SOP DRAFT FOR ATD CREATION

[This Index Is Meant To Model the Creation of an Artificial Training Data Set From START to FINISH. Thus, each section is written with the expectation that all sections above have already been completed unless otherwise stated.]

- Using A Herbarium Lightbox To Take Photos of Preserved Herp. Specimen -

Supplies -

- Trays w/ sealing lid for “used” specimen
- Forceps
- Gloves
- 70% Ethanol (To fill the trays halfway)\
- Paper Towels
- A selection of whatever specimen you need…
- Herbarium Light Box
- Smart Shooter 4 Software
- Canon DSLR Camera [Mounted above Lightbox]

Steps -

1. When obtaining the preserved herp specimen from storage, ensure to keep track of all the labels associated with that specimen (Including **Species Name, Location to County/Out Of State, JAR LABEL #, and Specimen Catalog #**) on a google/excel spreadsheet.
2. Additionally, grab two sealable containers, label one “Unused Specimen” and the other “Used Specimen” for the sake of organization.
3. Fill each container halfway with 70% Ethanol.
4. Using the forceps, remove specimens individually from the preserved container and place them into the “Unused” container.
5. When Preparing SM4 workspace, go to File -> Options -> General and ensure that your photo download directory is set to C:\Users\ccber-intern\Pictures\Smart-Shooter 4\CIG_2020 → Then Make A folder specific to the date you are taking pictures on
6. Thereafter, click the “Name Policy Tab” and enter “[A]_[S]_[D]_[T]” in the “Filename Expression” box.
    a. Then declare the “Application Node Name” ([A]) to be the “Genus Initial_Species Name)
        i. Ex. S_occidentalis
    b. Also, make sure that the “Sequence Number and Batch Number” are set to reset every time the application is closed and reopened.

7. Now click "Apply" and navigate out of that window and you should see the long vertical "Camera Controls" bar. Click "Enable" under live view to get a live feed of what the camera sees.
8. It's recommended that the camera settings be set to the following for capturing the highest picture quality… Aperture - Shutter Speed - ISO - Exposure = 7.1 - 1/15 - 100 - 2.3 or 3.0depending on the color of the lizard (if it's darker, set the exposure to 3.0).
9. Next, place a length/color standardizing block in the box, click "Auto focus" and then click "Shoot" to capture a picture. (Remove the block after this.)
10. Finally, you can begin capturing images of the preserved specimen, taking one out at a time to place into the center of the light box and clicking "shoot" to capture photos. (Additionally, it is recommended that you refocus the lens for each new specimen placed in the light box.
11. For the purposes of this study, 15 specimens were initially captured for each species, and directed to a folder labeled "S.Occidentalis -> Raw Lightbox Photos"

***NOTE -**

1. **Some species may require special rigging to prevent limbs (including the tail) from coming into contact with the body and/or other limbs.**
    - **If limbs do come into contact with the body or other limbs it will make the photoshop cropping process more difficult//time consuming.**
2. **If you want pixels to represent a certain portion of a cm, all pictures must be taken on the same "zoom" and not resized at any later date.**
3. **SAVE AT LEAST 1 PICTURE OF A BLANK WHITE BACKGROUND FROM THE LIGHTBOX FOR USE LATER.**
    a. **Save as "Light Box Source" (LBS) in an approariate safe space where it can be utilized later.**

-Using Photoshop To Prepare HFS Cutouts (For Animation)-

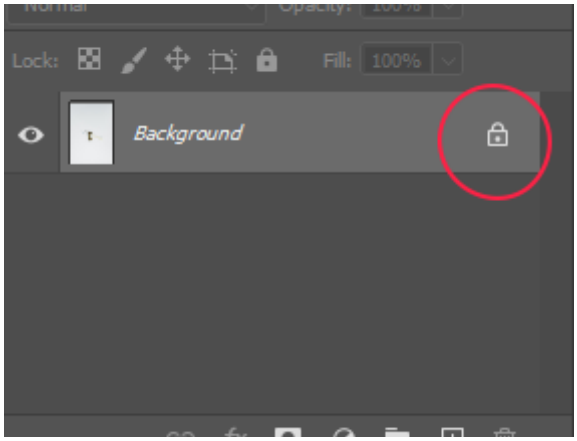
Supplies -

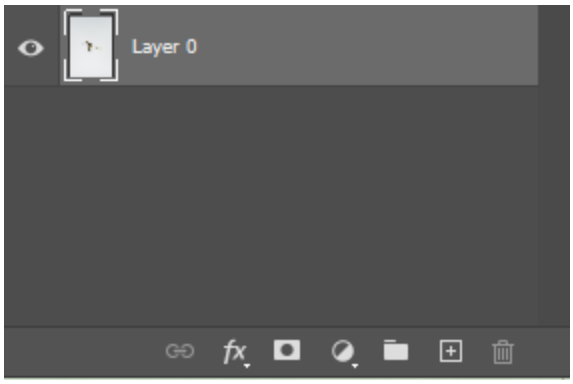
- Adobe Photoshop
- Raw Lightbox Photos of Preserved Herpetofauna Specimen

Steps - [From here on I will refer to Herpetofauna specimen as 'HFS']

1. **Open Adobe Photoshop**
2. Import photo of the preserved HFS into Adobe Photoshop.
3. Unlock the "background" layer by clicking on the lock icon (circled below).
    a. Once the background is unlocked it should rename the layer to "layer 0'.
    b. Changing the photo to a layer allows you to make edits to the photo. (In this case we will be cropping the photo to delete all excess white space, leaving only the HF specimen.)

4. Navigate to the toolbar on the left-hand side of the screen and click on the tool labeled

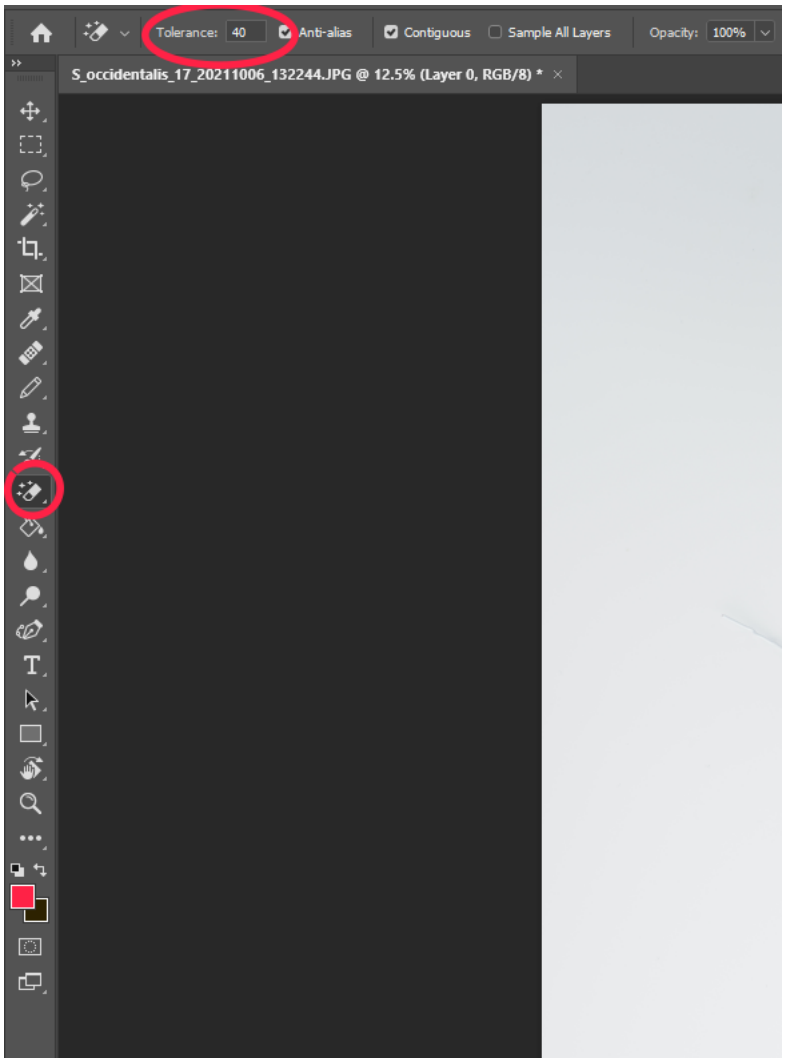




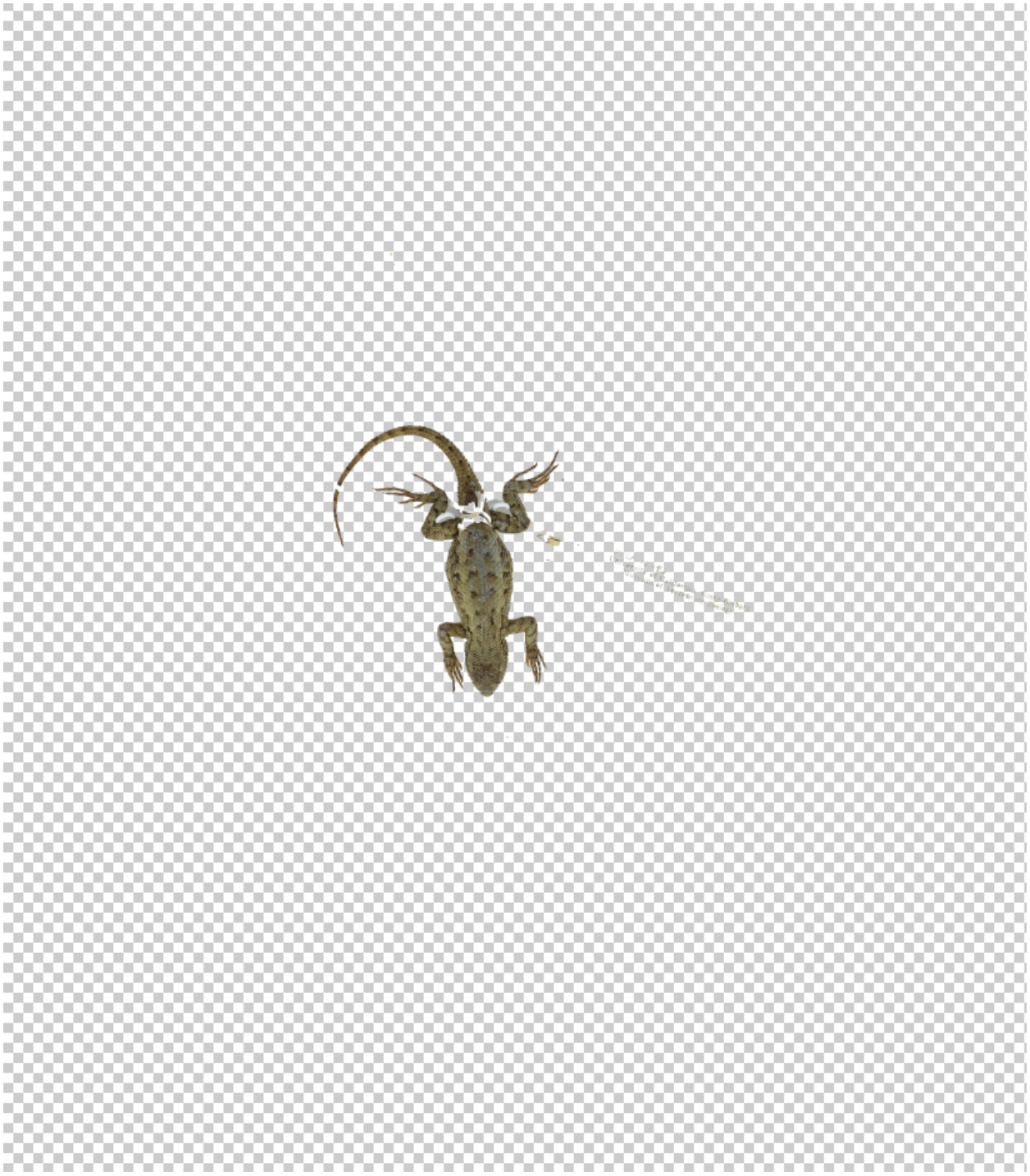
"*Magic Eraser Tool" (MET) .*

   a. Note, this may require that you right-click on the eraser tool to specifically select the correct tool.

5. Navigate to the options bar for MET at the top of the screen, and set the tolerance to 50.



6. With the magic eraser tool, select the area of **white background CLOSEST to the HFS**.
    a. This should effectively eliminate a large portion of the white background AND whatever tags are attached to the HFS. (Although the black text on these tags will likely require manual erasing)

