS

Whilst it would be more difficult to use the chromakey process with games and virtual worlds other than OpenSim and Second Life (especially ones that do not support user-created content), it is by no means impossible. All that is required is to find a location that has a relatively uniform texture, position the avatar against that surface and use the 'Color Key' tool to isolate a particular color and render it invisible to reveal the real-world footage playing behind it.

Using this approach is not as tidy or predictable than a backdrop with a single consistent color, but with persistence you can achieve similar mixed-reality results to those in Second Life and OpenSim. Here is an example of a good result from extracting the sky color from the sandbox game 'Scribblenauts Unlimited' to substitute it for a real-life sky layered beneath.

'Scribblenauts Unlimited' © 5th Cell Media and Warner Bros. Interactive Entertainment

G. CUT AWAY THE WALLS OF THE CLASSROOM TO SHOW A VIRTUAL WORLD BEYOND

As well as overlaying virtual media such as avatars and objects on the real world, you could also reverse the process and overlay the real world onto the virtual environment. An obvious example is to “cut out” the walls of a classroom in order to view a live, controllable virtual world behind them (i.e laid underneath the camera feed of the classroom in the XSplit software.)

This can be accomplished easily just by covering the classroom walls with fabric sheets such as curtains that are of a single, plain color throughout. Selecting this color with the dropper in XSplit will cut away the curtains and display the virtual environment laid beneath the camera feed.

Using this method, the classroom and its students and equipment can be transported anywhere, from outer space to a clearing in a beautiful forest. And because the virtual environment is displaying in real-time, it can be controlled by a student or teacher.

If the students were controlling their avatars at a classroom computer then they could even watch those avatars interacting with the world behind their walls in life size, responding to the actions that they input into their computers. Controlling those avatars hands-free via motion-sensing devices such as Kinect for Windows and the Creative Gesture Camera instead of a mouse and keyboard or joypad would result in an even greater sense of immersion.

This could also be an easy way for younger students to make games, using the “cut-away classroom” as a new form of video game development studio that focuses primarily on creating and performing outstanding stories. Instead of having to learn drawing and coding, their real-world bodies / hands and equipment could be used in conjunction with the virtual environment instead, and they can act out scenarios without having to awkwardly use traditional control methods.

Cutaways need not be confined to the classroom either. Other areas of the school could also be marked with plain strips that are substituted for digital content such as virtual reality elements or information signage when a live mixed-reality video of that location is viewed on a mobile device.

In schools where every student has a smartphone or tablet, it could act as a school guide-book that can be easily updated in real-time by administrators just by making changes on the computer that is processing and transmitting the XSplit broadcast.

H. USE BACKGROUND CUTAWAYS FOR PROFESSIONAL DEVELOPMENT SESSIONS

The above method in Appendix G could also be a useful tool for virtual-based professional development sessions. Instead of teachers having to learn how to use avatars and digital interfaces, or talk through an impersonal interface like Skype, they could be given a white sheet or a piece of large white cardboard to place behind them at home and point a cam at.

All of the teachers in that training session who are doing the same in their homes would then be brought together in a collaborative virtual environment but able to use their real bodies to communicate via the cam that is capturing their voice, movements and whatever they are holding and showing to the cam so that the other session members can see it.

The process for making this possible is more complex than the previous reality-merging techniques.

Requirements for each participant in a session

1. A large white sheet or backing board
2. A cam with 'IP Camera' functionality
3. A means for each participant to view a video via an internet URL (e.g a computer or tablet.)
4. A session coordinator with a computer that has the XSplit video software installed so that they can receive and merge together each participant's IP Camera video feed and combine it with a virtual environment to produce a final merged mixed-reality video with real-life and virtual elements
5. Instruct all participants not to wear any clothing or objects that are the same color as the background behind them, otherwise those parts of their body will be removed by XSplit on the video

Step One

Each teacher is sat in front of a white sheet or large white backing-board, with a cam pointing at them. The background should be large enough that the cam's lens cannot see beyond its outer edges.

The cam being used should be one that has a function in its feature list called 'IP Camera.' This means that the cam is capable of transmitting what it sees over the internet live so that another computer that is distantly located from the source of the movie (e.g not on the same wi-fi network) can receive that video stream.

IP Cameras are commonly used for CCTV home surveillance so that the owner of that home can view the it over the internet to check that it is okay. Enter 'IP Camera' into Wikipedia for further details.

Step Two

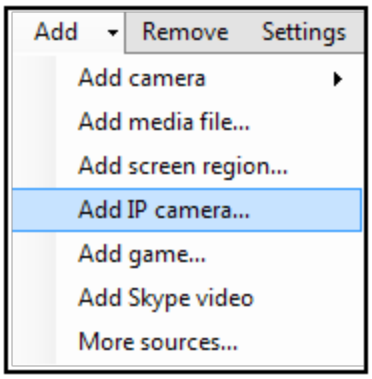
Each teacher who will be participating in the session should find out in advance what the 'IP address' of their computer is and then give it to the person who will be coordinating the session. An excellent website that instantly displays the IP address is What Is My IP. (http://www.whatismyip.com)