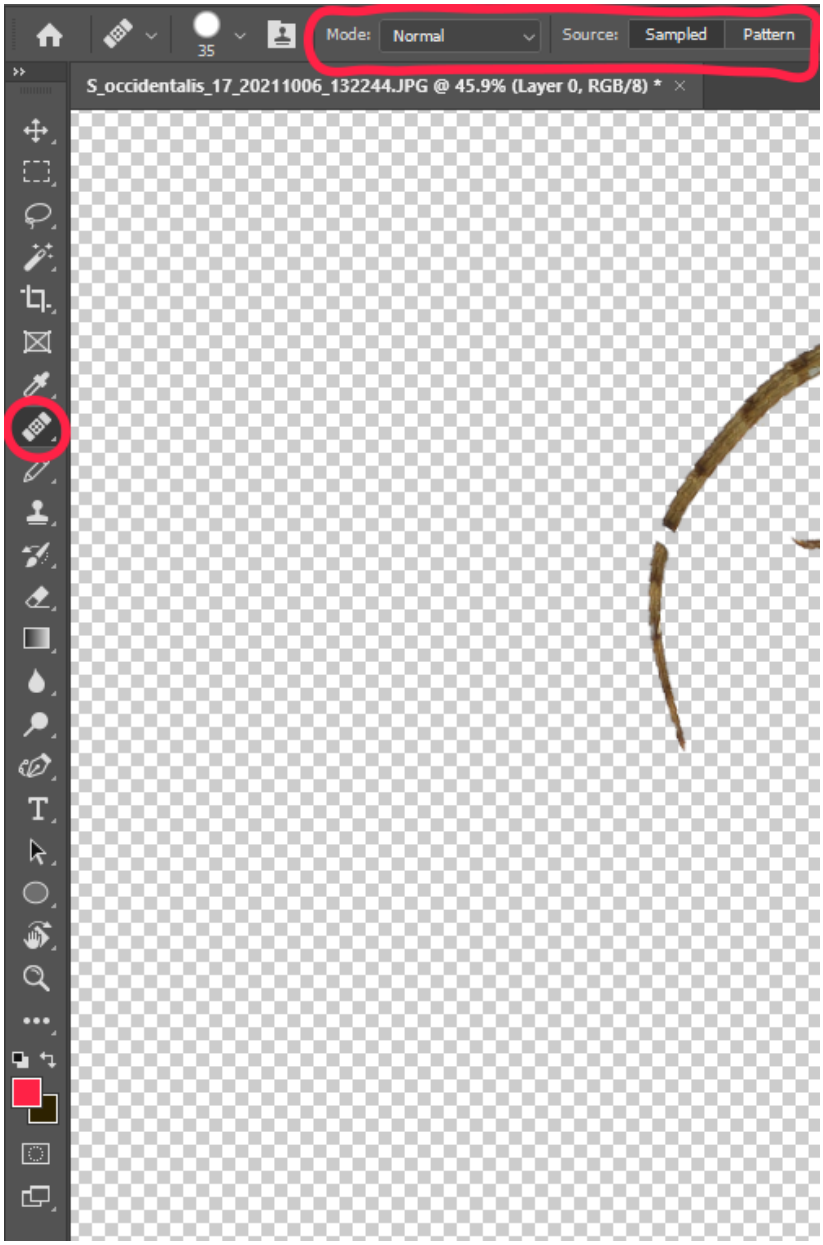


7. Whatever pieces of the background that remain can be eliminated by a combination of the MET and regular eraser tool.

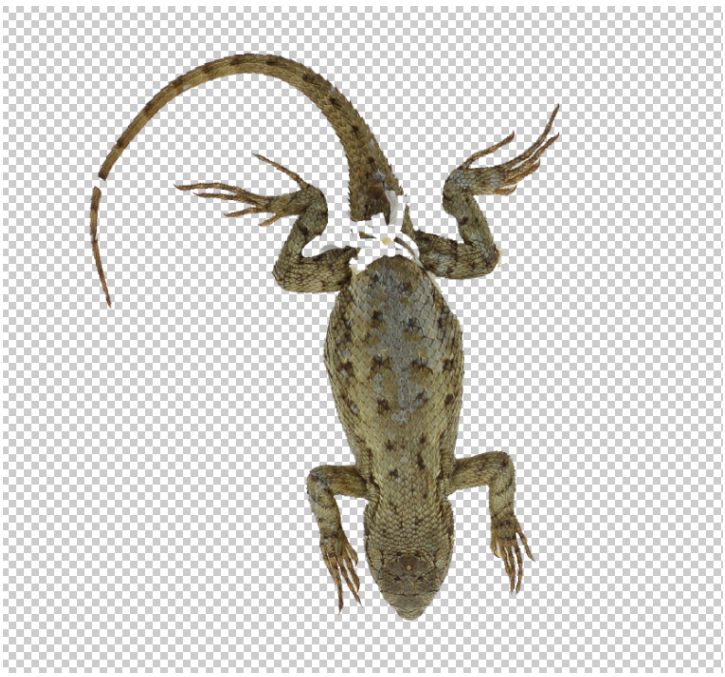
a. Ensure that you zoom in close to the HFS and pay extra attention to erasing the white space between limbs and the body; this will be important during the animation process…

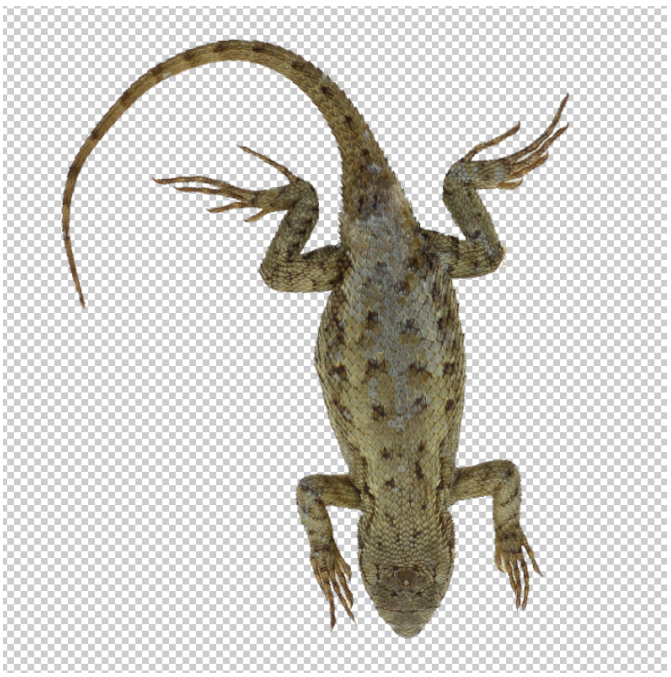
8. Navigate once again to the left-hand tool-bar and select the "*Healing Brush Tool"* (HBT)

9. Then navigate back to the tool options on the top bar and make sure that you have *"Normal"* selected as your mode and that your source is *"Sampled".*



10. Use the healing brush tool to fill in the portions of the HFS body that were erased due to the presence of the white tags. (Refer to adobe help guide for further assistance on how you use this tool)





11. Save the HFS as an adobe ".psd" file to the "Cutouts" folder under the directory of that species.

a. Ex. Of Directory and save name: **ATD → Species → S. Occidentalis → Cutouts → "S_occidentalis_24_20210830_13144"**

-Using Adobe After-Effects to “Animate” HFS Cutouts: [Macro-Batch Round 1]-

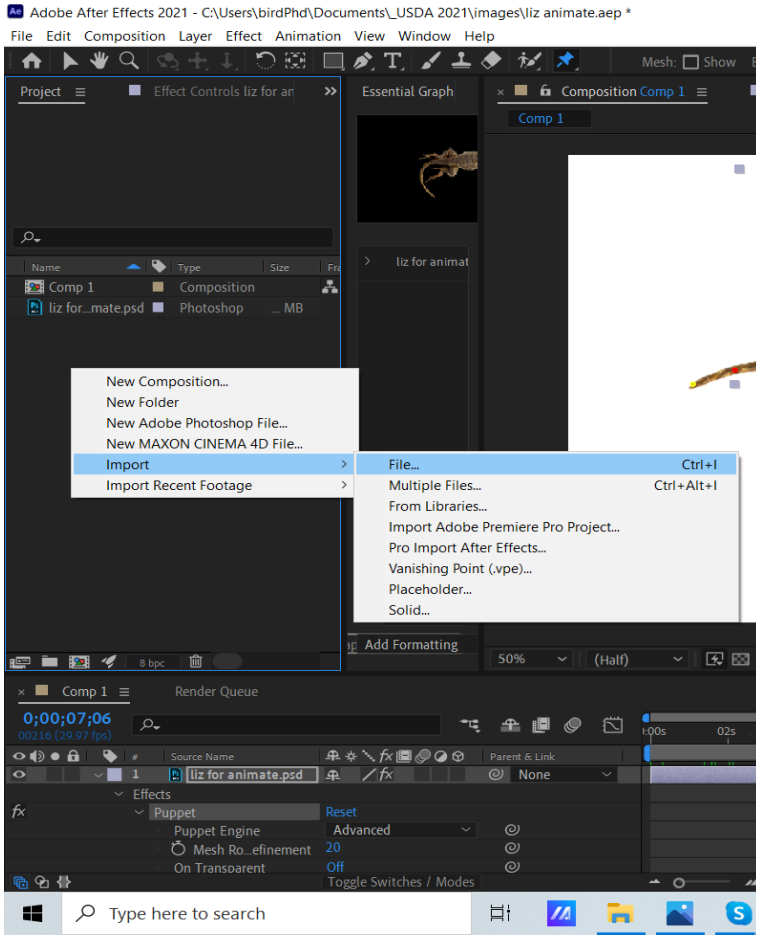
*****NOTE - This step should be completed on the same computer as the previous step as it requires a specific file directory.*****

Supplies:

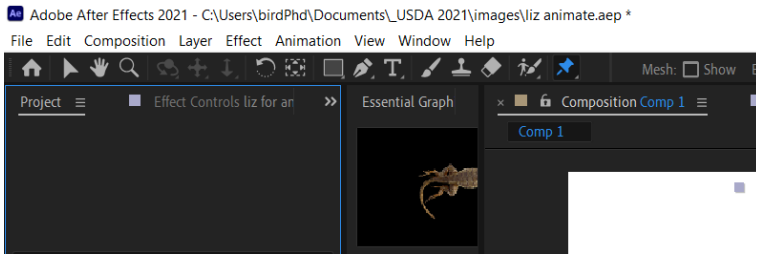
- **Adobe AfterEffects (AEE)**
- **HFS Cutouts**

Steps:

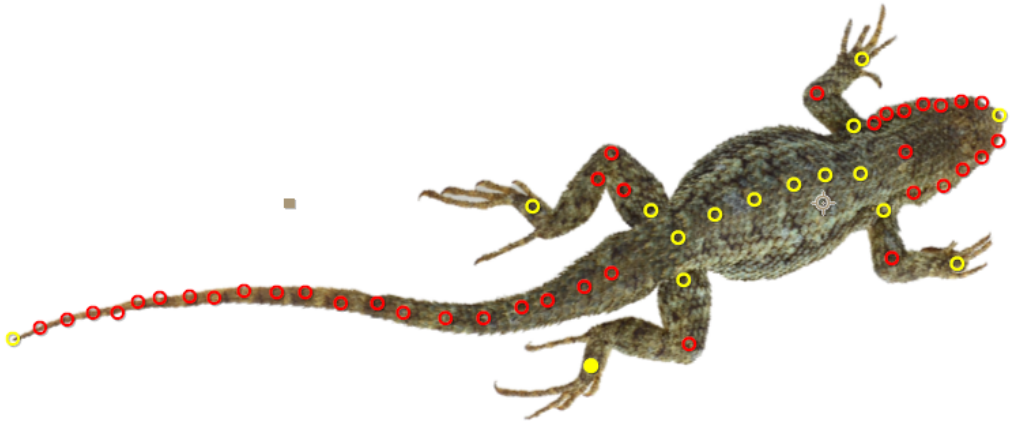
1. Open Adobe AfterEffects.
2. Create a new project.
3. Create a custom composition to match the pixel area (dimensions) of your “Raw Lightbox Photos”. This will be important later.
    a. For Example, our raw lightbox photos are output in the dimensions of **“4912 px” for width and “7360px” for height**.
    b. In the same “New Project” window, set the composition time length to “00:05:00”, which is equivalent to 5 seconds.
4. Import a HFS cutout .psd into your AfterEffect project.



5. Click the puppet pin icon to use default pins (yellow pin). Stick a pin in each joint and end. I.e, neck and nose tip, shoulder, elbow, end of toes. (Blue pin icon in upper right, below).



6. Select the "Position" pin (PP) by selecting the "Puppet Pin Tool", this pin should be YELLOW, and push *CTRL + P* to select the "Starch" pin (SP), this will be red. (Ex. Of Pin Configuration On A Preserved S. Occidentalis Specimen Provided Below)
    a. **Place PPs on areas that you intend to either manipulate or wish to act as an anchor point.**
        i. **You will not require many of these in most circumstances involving herpetofauna as their movements are relatively stiff and/or jointed.**
        ii. **We primarily added these pins to the tip of the head, base of limbs, feet, base of tail, and the tip of the tail.**
        iii. **Additionally, many PPs were added down the backs of HFS's to imitate vertebrae/spine, allowing for core readjustments if the specimen were not preserved properly.**
    b. **Place SPs on areas that you do not intend to directly manipulate.**
        i. **These pins impact the stiffness in the region between Starch pins and other pins, thus more are needed to maintain the structure of the HFS during animation steps.**
        ii. **This makes SPs extremely important when rigging the tail of an HFS to make it rigid. [Explanation of how to rig and straighten tails is provided in subsequent steps.]**



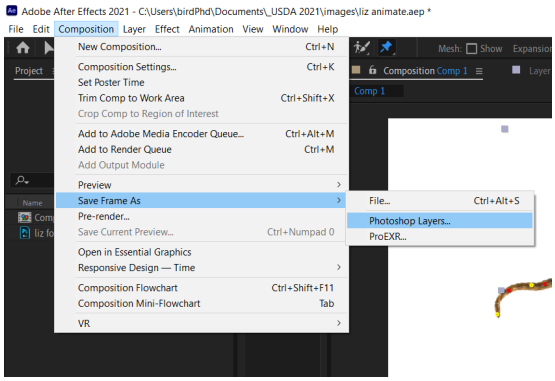
7. Adjust all limbs, including tail, so that they are all in a "resting position" similar to standard posture for small lizard preservation
    a. First adjust the head so that it faces straight forward in line with the rest of the body.

    b. Then adjust the limbs so that they are positioned 90 degrees relative to the body of the HFS

.

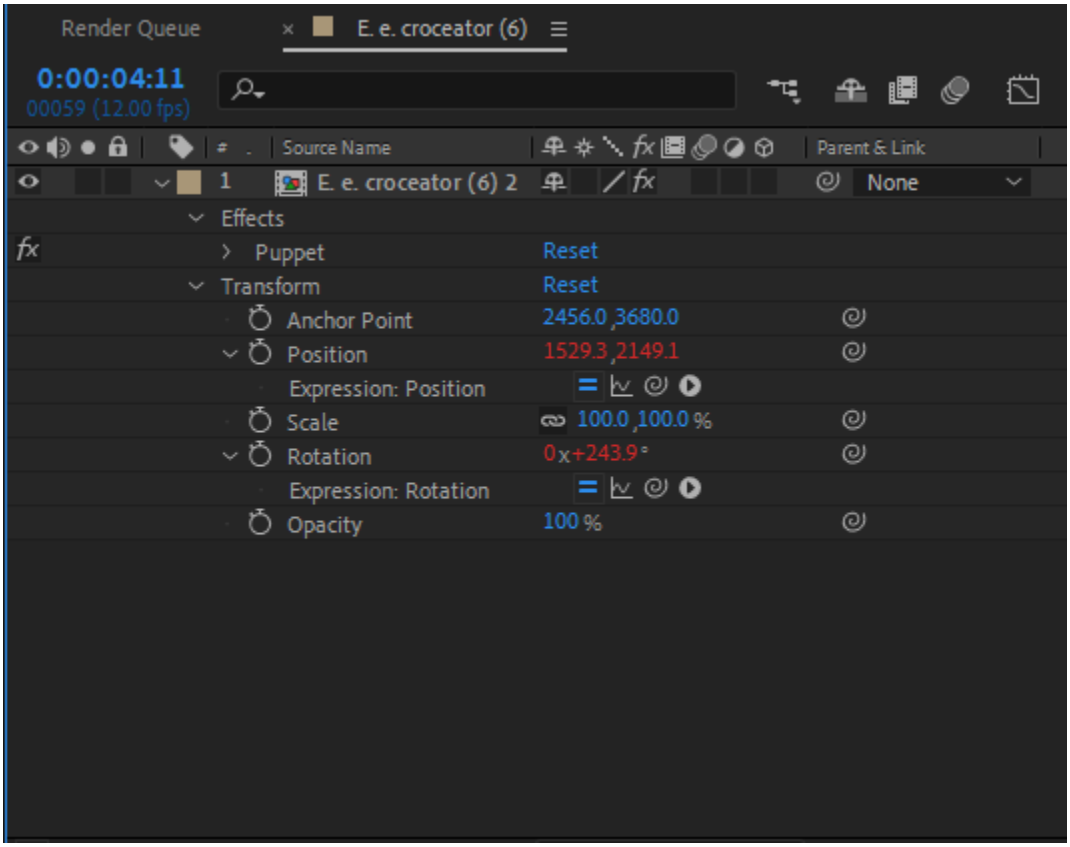
c. Thereafter, adjust the tail so that it is completely in line with the head and body, not curled.
    i. Don't get hung up on minor kinks in the tail, just make sure it's generally straight when in the resting position.

8. Move the timeline from "0:00" to "1:00" (seconds), and proceed to position limbs in accordance with the walk cycle of the species you are working on. [Below are notes on the walk cycle S. Occidentalis to provide context.]
    a. Taxa have unique walk cycles, so finding sources to reference as a model for the animations after is essential here.
9. Drag the timeline to 3:00 (sec) and move limbs in accordance with the rest of the walk cycle. [Intentionally over simplified here]
10. Drag the timeline to 4:00 (sec) and return limbs to "resting positions".
11. Drag timeline to 4.25 (sec); adjust head position to swivel right, then drag timeline to 5:00 (sec) and readjust to swivel head left.



12. Next is a method for achieving complete randomization of position, orientation and pose

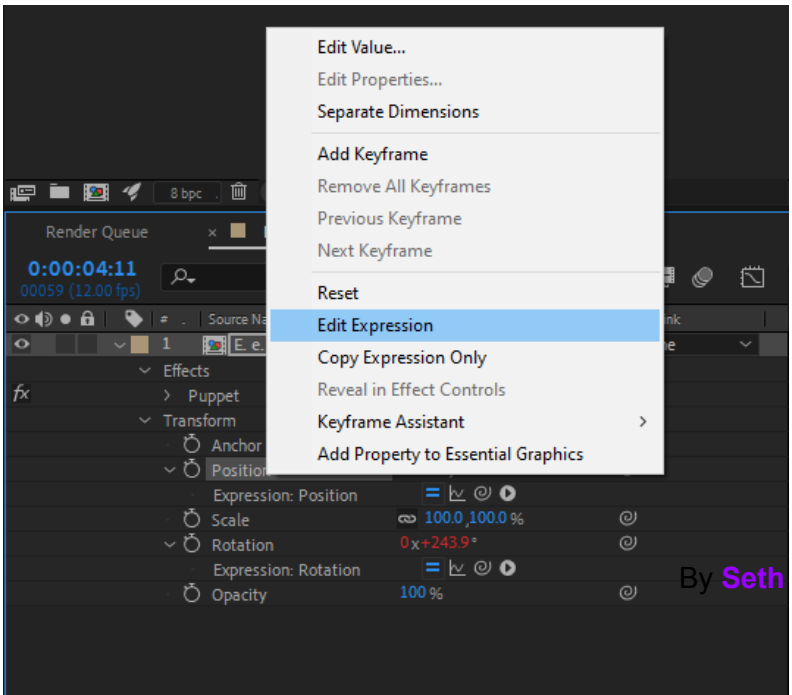
a. Navigate to the "*Layer Properties"* window at the bottom of your work-space, next to the time-line.



b. Right-click the "*Position"* tab and select "*Edit Expression"* and insert this code in the timeline expression box to the right...

x = random(-10,5000);
y = random(-10,7000);
z = random(0,0);

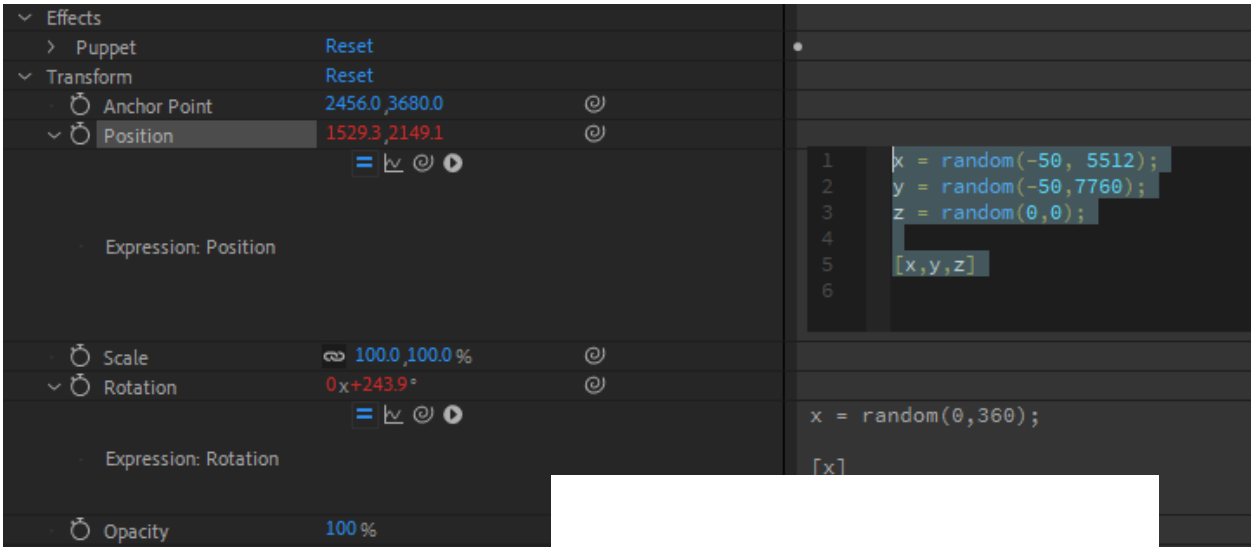
[x,y,z]



Then, right-click "enter the *"Orientation"* tab and select *'Edit Expression"* to enter this codein the timeline expression window...

x = random (0,0);
y = random (0,0);
z = random (0,360);

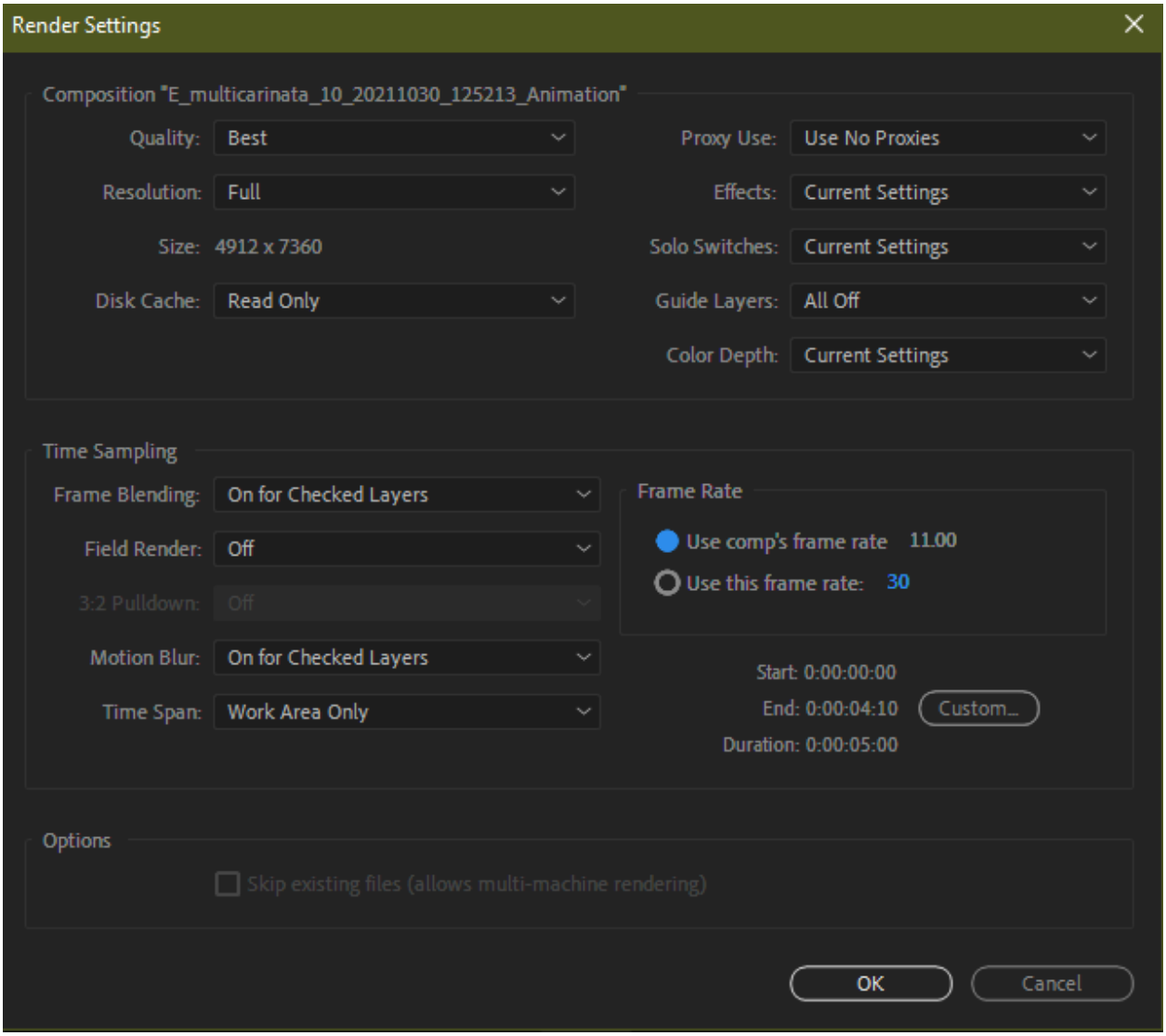
[x,y,z]



c. You should now see that the lizard is randomly positioned/oriented at every new frame of the timeline as you drag along!.

13. Go to "*File -> Export -> Add To Render Queue"* and click "*Add To Render Queue"*
14. Click on the "Render Queue" tab.

a. Navigate to the subtab "Render Setting" and adjust the frames per second (FPS) to any desired rate. (Remember, higher FPS will output more frames in the PNG sequence, and will take more time to render.)
b. For the purpose of our work, we chose 11 FPS for the 5 second sequence, which outputs 55 photos per specimen.

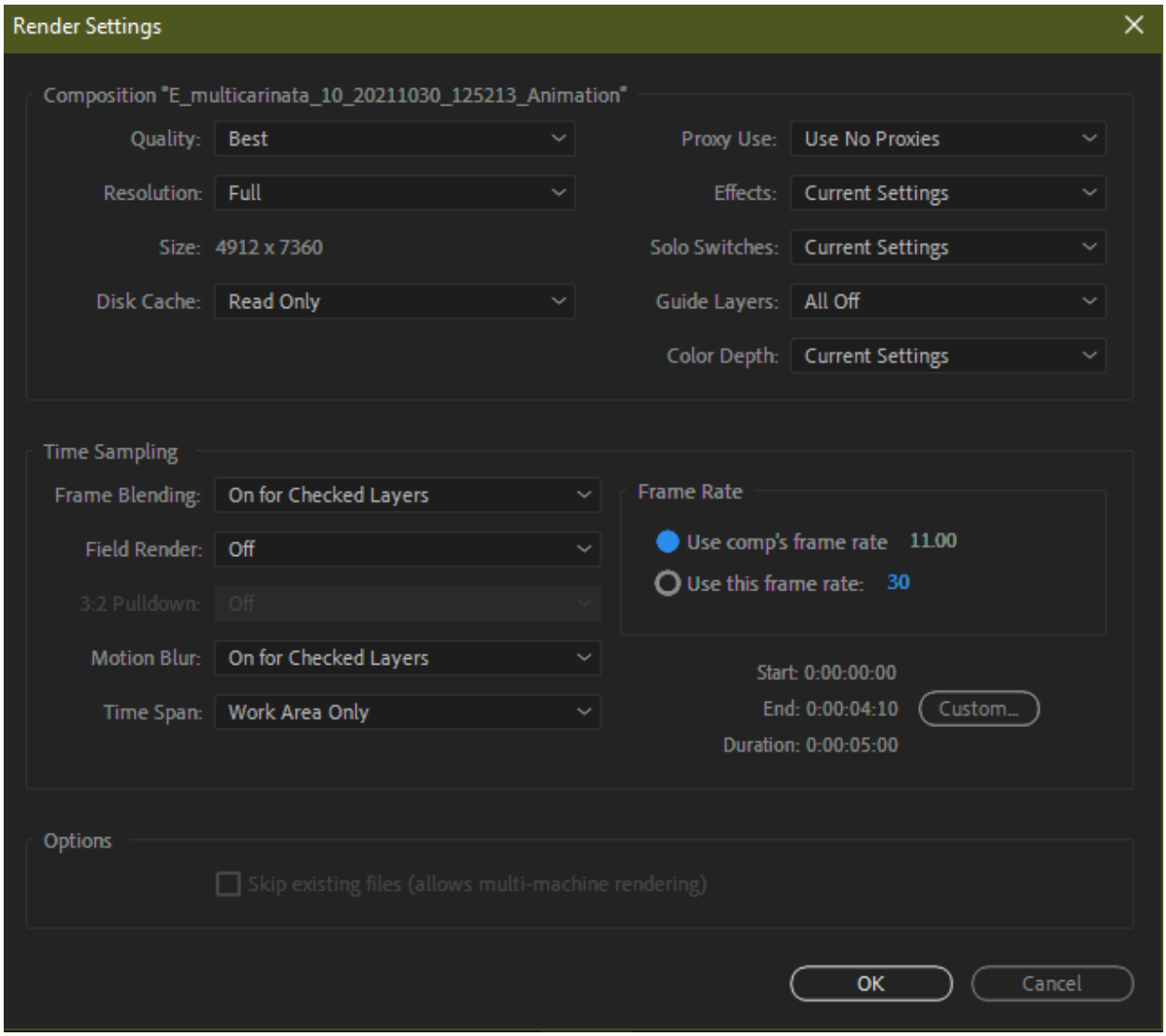


15. Navigate to "*Output To*" and direct output to a subfolder (Ex. Macro Batch -> Edited -> Round 1 - Animation ->) with a name that is named after the meta-data descriptions assigned during the initial light box photo capture + the suffix "_Animation" at the end of the name.
    a. **Ex. S_occidentalis_24_20210830_131443_Animation**