Step Three

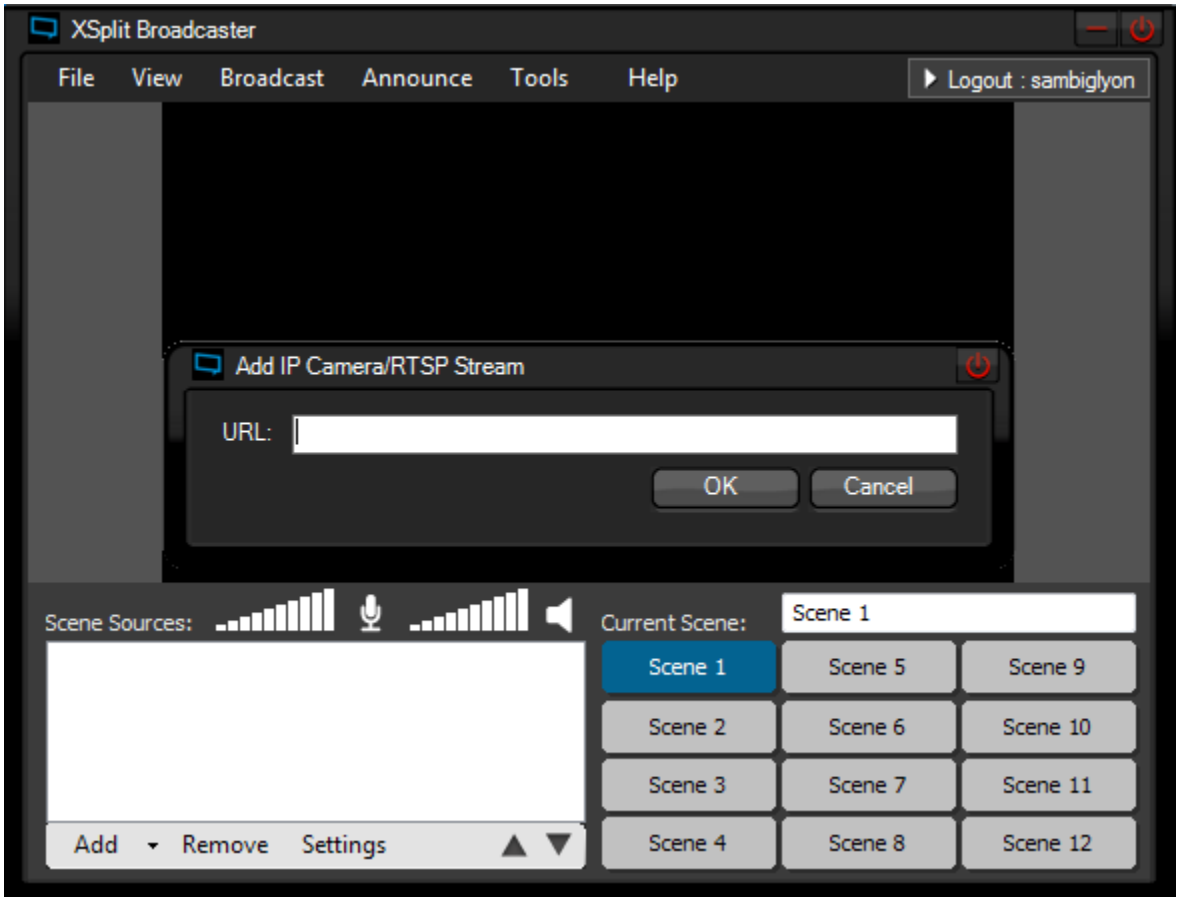
The coordinator of the session who is controlling the computer with the XSplit video software installed on it should set up a multi-paneled Scene in XSplit as described earlier in the manual, but with a minor difference this time.

In the original version of the XSplit scene setup, live video from a webcam was added to the scene construction stage by clicking the 'Add' option to open a sub-menu of media types and selecting the 'Add Camera' sub-option.

This time though, instead select 'Add IP Camera' from that menu.

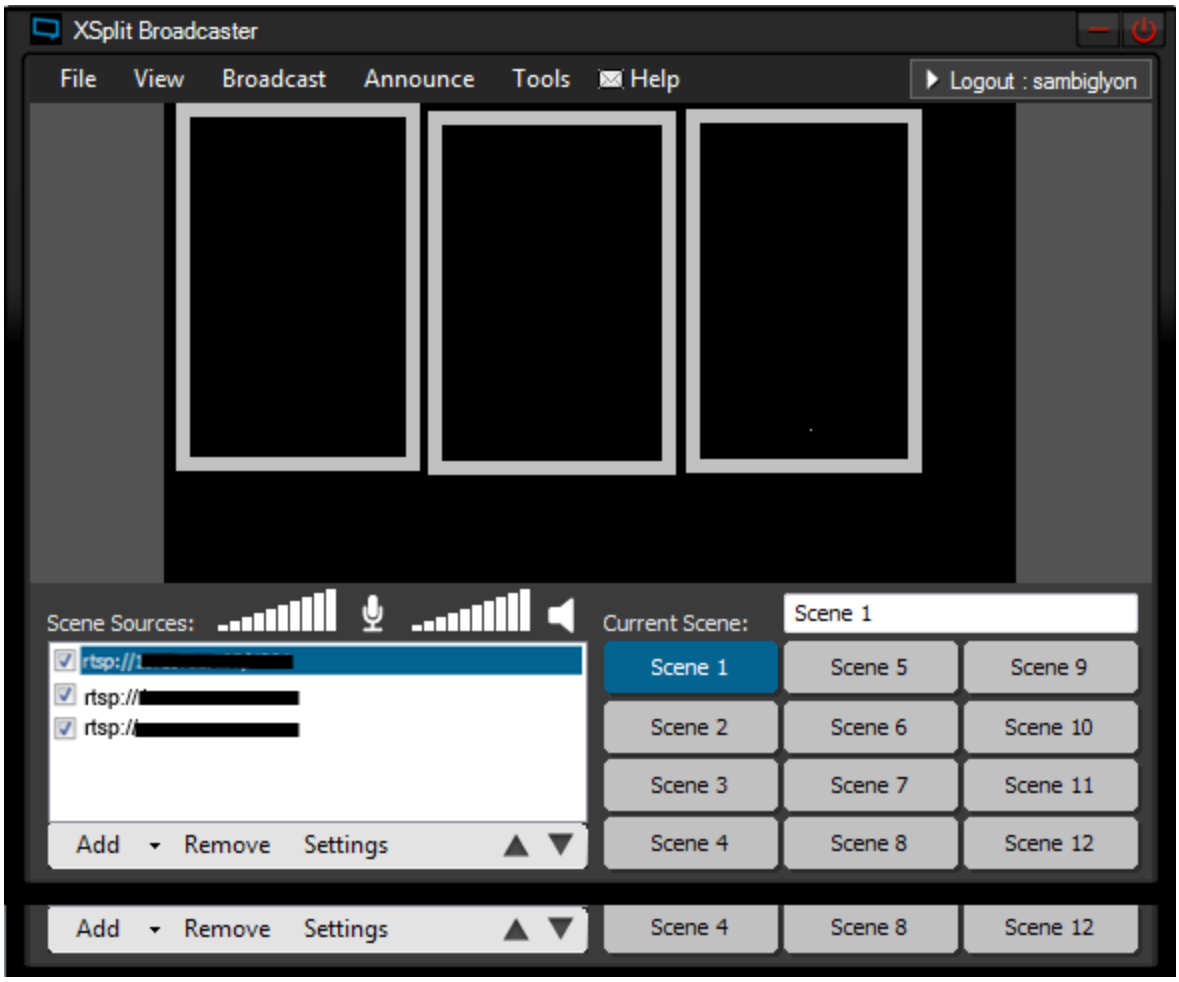


Step Four
A pop-up window named 'Add IP Camera / RTSP Stream' will appear. Enter each session participant's computer IP address one by one by repeatedly using the 'Add IP Camera' option until everybody' who will be in the session has been accounted for.



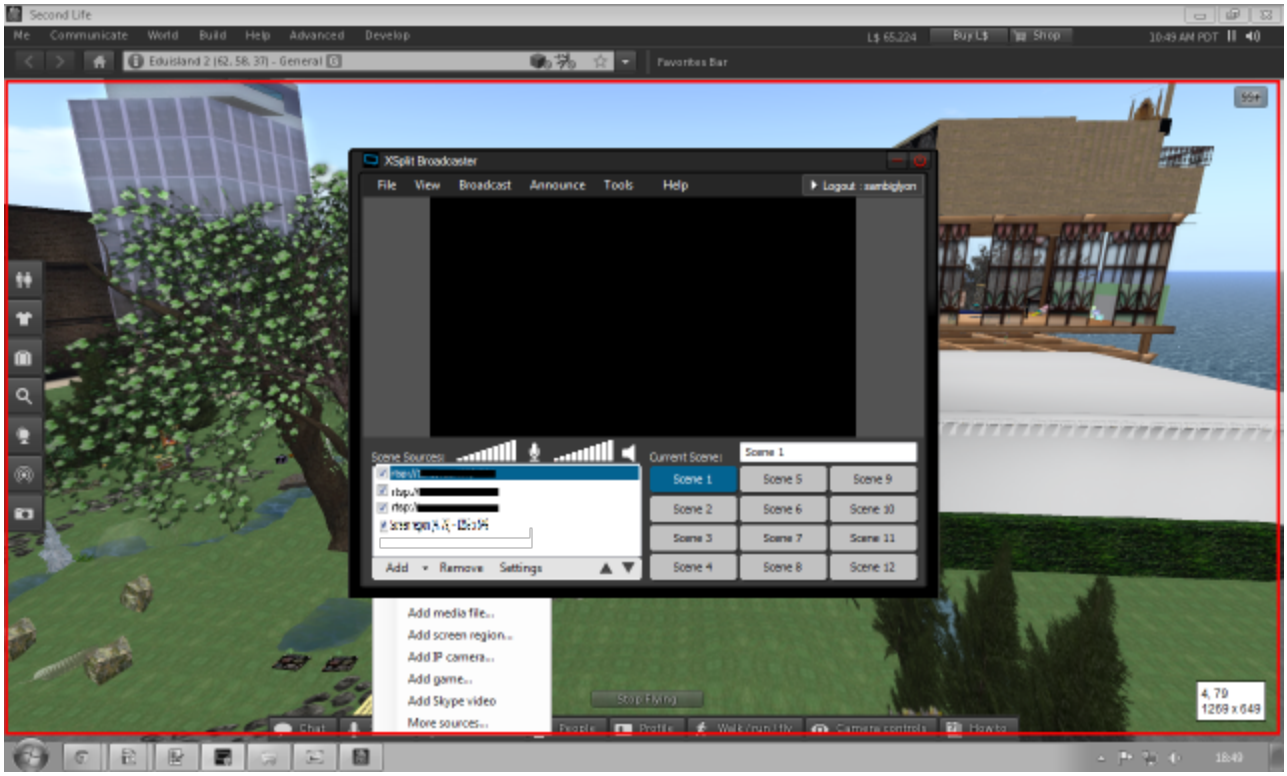
The central construction stage of the XSplit window should now have a series of panels on it, each representing a specific participant's IP Camera video feed that will be transmitted across the internet to the XSplit software. The panels will not likely have any video playing in them at this point because the session participants' IP Cameras will be offline.

Arrange each IP Camera panel so that they do not overlap one another. This will help to ensure that the participants are not obscuring each other on the final merged video..