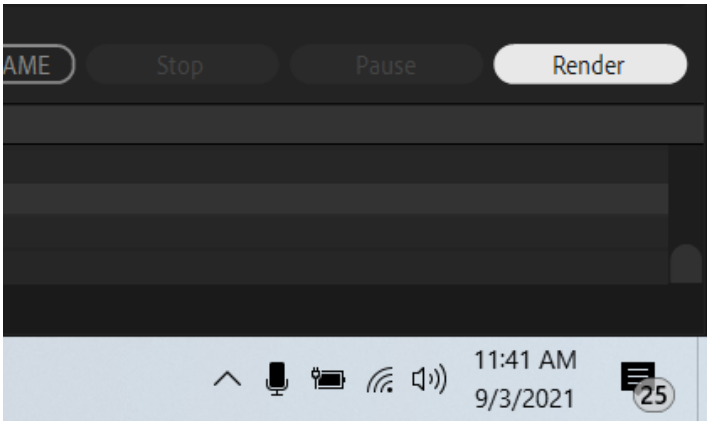
Thereafter, you should see an option for the naming convention for the PNG sequence. Add "_Randomized" to the name just before the set of bracketed #'s.

    b. **Ex. S_occidentalis_24_20210830_131443_Randomized_[####]**

16. Then, click "*Output Module*" and ensure that all of your settings match the picture below. ****ESPECIALLY REMEMBER TO CHECK THAT THE OUTPUT SEQUENCE IS PNG, NOT JPEG** -> FIX THIS**

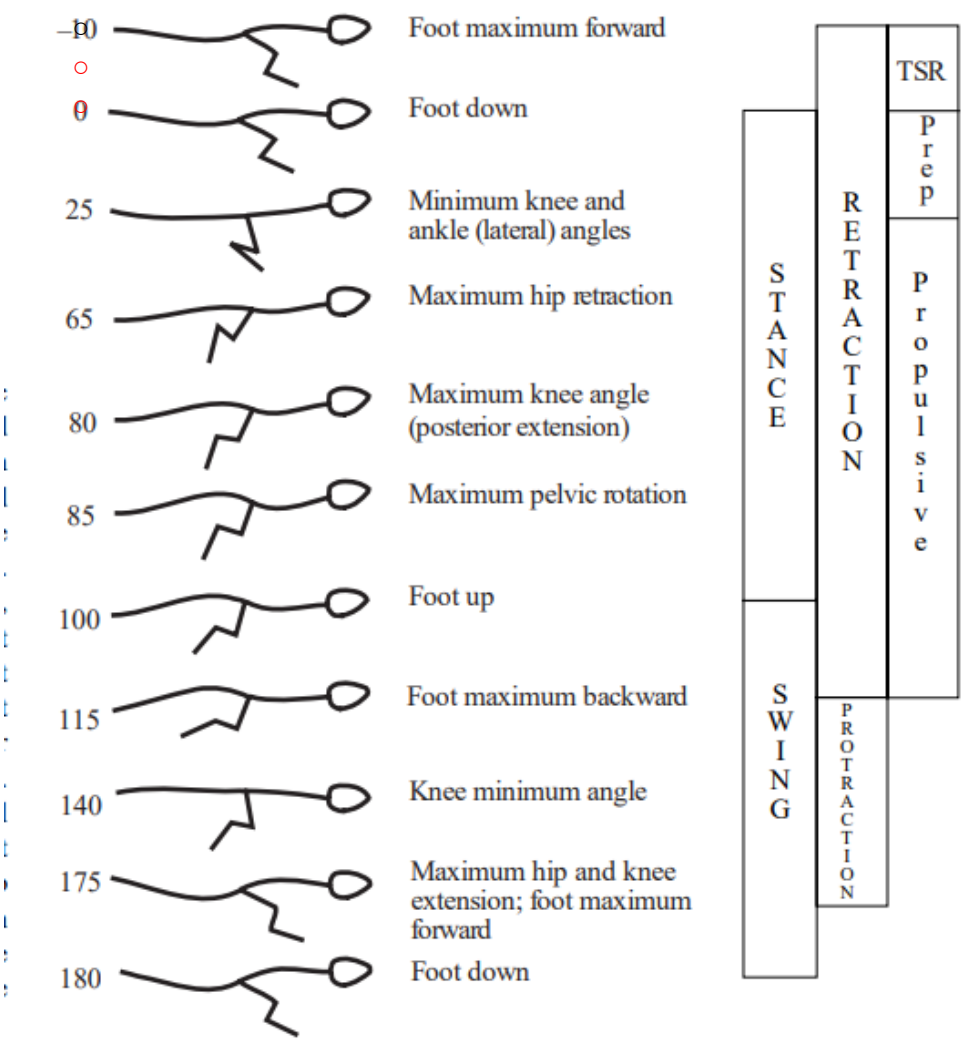


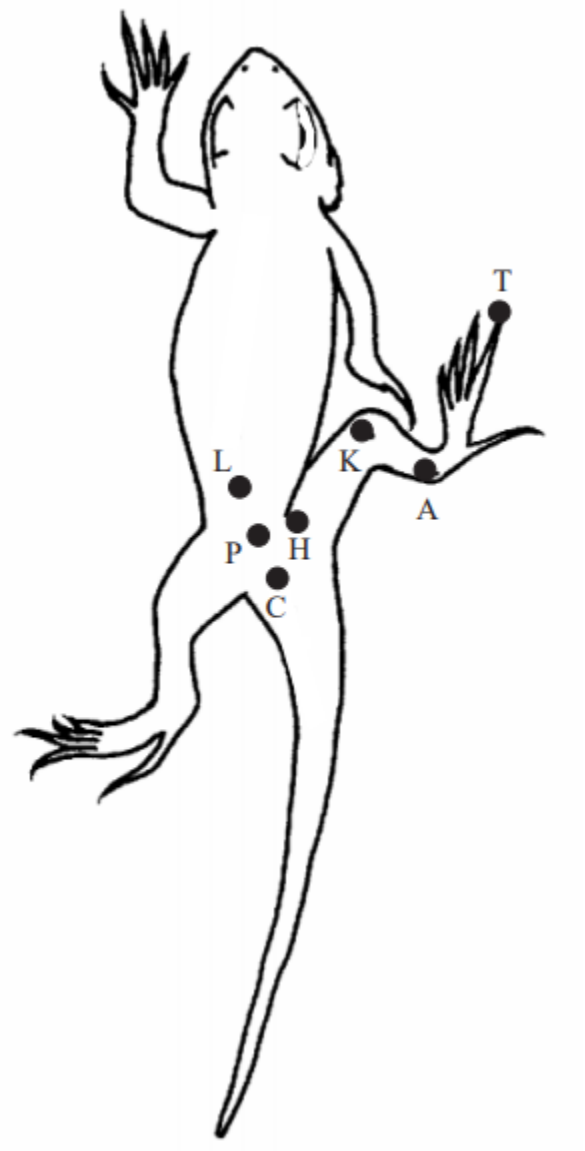
17. Click the RENDER button on the timeline on the bottom right. (Repeat for all cutouts of a Species)



SERIOUS CONSIDERATIONS WHEN USING THE ANIMATION TOOL:

- Make sure that there is a reasonably large gap between limb extremities and any other part of the body, otherwise the After Effects rigging tool will consider the two points connected...and you will be unable to properly manipulate the specimen.
- For each species of lizard there will be nuances to their walk cycles which may pose some issues… However, Scoloperis can be used as a well documented model to build our understanding of the generalized "Lizard Gate"...
    - Including the minimum and maximum angles that jointed regions rotate at different stages of the walk cycle. [Diagrams included for reference]
    - **Reilly, S. M. and M. J. Delancy. 1997. Sprawling locomotion in the lizard Sceloporus clarkia: quantitative kinematics of a walking trot. The Journal of Experimental Biology 200: 753-765. https://cob.silverchair-cdn.com/cob/content_public/journal/jeb/200/4/10.1242_jeb.200.4.753/1/753.pdf?**




T
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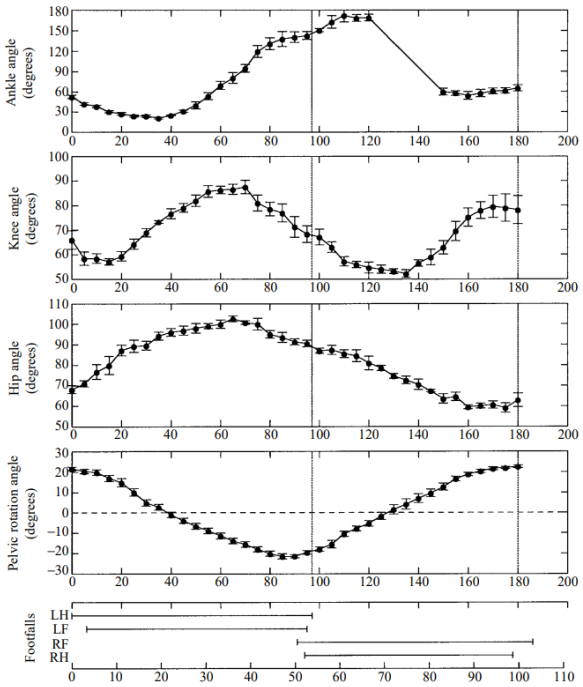

Ankle angle (degrees)
Knee angle (degrees)
Hip angle (degrees)
Pelvic rotation angle (degrees)
Footfalls
LH
LF
RF
RH

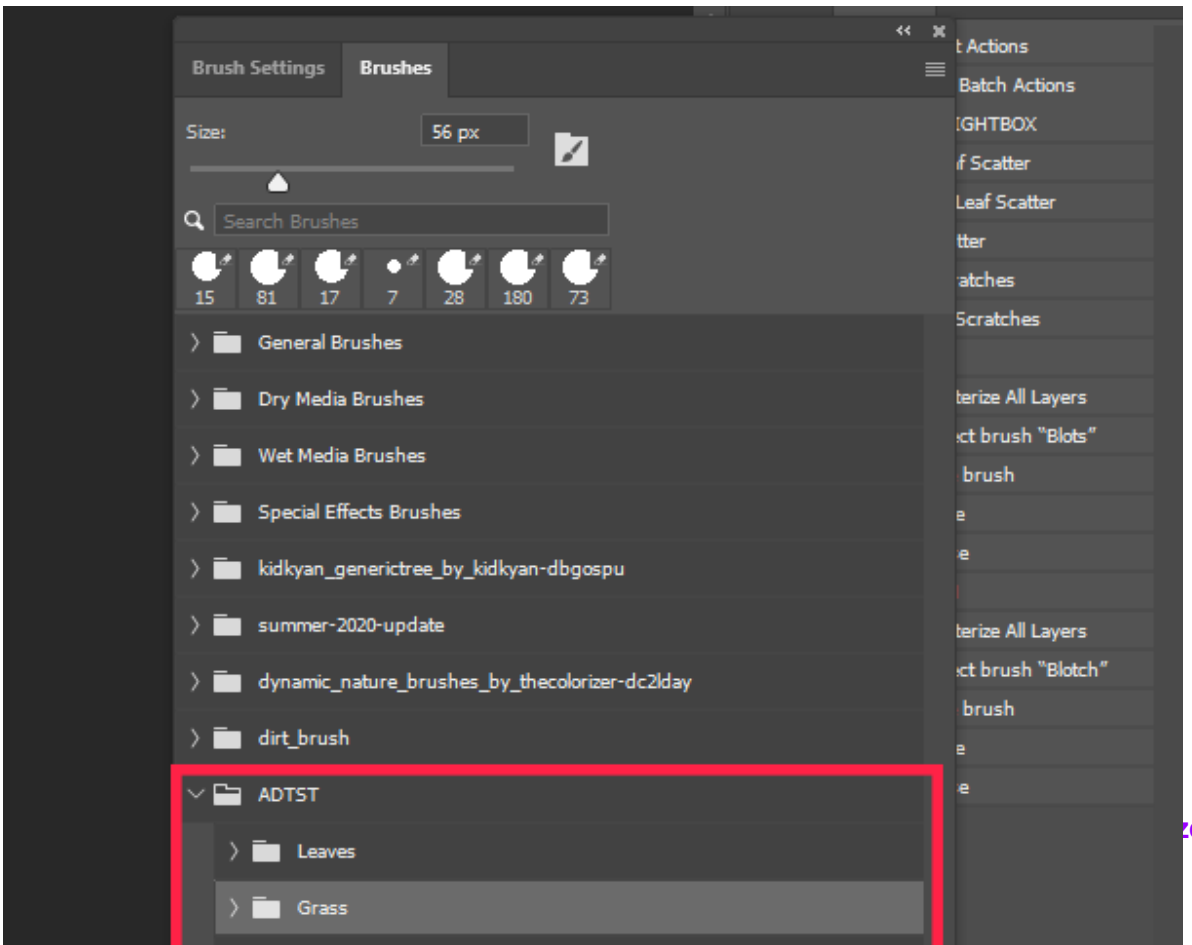
-Using Photoshop Batch Processing to Generate Randomized Backgrounds and Randomly Match Backgrounds To Animated HFS Frames: [Macro-Batch Round 2]-

*****Additional background combinations or more complex backgrounds (like the “*Dirt Road " background* marcrobatch provided) can be generated by running a macrobatch that uses several brushes, layering, and special fx (bevel & emboss + drop shadow).*****