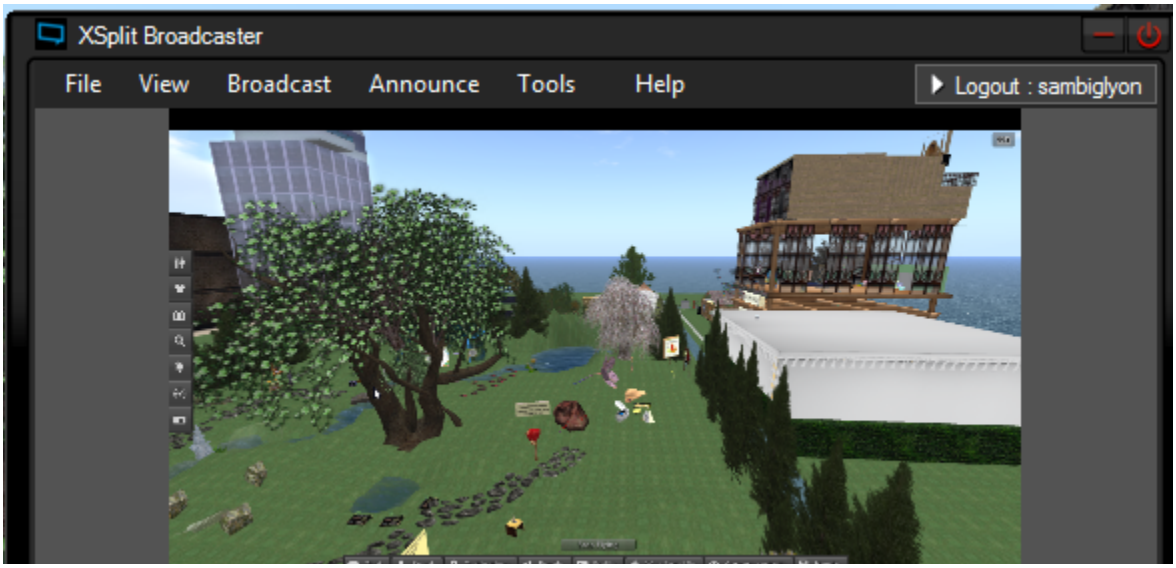


Step Five
Add the virtual environment to XSplit by setting that program (e.g Second Life or OpenSim) as the active window on the desktop and bring up the XSplit window on top of it.

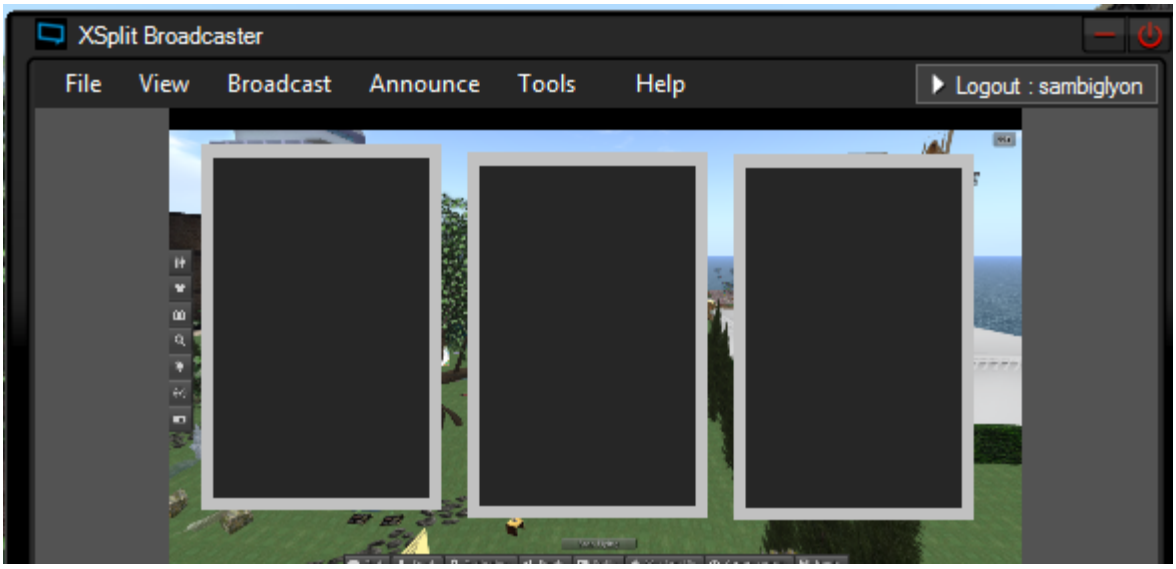
Click on XSplit's 'Add' option, select 'Add Screen Region' and use the red cross-hairs to set the area of the virtual environment's window that you want to be displayed in XSplit, as shown in the example earlier in the manual.



The virtual environment in the active window on the computer will be displayed on the construction stage in XSplit. Drag its panel's corner out so that the panel fills all of the stage.

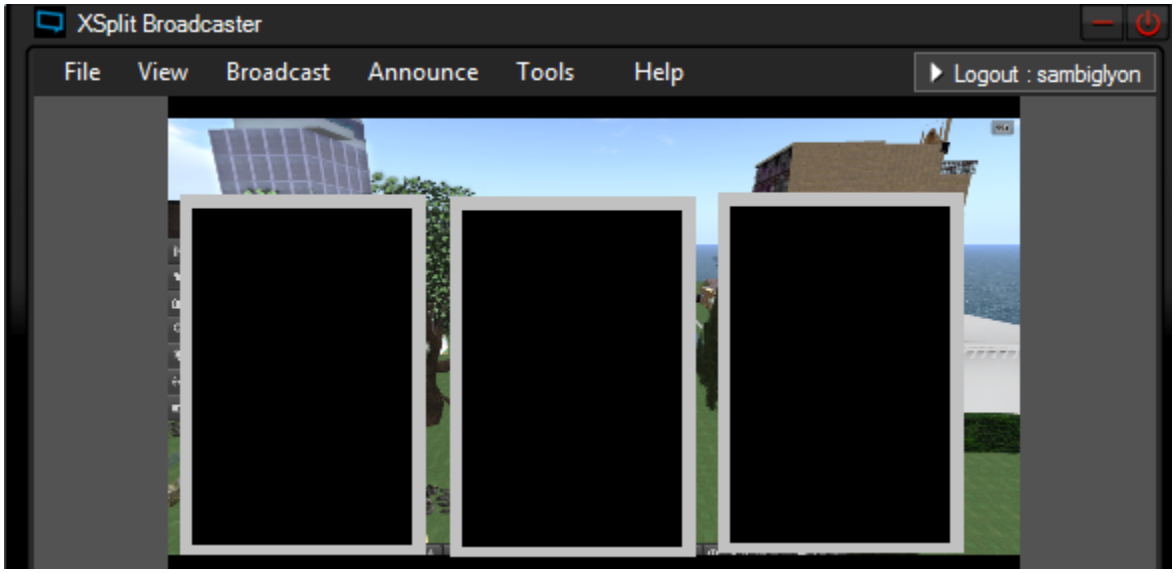


Step 6
Drag and drop the text descriptions of the IP Camera feeds in the 'Scene Sources' section of the XSplit window to re-order the priority assigned to the camera feeds and so to bring them to the foreground as overlays on the virtual world window that is being live-captured.