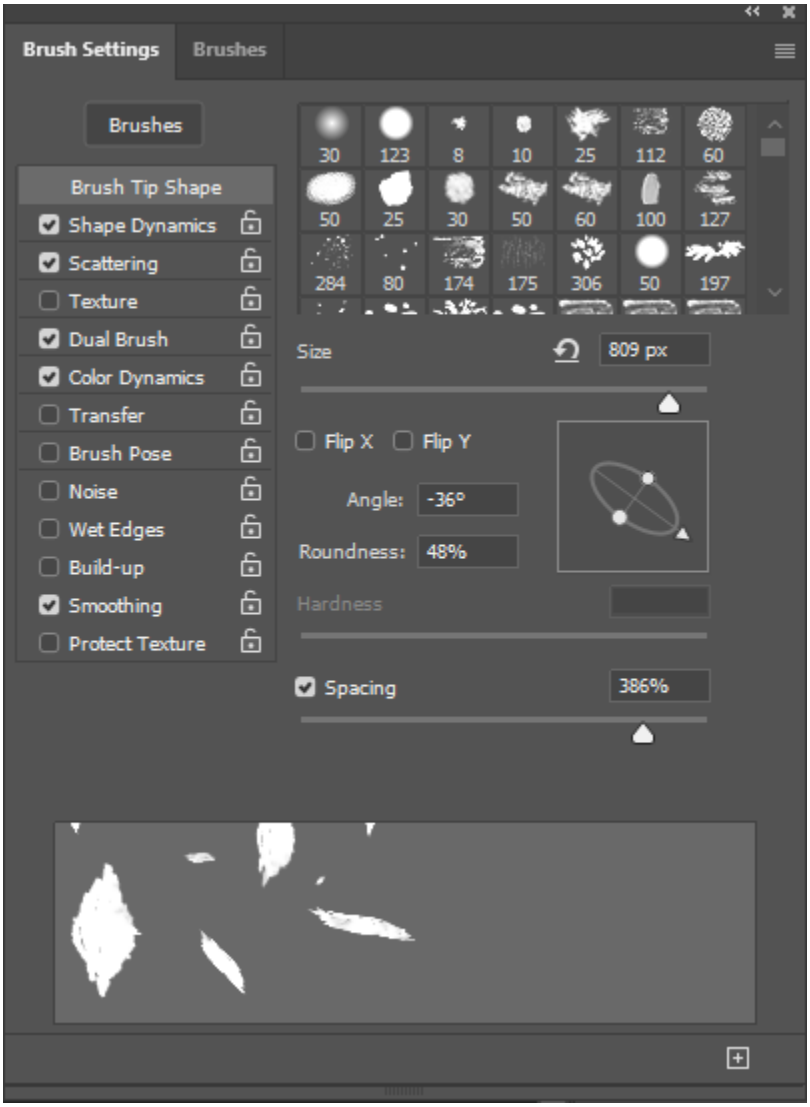
****It is also recommended that, if possible, one creates brushes from foliage//dirt texture samples that are from the target site that these species are found). ****

Section 1 - Creating Customized Brushes // Brush Types

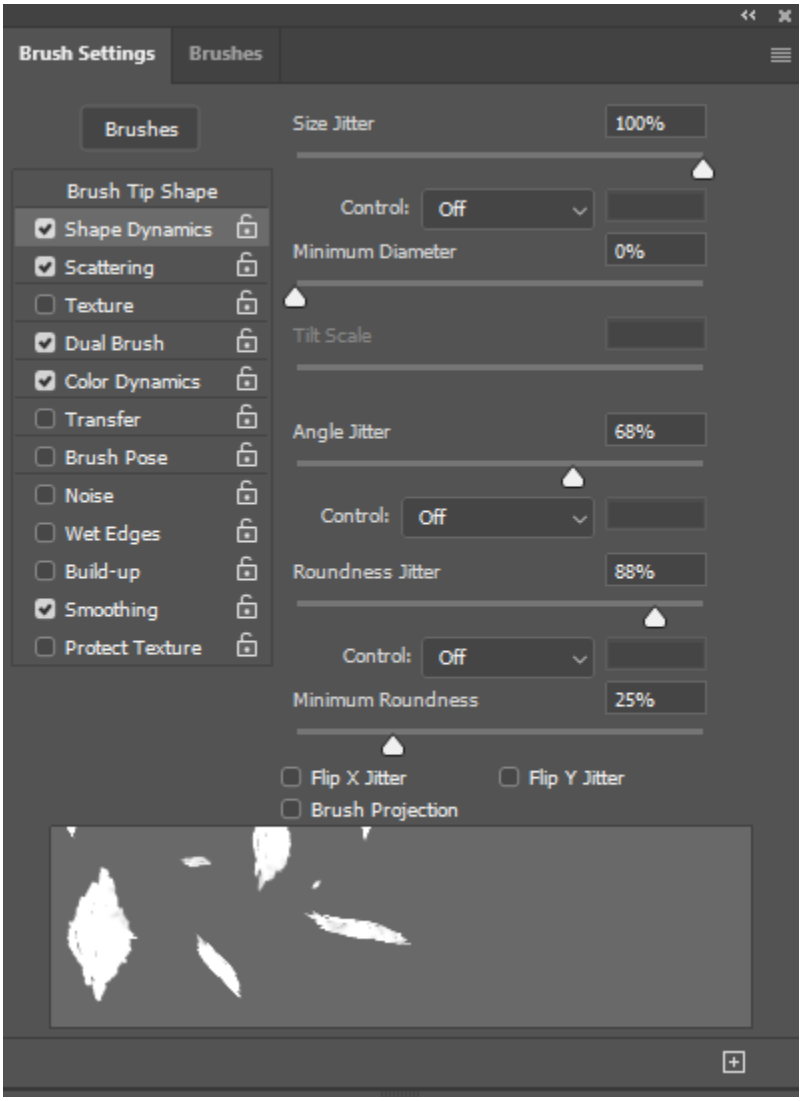
1. Download the provided “*ATDST”* custom brush files.
2. Open Adobe Photoshop.
3. Click the “*Help”* tab on the upper right corner of the top bar and select “*Photoshop Help”*.
4. Type “Brushes Window” into the search tab and click on the top result.
5. Drag and drop the *ADST* brush file into photoshop.
    a. The *ADST* brush set should now be visible as a folder in the brush tab window with three subfolders that contain brushes for creating “Leaf”, “Grass”, “Dirt” and “Pebble” backgrounds.



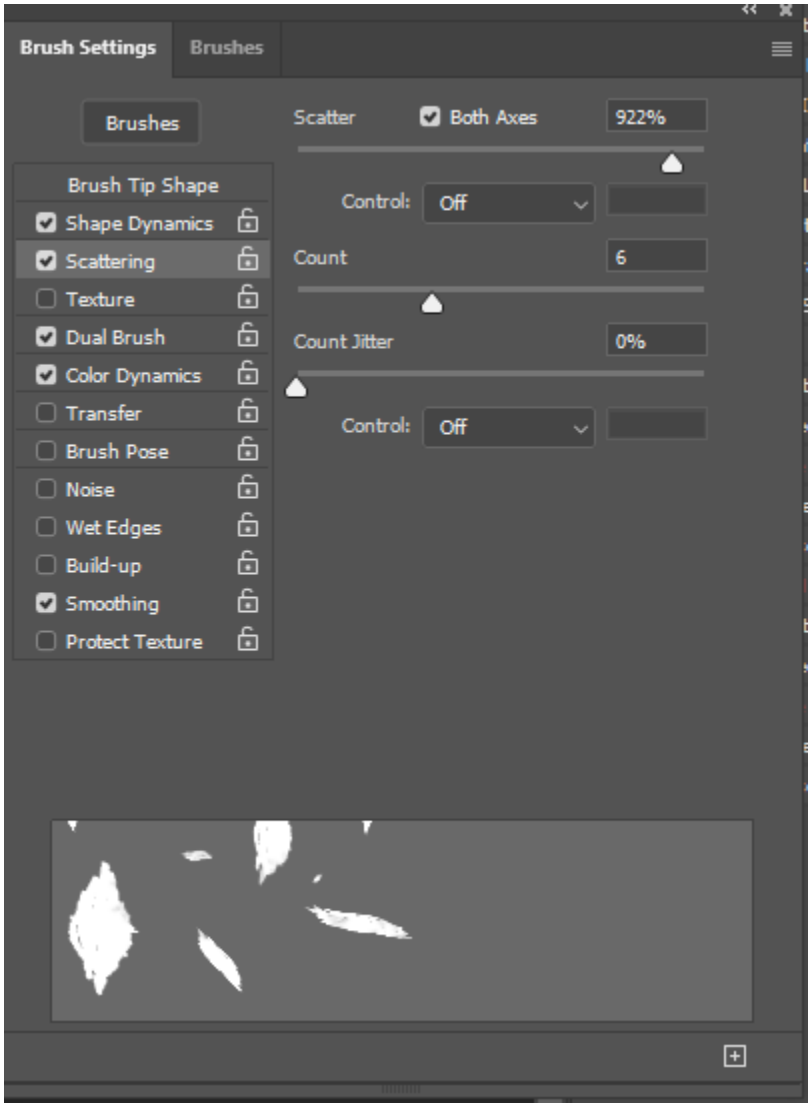
6. [Optional] Go through each brush of every subtype and adjust the individual spacing settings on the "Brush Tip Shape" tab to increase or decrease the space between appearance of a brush stroke.



a. And/Or navigate to the "Shape Dynamics" tab to adjust any setting with a "Jitter" modifier to increase the degree of randomness in which a brush stroke is applied to a background.

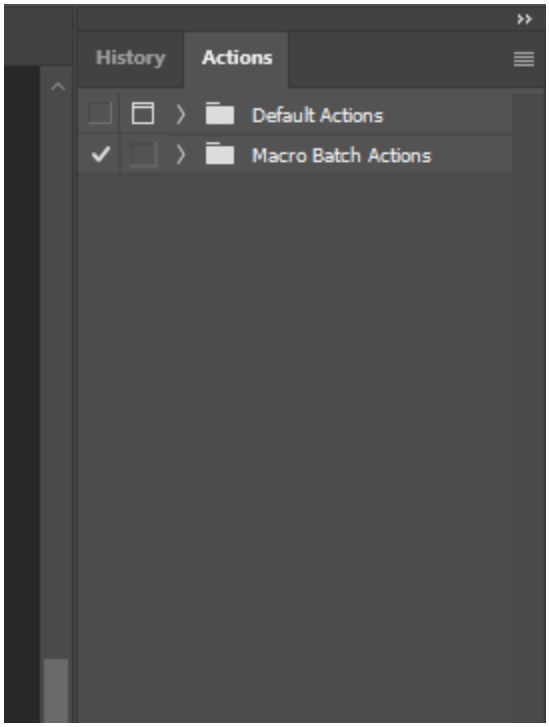


b. And/Or navigate to the "Scattering" tab to adjust the "Scattering Jitter"



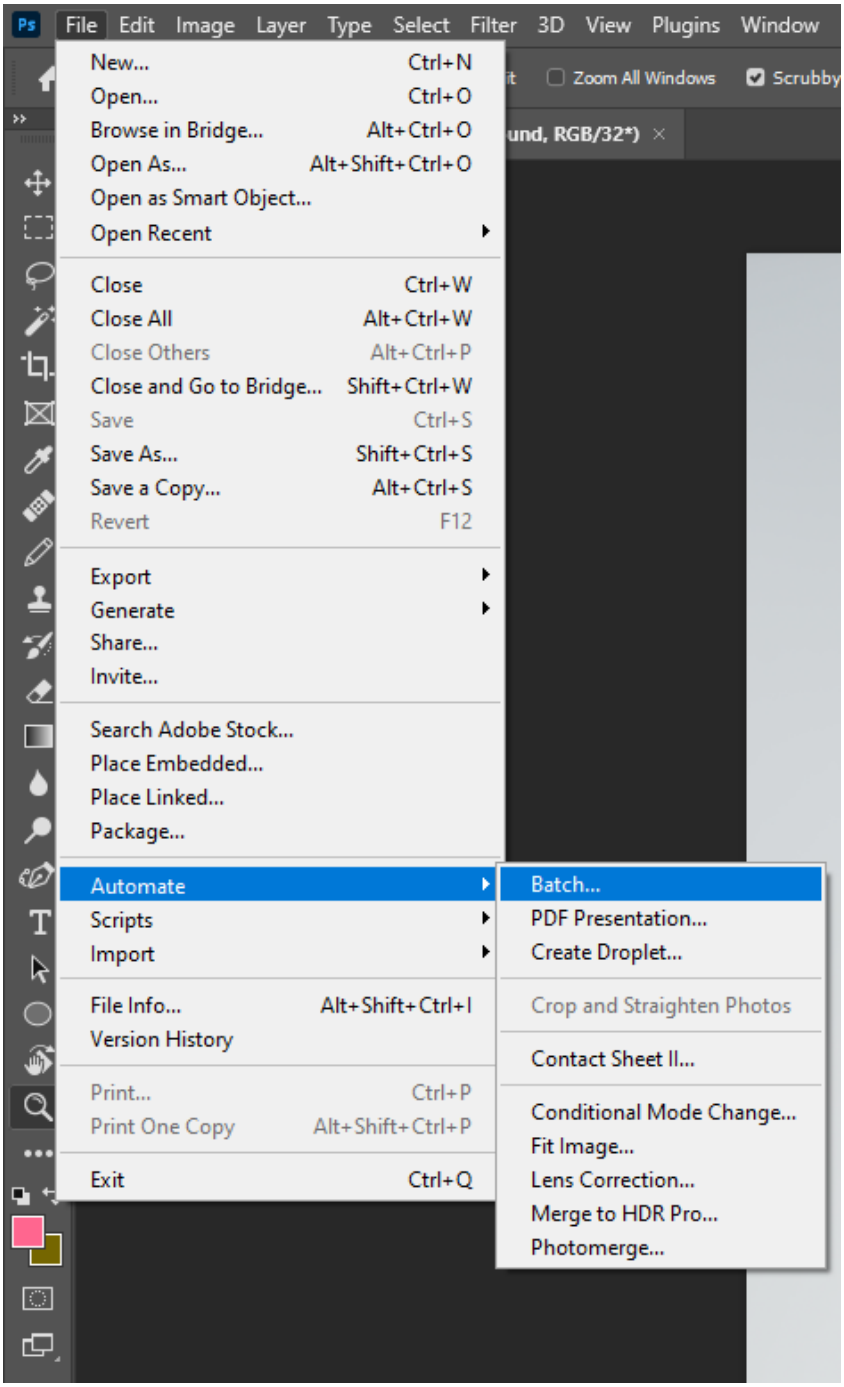
Section 2 - Generating “Randomized” Background Layers

1. Recall the previously mentioned LBS photo taken in the “Using Herbarium Lightbox…” section.
2. Relocate said photo to a new folder named “LBS Copies”
3. Duplicate the LBS photo a minimum of 50 times (the amount is dependent on your data output needs), and mass rename them to “LBS”. There should be LBS(1) - LBS(50+) now.
    a. Close this folder window when done…
4. Open Photoshop, and immediately navigate to the “*File -> Open*” tab to open LBS(1).
5. Navigate to the “*Window”* tab and select “*Actions”* to make the action window visible in your workspace.
    a. You should now see a panel appear on the right side of the workspace/screen.