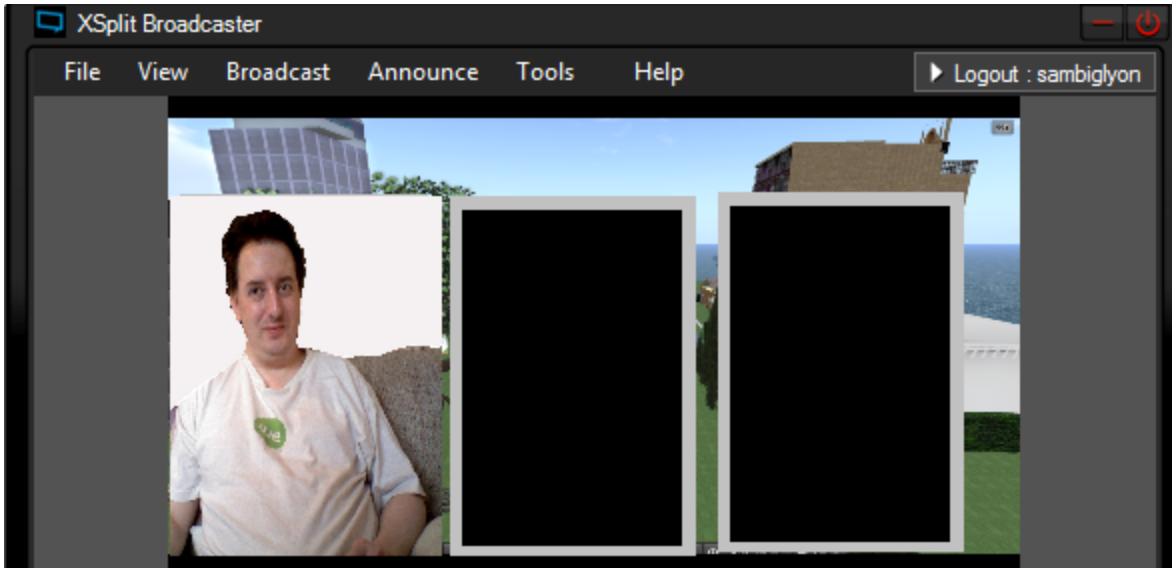
The setup for the teacher training session on the session coordinator's computer is now largely complete. The panel configuration is automatically saved and will be ready and waiting for the coordinator the next time that they start up XSplit.

Before we close down XSplit until we are ready to use it in a real, live session though, it is a good idea to ensure that the base of the IP Camera panels are positioned right at the base of the construction stage though. Doing so means that when the video feeds of the session participants go live, their cam feed will not be floating disembodied in the middle of the virtual environment and so break the sense of immersion.

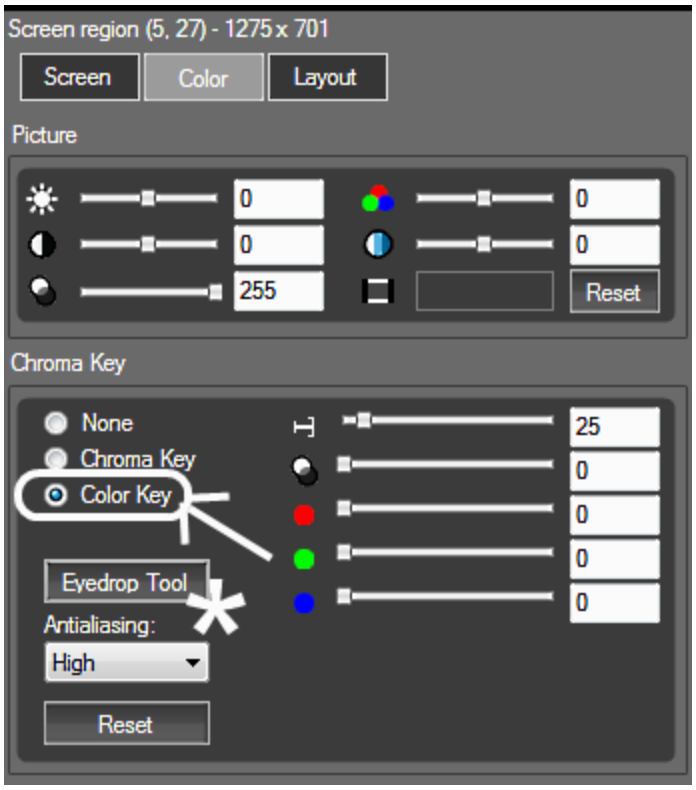


Step 7

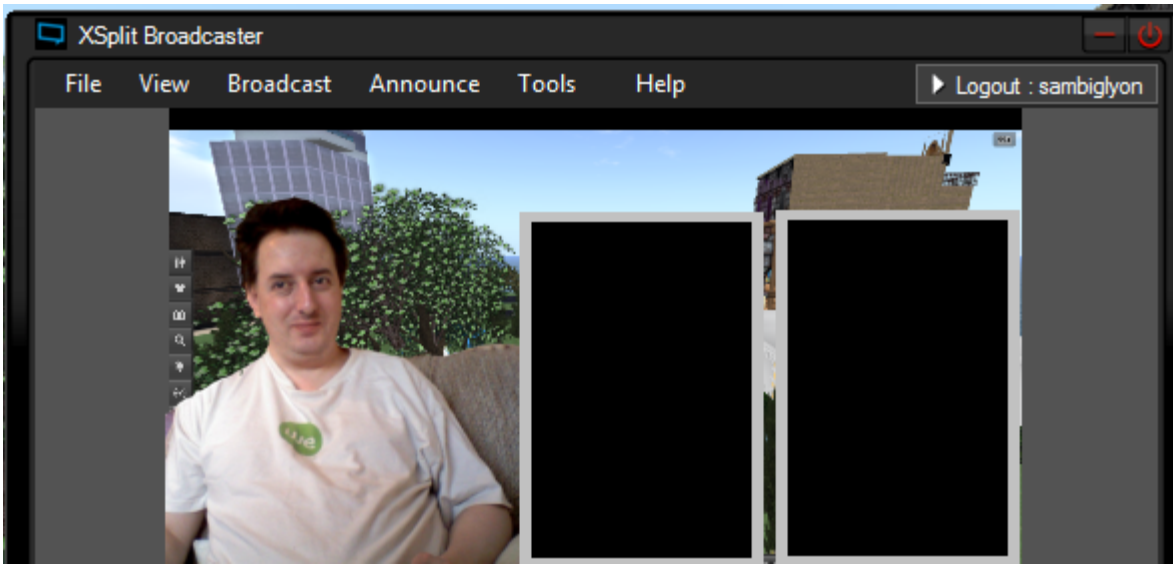
Before the day of the professional development session, it is a good idea to get at least one of the colleagues who will be at the session to go live in front of their IP Camera at their home so that the coordinator can test that the system is working. Arrange beforehand for that person to have the white sheet / backing board background to place behind them so that the background cut-out function can be tested.