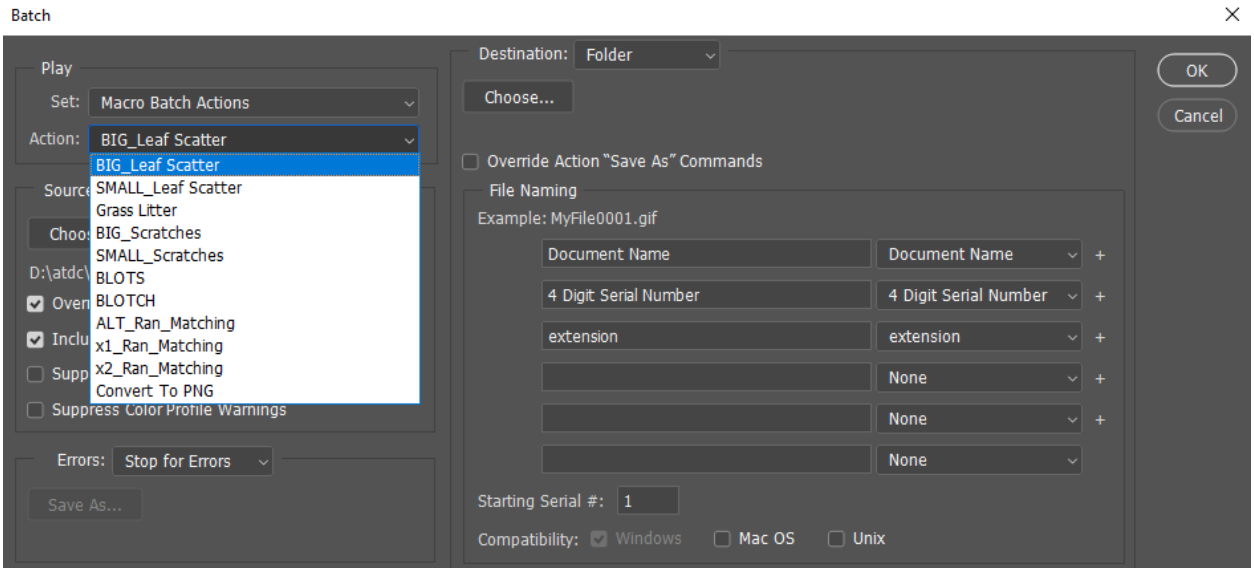


6. Download the “ATD-Macro Batch Actions” file provided to you under the “Photoshop Tools -> MB Processes” directory in the “ATD Creation Resources” package..
    a. Drag and drop the downloaded file into photoshop.
    b. There should now be a folder called “Macro Batch Actions” visible in the actions panel.

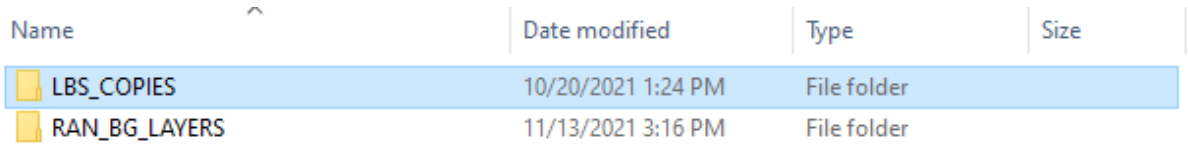
7. Navigate to "*File -> Automate -> Batch…*

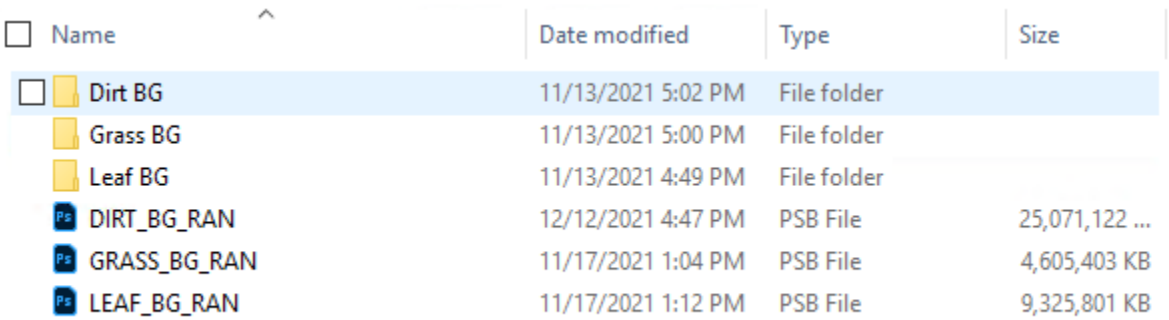


8. In the "Batch Window" begin by selecting the top action "*BIG_Leaf_Scatter"* (You will begin with this action and repeat the following steps for each action **UP TO AND INCLUDING "*BLOTCH")***

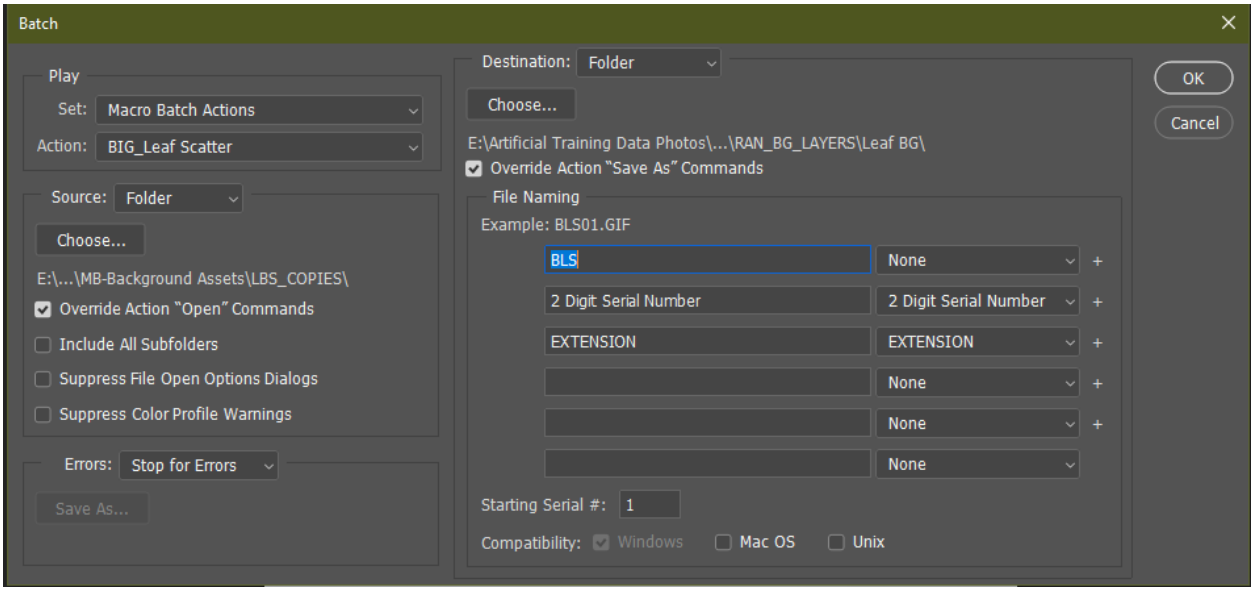


9. Next, ensure that your file "*Source"* is "*Folder"* and then click "*Choose"* to select the folder containing the *LBS Copies.*
10. Then, ensure that your destination is set to "*Folder"* and click "*Choose"* to select the "*LEAF_BG*" folder under the "*Photoshop Tools -> MB_Backgrounds -> RAN_BG_LAYERS"* file directory.
    a. "*Grass Litter"* action outputs should be directed to "*Leaf_BG".*
    b. "Big Scratches" through "*BLOTCH"* should all be directed to "*Dirt_BG*"
    c. "*Small Pebbles"* and *"Big Pebbles"* should be directed to "*Pebbles_BG*".





11. For the "*File Naming"* section, follow this convention…
    a. First box = Acronym of the action name
        i. Ex. "*Big Leaf Scatter"* = ***BLS***
    b. Second box = Select "*2 Digit Serial Number*" by clicking on the tab drop-down of the right hand column and then check that the "*Starting Serial"* at the bottom right of the Batch Box is equal to '1'
    c. Third box = Select "EXTENSION" by clicking on the tab drop-down of the right-hand column.
12. Finally, ensure that "*Override Action 'Open' Commands" and "Override Action 'Save As' Commands"* are check marked.
13. Click "*Ok"* and the batch process should proceed.
    a. Rinse and Repeat these steps for all remaining background batch processes. **PAY SPECIAL ATTENTION TO DIRECTORY AS IT IS EXTREMELY IMPORTANT!**



*****NOTE - We Highly recommend creating a secondary folder for "Null" case backgrounds. Essentially, these backgrounds would not be matched to any HFS rather they act as training data to teach the ML model what ISN'T an HFS.**

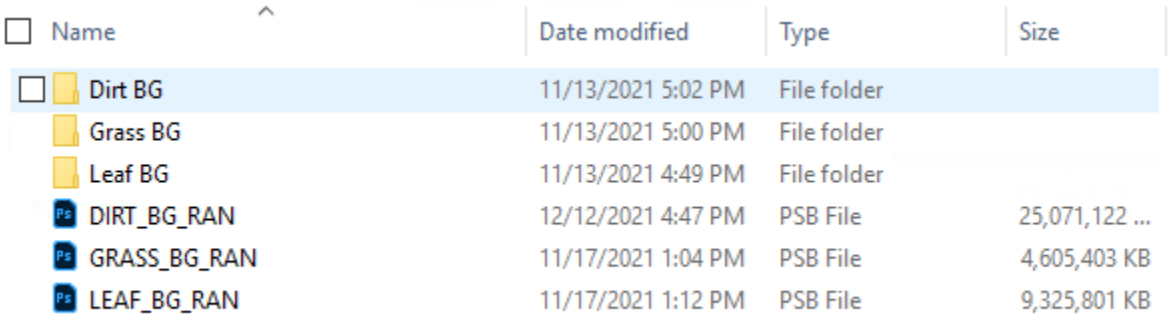
- **The hope is that the model will adapt to the presence of noise and be able to pinpoint a HFS anywhere in the frame.**

Section 3 - Randomly Matching Backgrounds Layers To Animated HFS Frames

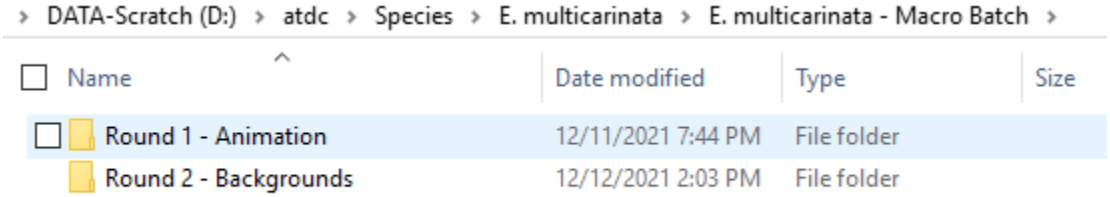
1. Open Photoshop and then open the first PSD file in the "*Leaf BG*" Folder
2. Select all subsequent files in the "*Leaf BG"* folder to drag-and-drop into the center of the PSD file that is already loaded.
    a. This will essentially insert all those background layers that were generated into one document as separate layers.
    b. You will need to repeatedly click on the "*Enter"* key until all layers have been loaded/placed **(Spamming the "Enter" key does work for this).**

3. **Once all layers have been placed, save the file as "*LEAF_BG_RAN"* under the file directory *"Photoshop Tools -> MB_Backgrounds -> RAN_BG_LAYERS"***
    a. DO NOT save within the actual "*Leaf_BG"* folder.
    b. It will automatically attempt to save this as a normal ".psd" file at first, but will then prompt you to save it as a ``.psb" file once the system recognizes the file size is too large for PSD.
        i. Follow through with this process, it will just take a while for the save to complete.

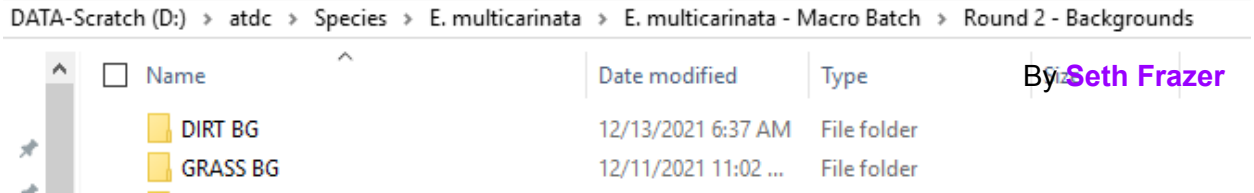
4. **REPEAT THIS PROCESS FOR THE GRASS AND DIRT BACKGROUND LAYERS!**
    a. Dirt backgrounds will be saved as "DIRT_BG_RAN".
    b. Grass backgrounds will be saved as "GRASS_BG_RAN".