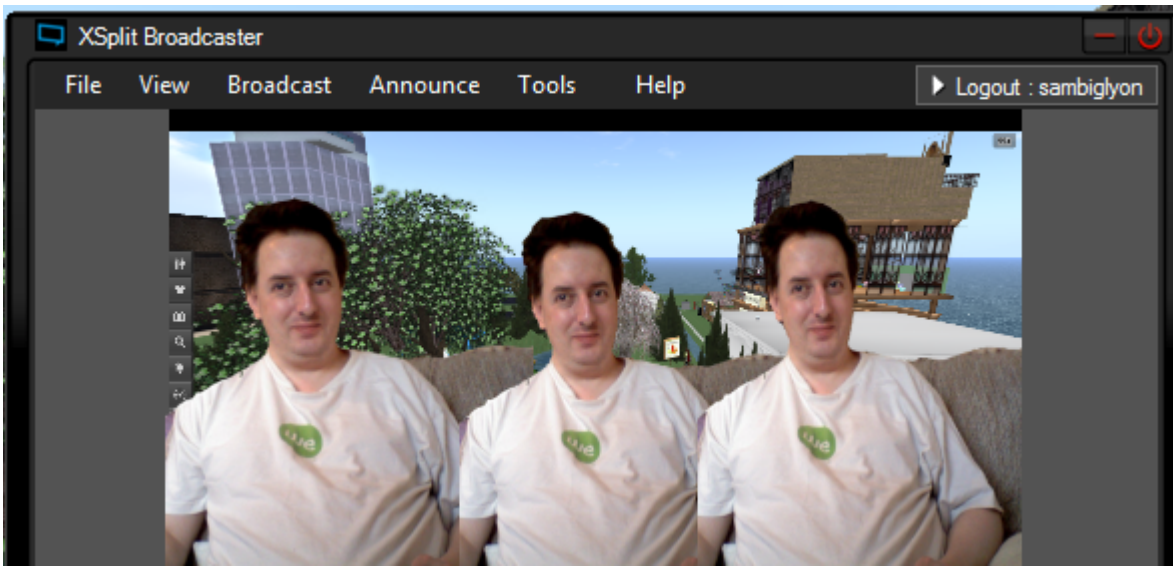
Right-click on the text description of that user's IP Camera in the 'Scene Sources' panel to pop up its configuration panel. Select the 'Color Key' option and left-click on the 'Eyedrop Tool' option that appears to activate the color dropper tool.



Move the color dropper tool (ringed in the image below) to the white background and left-click on it to select the white color as the shade that will be removed by the XSplit software, revealing the virtual environment behind the image and leaving the colleague as an impressive-looking integral part of the environment.



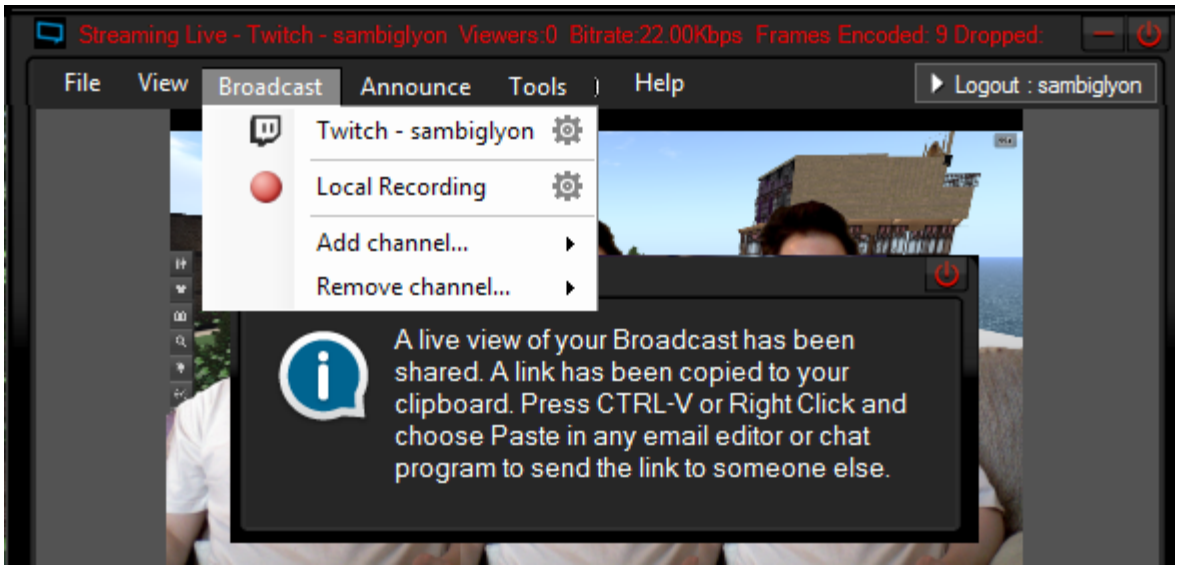
Step 8
On the day of the professional development session, once all of the session participants' IP Camera feeds are active on the XSplit screen, the coordinator can quickly repeat the color-dropper action in the configuration settings of the other cameras to remove the white background from those colleagues as well..



The coordinator should bear in mind that until they go live with the broadcast, they will be the only person who can see this view and so there need not be a mad rush at the start of the session to initiate the dropper action. You can take your time with it and relax.

Also remember that XSplit will remember all of the settings changes that you make, so you need only dropper a particular IP Camera once and XSplit will store that setting and automatically apply the background cut-out effect to that specific participant next time they are taking part in a session.

Step 9
The final step of the process is to broadcast the merged real-life / virtual production to the internet so that the session participants can view it on their computer and see themselves together with their colleagues in the virtual meeting space.



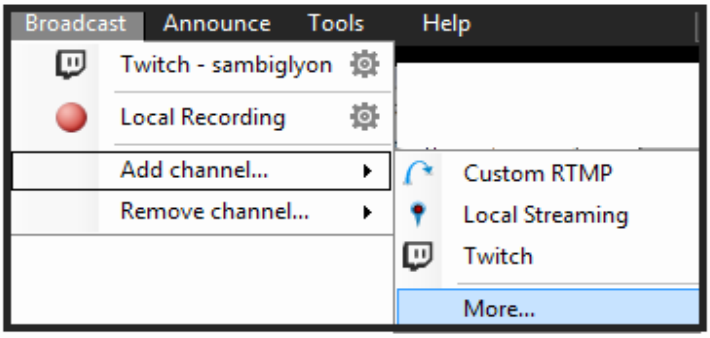
Clicking on the 'Broadcast' option at the top of the XSplit window and selecting a Twitch video streaming account linked to your XSplit account causes the merged video to be immediately sent to one's Twitch video channel web-page so that those who have the channel's URL (i.e the other session participants) can see the session on a computer, tablet or other web-equipped device in their home!

Every movement that they make will be picked up by the IP Camera that is pointed at them and shown live in the video. Likewise, the camera will pick up whatever they say and automatically incorporate that into the video playing on the Twitch channel too,

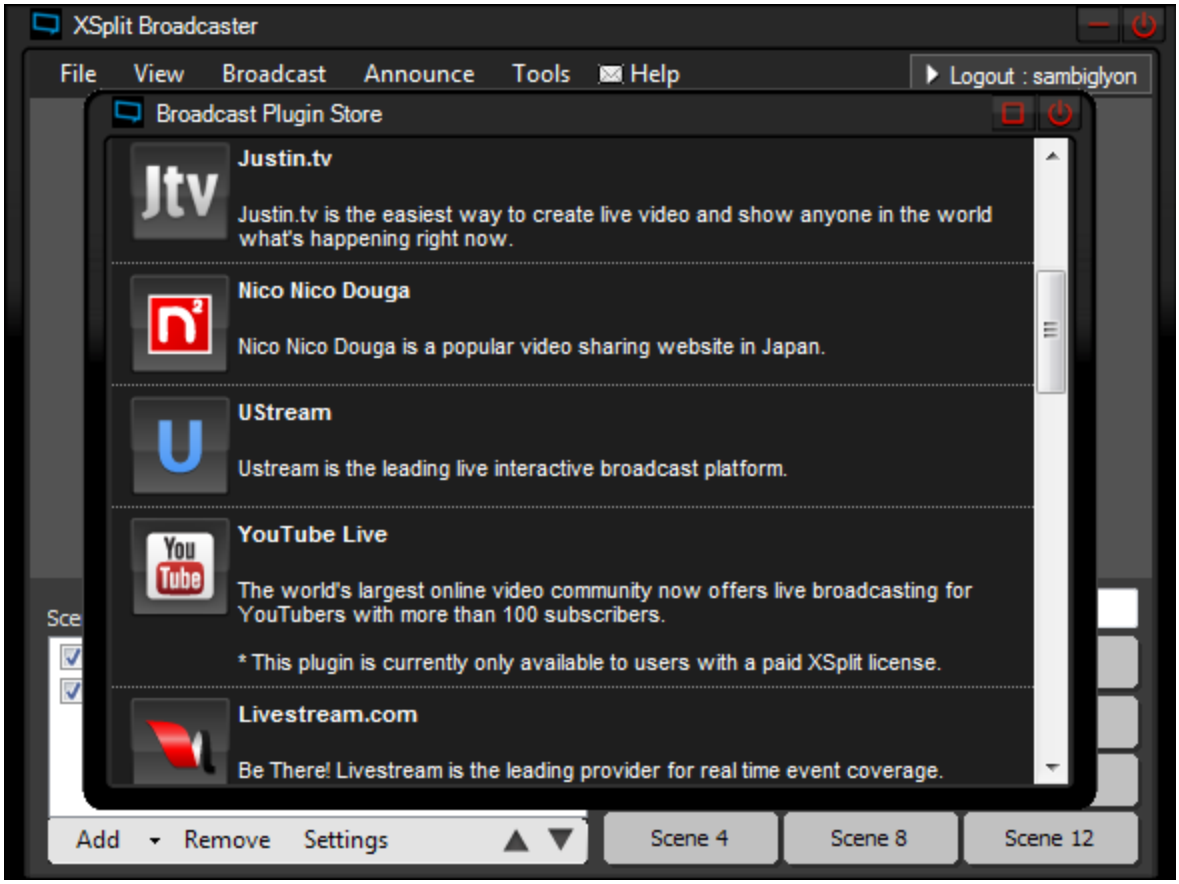
Important Note About Twitch Terms of Service

It should be noted that Twitch is not the ideal streaming platform for a professional training session. It is capable of handling it, but there is a clause in Twitch's Terms of Service that requires that the majority of a broadcast be related to gaming, with a small amount of real-life footage of broadcasters permitted. Whilst use of the system for student activities within a virtual environment is likely to qualify as gaming, the same can not be said for a group of teachers sitting discussing Common Core, even if they have a virtual world as a backdrop.