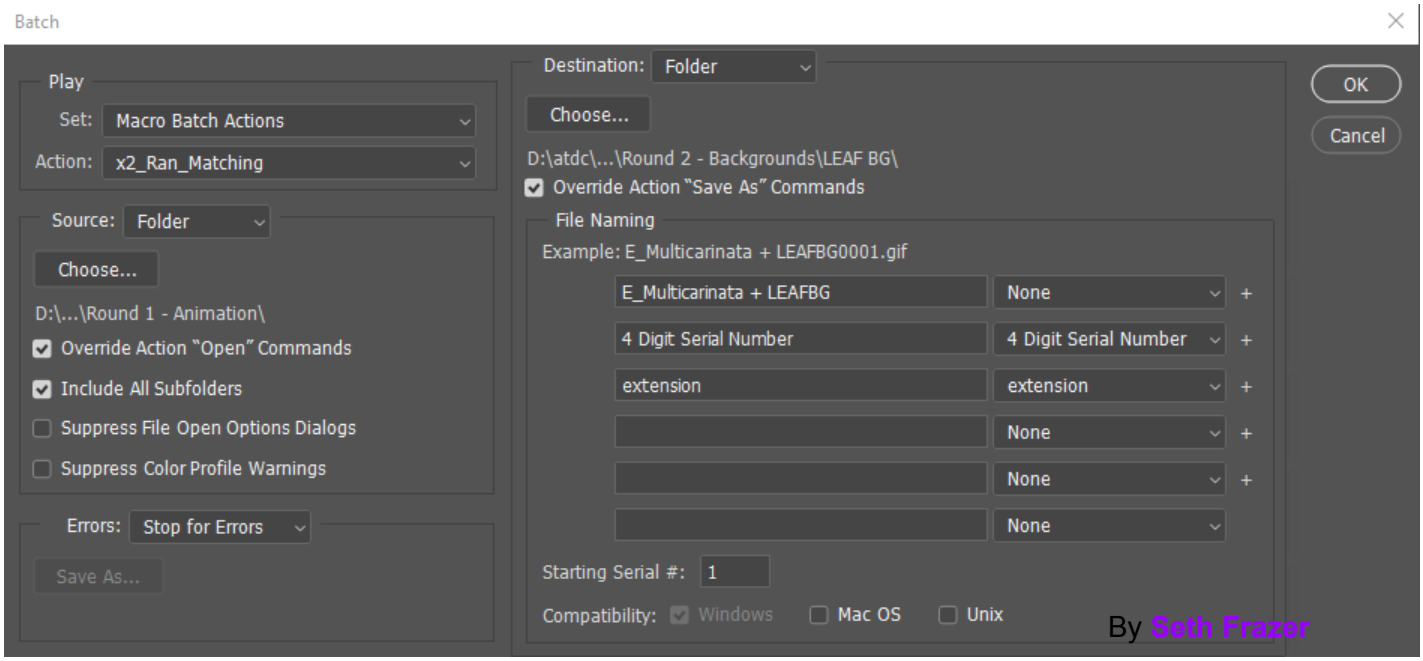
5. Open "LEAF_BG_RAN"
6. Navigate once again to the batch process window.
7. Select the "*x2_Ran_Matching"* under the "*Action"* drop-down tab.
    a. **NOTE - If your system is running slow, select "*x1_Ran_Matching*" instead.**
8. Select the "*Choose…"* button within the "*Source*" box…
    a. Navigate to the folder containing the randomized HFS animation frames for the first species you wish to process.
        i. Ex. Directory - *Species -> E. multicarinata -> E. multicarinata - Macro Batch -> Round 1 - Animation*
9. Within the same "*Source"* box, ensure that "*Override Action 'Open' Commands"* and "*Include All Subfolders"* are check-marked.



10. Next, select the "*Choose"* button in the "*Destination"* box…
    a. Choose a folder as the destination for the match between the randomized background and HFS frame.
        i. Ex. Directory - *Species -> E. multicarinata -> E. multicarinata - Macro Batch -> Round 2 - Backgrounds -> LEAF_BG*
        ii. In this case, we made it so each species has a subfolder for each of the three background types that it is combined with.



11. In the same *"Destination"* box, ensure that "*Override Action 'Save As' Commands"* is check-marked.
12. For the "*File Naming"* section, follow this convention…
    a. First box = **'Species Name' + 'Background Type'**
        i. **Ex. "E_Multicarinata + LEAFBG"**
    b. Second box = Select "*4 Digit Serial Number*" by clicking on the tab drop-down of the right hand column and then check that the "*Starting Serial"* at the bottom right of the Batch Box is equal to '1'
    c. Third box = Select "EXTENSION" by clicking on the tab drop-down of the right-hand column.
13. Select the "Ok" button to begin the batch process.
    a. This process **WILL take hours** and an **EXTREME amount of storage**, so we **HIGHLY recommend** that you run these on computers with substantial computing power and/or a computer cluster.
14. **REPEAT THIS PROCESS FOR EACH SPECIES, THEN CHANGE THE BACKGROUND TYPE AND REPEAT FOR EACH SPECIES ONCE AGAIN.**
    a. Continue this until you have processed all species with each background type.
    b. *****NOTE - This process automatically outputs BOTH a PS file for future modification steps AND a JPG file that can be resized to the recommended 500x749 pixels to be uploaded to the Google Cloud Platform for model training.*****

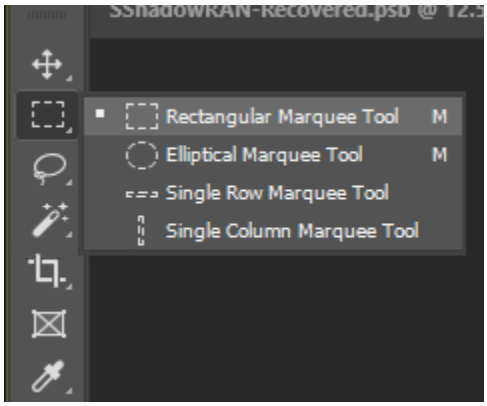


-Using PS + AEE to Add “Shadows” to ATD Images-

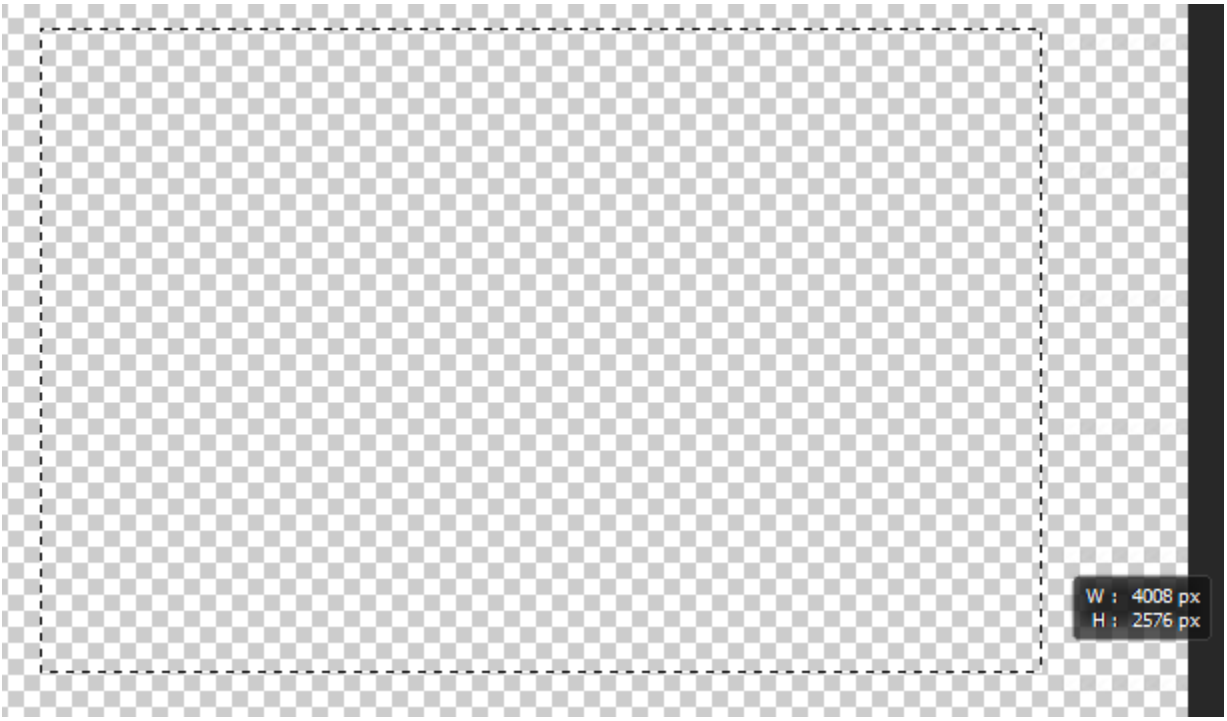
[Macro Batch Round 3]

Section 1 - Using PS to Make “Shadows”

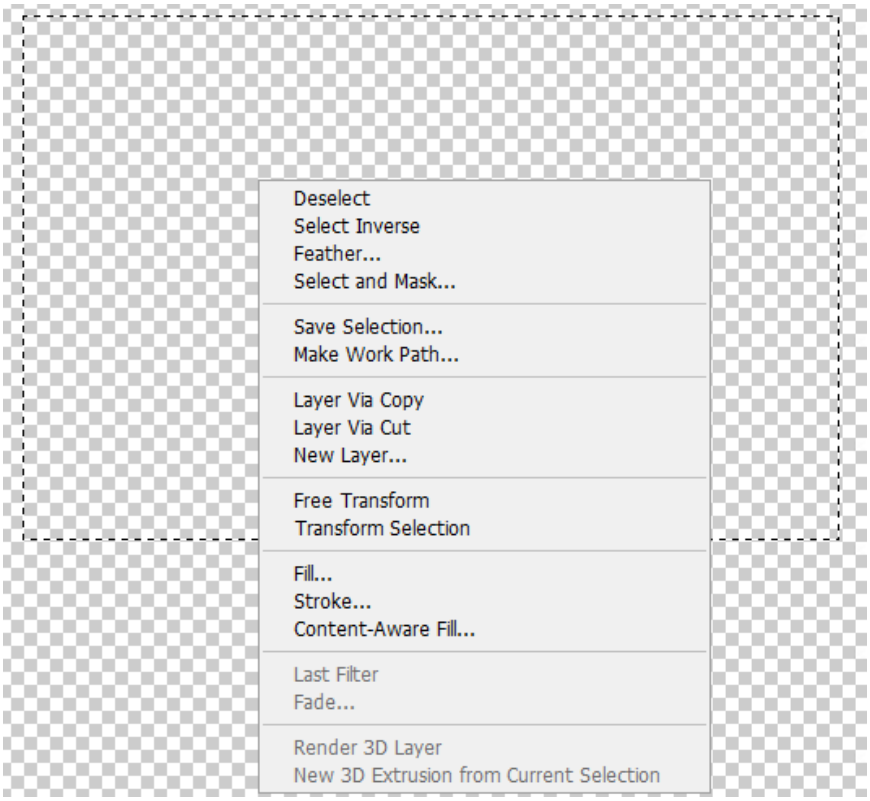
1. Open PS.
2. Select the “*Rectangle Marquee Tool” (RMT)* on the left-hand toolbar.
    a. The following techniques can be applied to any of the Marquee tools, including a free-hand shape.



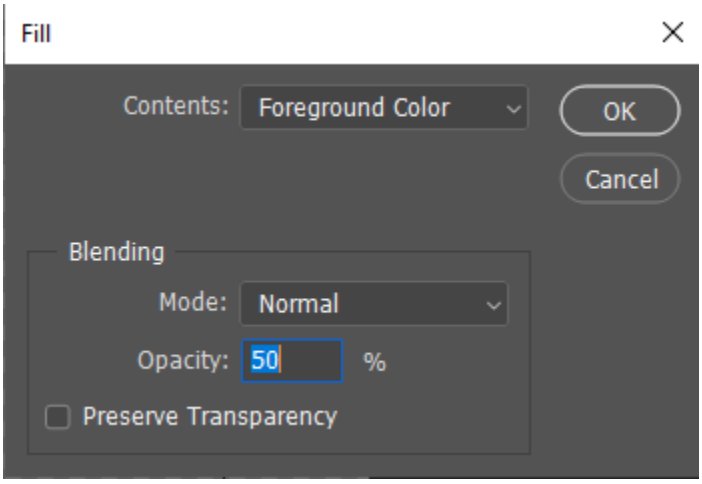
3. Draw a rectangle to whatever dimensions are desired.

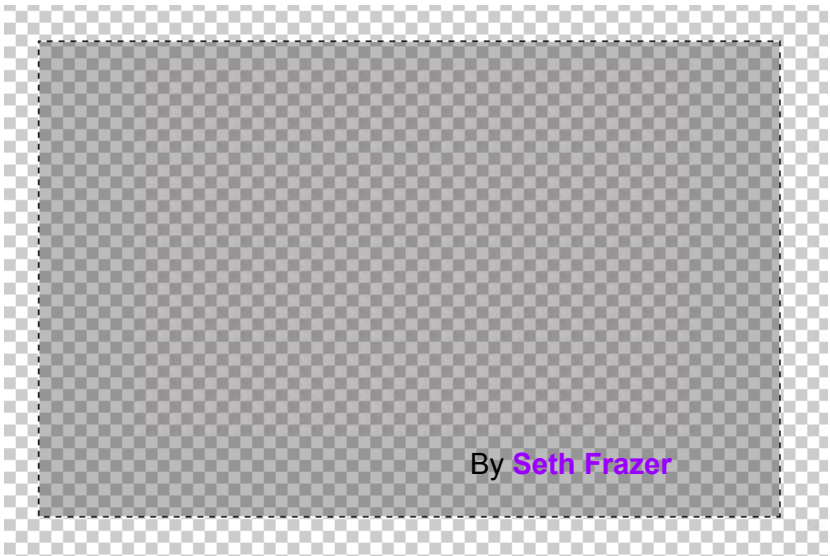


4. Right-click your newly created rectangle and select "*Fill"*
    a. Before doing this, make sure your "*Foreground Color"* is set to Black.

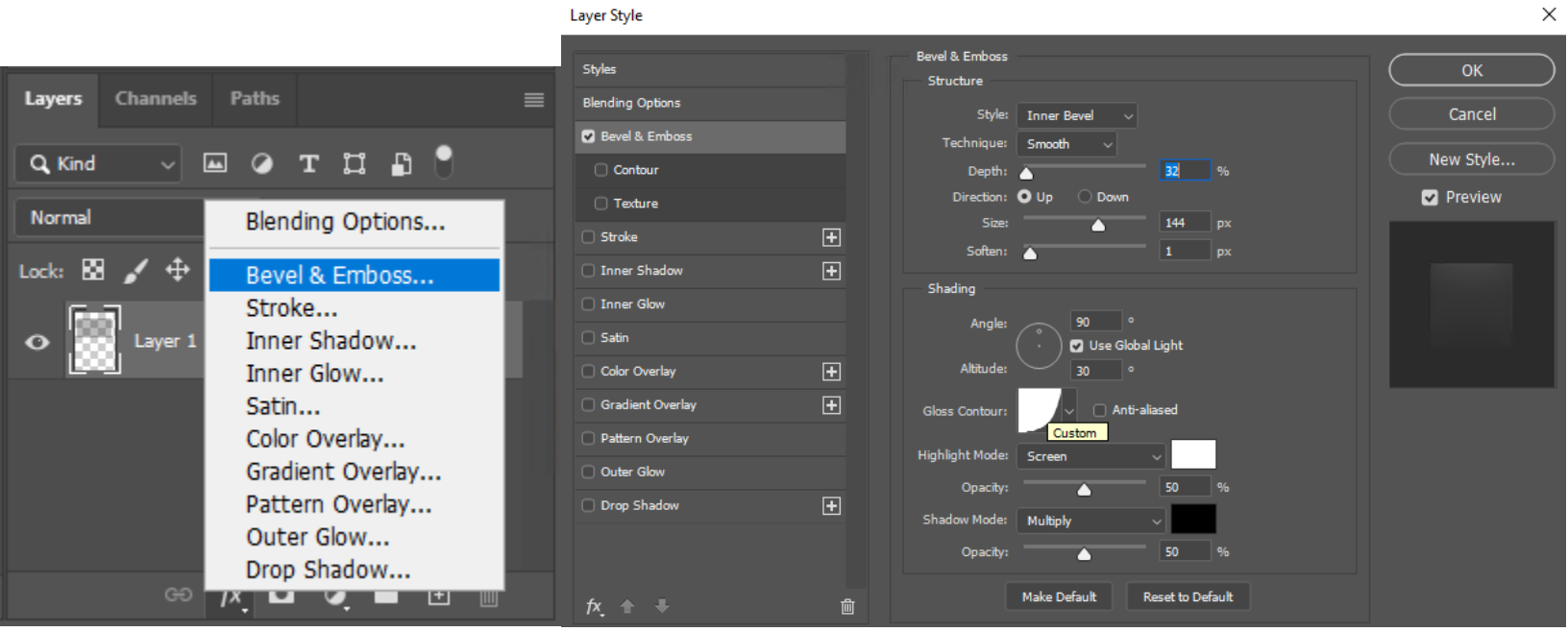


5. In the "*Fill"* window, select "*Foreground Color"* in the "*Contents:"* drop-down menu.
    a. Also, set "*Mode"* to "*Normal"* and "*Opacity"* to **50-55%**
    b. Select "*OK"* when finished.