In order to establish a system that can be used time and again without trouble or worry about bans, then, it is advisable that an alternative video streaming platform to Twitch is used for this project. Fortunately, XSplit offers the ability to select from a wide choice of alternative web-based channels to purchase as expansion modules and stream the finished video production to. To access the list, open the 'Broadcast' menu and select 'Add Channel' and 'More...'



A pop-up window with a long scrollable list of online video streaming platforms will appear. We recommend that you experiment and find the one that best suits your needs. Among the most popular sites on the internet (aside from Twitch) are YouTube, Ustream and Livestream.



Step 10

The session participants will now be able to follow the live professional training session on their web-equipped device at home. The session coordinator, who has the virtual environment running on their computer, can use that world to perform interactive actions, display information and drop objects from their in-world inventory onto the video.

Untitled Broadcast

sambiglyon Edit

A common complaint from users of multiple virtual worlds is the inability to take inventory between worlds. The mixed-reality system offers a way to address this problem by overlaying objects and avatars from one world onto another environment.

The integration of living users with virtual tools also provides those users with the ability to attempt to solve the problems that they are dealing with through 'sandbox' experimentation and testing of possible solutions in a way that is not possible when sitting around a table or in a lecture hall in the real world.

They also do not have to wait as long for a solution, as online meetings can be rapidly arranged to suit everybody's schedules instead of having to re-organize real-life schedules to fit in a special meeting at school or – worse – wait until the next pre-scheduled in-school training session.

There are opportunities to expand such a training program into an open discussion with massed participants from other schools in a district / county / state within the mixed-reality environment, sharing best practices with each other and thus filling in specific knowledge gaps at each school. The participants in this large-scale collaboration could also engage in 'pro tournament play' in the sandbox simulation, taking turns to try out different approaches in order to see whose methods work the best.

I. ADD NEURO LINGUISTIC PROGRAMMING (NLP) CUES TO PRODUCTIONS

Neuro Linguistic Programming is a psychological science that predicts how the mind reacts to specific inputs – a smell, a sound, an image, a touch on a certain area of the body, etc. Once one understands how and why such reactions occur then they can purposely design media to incorporate triggers that automatically activate the impulse in the mind that the designer intended.

An example is giving students a chapter to read for homework but not asking them to try to remember the contents of the chapter – just scan it with the eyes. The page contents will be absorbed by the mind and can be drawn instantly back to the student's conscious memory in the next class session by providing them with a media cue that ties in to what they have skimmed during their homework.

Whilst it may sound sinister, in the hands of an educator NLP can be an extremely powerful tool for developing learning programs where students are instinctively and effortlessly absorbing, retaining and recalling information.

NLP is a topic that is too vast in scope to do justice to here in the space available. If you would like to read a range of beginner-level features about it then an excellent place to start is the 'Features Archive' section of the website of this author's non-profit company, Sambiglyon (www.sambiglyon.org)

J. FORM A CULTURE OF 'TREE CELLS' IN THE SCHOOL COMMUNITY

A system that encourages mass interaction can also be utilized by schools as a model of mass cooperation that thinks of everyone in the school – from administrators through to teachers and the students – in terms of individuals who, when they come together, resemble the cells in the structure of a tree.

In the structure of a real tree, sap rises from the roots, up through the trunk and ultimately arrives at the leafy canopy at the peak of the tree. This means that nothing living at the top is immune to what is happening at the ground and middle levels.

Also like a real tree, there are both helpful and harmful / disruptive elements in the structure of the school. Individuals could be regarded as being 'Tree Cells' (a play on words of 'T-Cells', the cells in animal immune systems), with the aim being to ensure that there are many more helpful Tree Cells in the school and that students and staff who are negative cells – perhaps because of work stress, their family background, learning difficulties or other factors in their life - are helped to become healthy cells too.

This philosophy mirrors the saying “it takes a village to raise a child”, with the school community as a whole refusing to turn away and abdicate responsibility for taking care of somebody in that community who is in need of help – even if they take some persuading to accept it.

Each individual in a school can provide help in the areas where they have power to intervene: students helping students and making teachers aware of significant problems with friends that are beyond their help, and staff helping other staff. If there are common problems occurring then they could be addressed with group training programs, making use of tools such as the Rift headset and mixed-reality presentation technology.

In the US Military, soldiers are paired up as 'Battle Buddies' in a program designed to reduce suicides, with each buddy looking out for the well-being of their buddy both in battle and outside of it. Whilst a single-digit minority of soldiers surveyed about the program strongly resented having to be so deeply responsible for someone else's welfare, the majority believed it to be an excellent idea.

Likewise, in the internet science-fiction comic series 'Shades of Gray' (www.kahmith.com), students who enter a military-style academy at around 15 years old are assigned a partner who they will work with for the entire five-year term of academy life, except in exceptional cases where a new partner is assigned due to expulsion of a student or irreconcilable differences between the pairing.

Success or failure at the academy is dependent upon how well the partners work together: if one succeeds then the other does too, but the same is true for failure, and slipping grades quickly become a powerful motivator to resolve problems in the partnership.

This formula can be directly related to our real-life scenario where the Rift wearer and an adviser on a workstation with Second Life / OpenSim installed on it are mutually dependent on each other for success: the better that one performs, the better that their partner will do in their respective role.

CREDITS

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Sambiglyon are a not for profit educational services provider, multimedia developer and publisher based in the United Kingdom (Company Number 06890732) but offering a range of services that span the globe.

The name 'Sambiglyon' is derived both from a Greek term meaning 'Education, Entertainment' and also our mascot 'Sam the Big Lion', who represents what we do but also our values - including friendliness and protectiveness - that make us something special.

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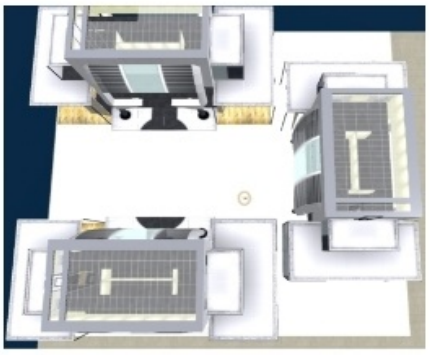

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