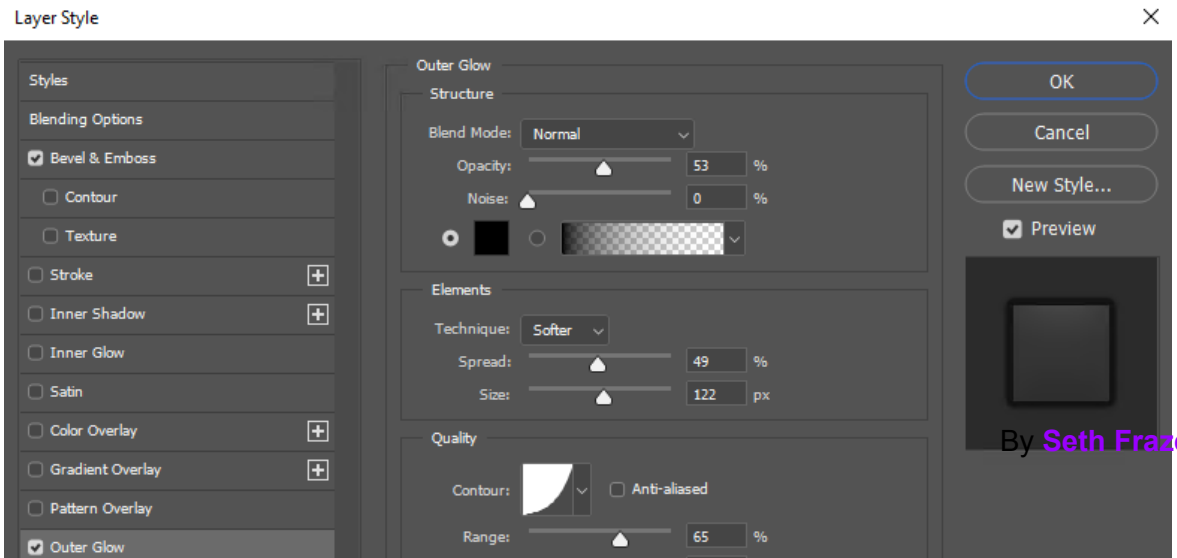


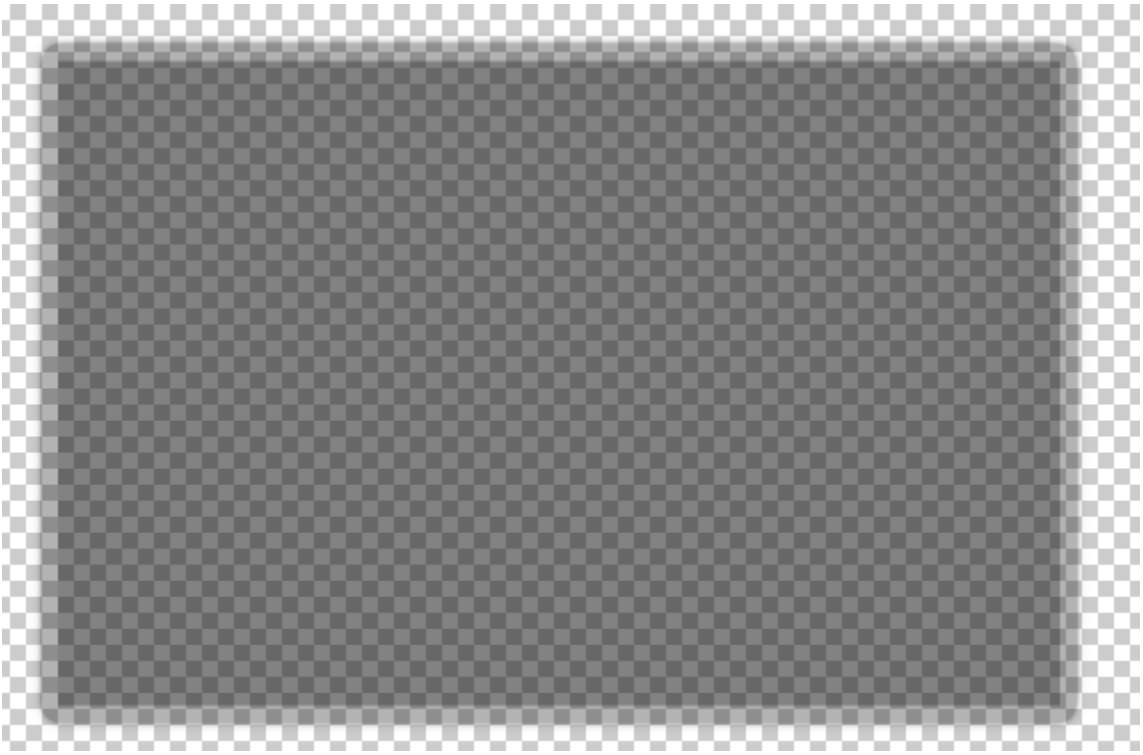


6. Navigate to the "*Layers"* window and select the "*fx"* drop-down menu.
    a. From here, select "*Bevel & Emboss"* and adjust your settings similar to what I have provided in the example box below…
    b. **NOTE** - Don't forget to adjust the *"Gloss Contour"* so that the graph is shaped like a parabola

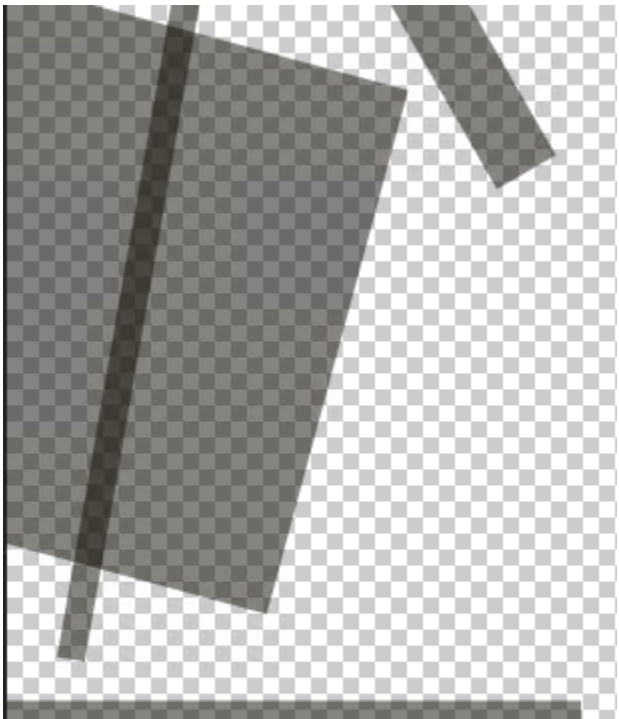


7. In the "*L*ayer Style" window select the "*Inner Glow"* tab and adjust the settings similar to what I have provided in the example box below…
    a. Again, make sure to adjust the "*Contour*" graph to a parabola shape, this will provide a more natural fade/softer fade to the shadow.



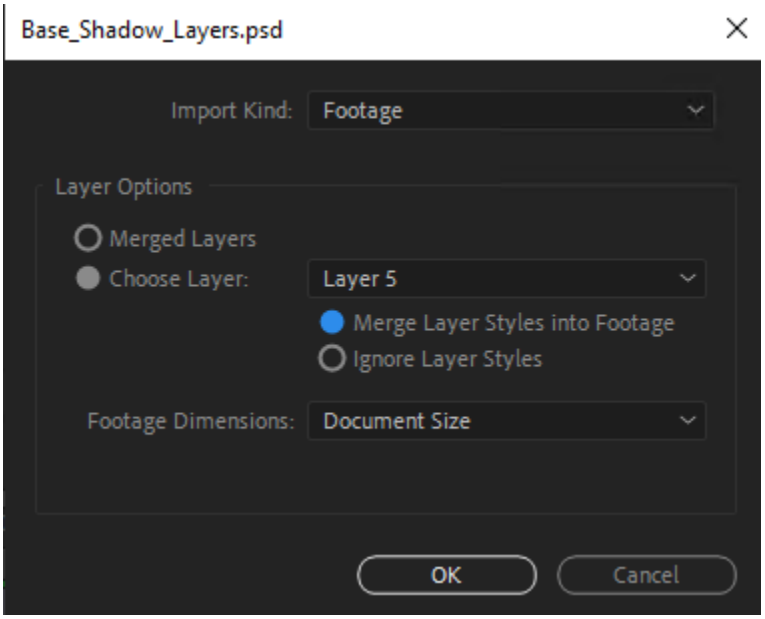


8. Now that the shadow is completed, rinse and repeat the steps above until you have all the shadows you desire.
    a. It’s recommended that you either do each shadow in a separate layer, or in a separate PSD document.



Section 2 - Using AEE to Randomize Position & Orientation of Shadows

1. Open AEE.
2. Create a new composition with the same parameters as recommended//used during the lizard animation process.
3. Import//”*Drag-and-Drop”* each “Shadow” object you intend to use in your batch processing to the composition.
    a. If you decide to make several shadows on a single PS file, you will need to individually import each layer and select “*Merge Layer Styles into Footage”.*



4. Navigate to each layer's “*Transform”* tab near the bottom timeline.
5. Right-click the first layer’s “*Postion”* tab and select “*Edit Expression”.*
    a. Enter the following code into the expression window on the timeline to the right…

```
x = random(-2500, 8412);
y = random(-2500,8360);
z = random(0,0);

[x,y,z]
```

   b. Repeat for the remaining shadow object layers.
6. Right-click on the first layer's "*Orientation"* tab and select "*Edit Expression".*
   a. Enter the following code into the expression window on the timeline to the right…

```
x = random(0,360);

[x]
```

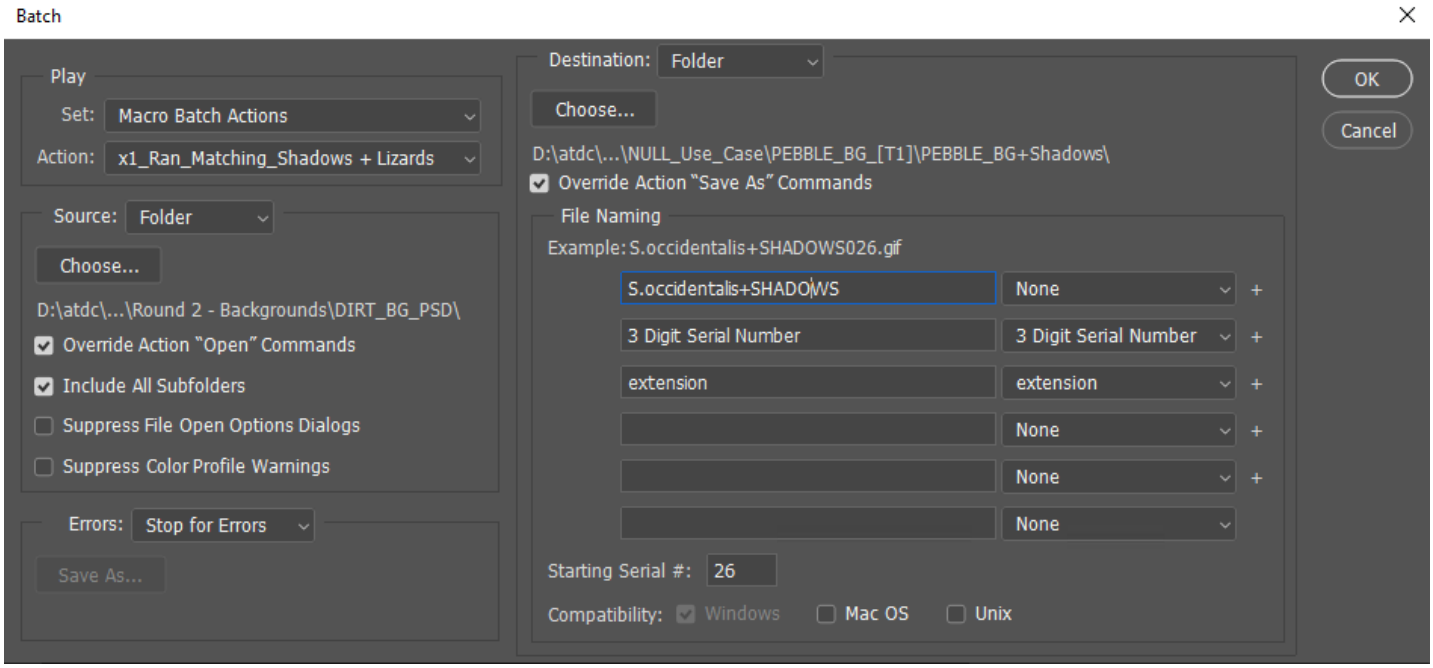
   b. Repeat for the remaining shadow object layers.
7. Navigate to the "*Add to Queue"* as done previously.
   a. For questions regarding the recommended setting for "*Render Setting"* and *"Output Module"* refer to the "*Round 1 - AEE HFS Animation"* section covered previously.
   b. With regards to "*Output To"*, it's highly recommended that you save these PNG sequences in a subfolder with whatever naming convention you are comfortable with.

Section 3 - Using PS to Randomly Match HFS-ATD to Shadows (+Matching Null BG's to Shadows)

*****NOTE - This section is nearly identical in approach to "*Section 3"* of "*Macro-Batch Round 2"*, however it utilizes a different set of macro-batch actions to achieve the "randomized matching".**

1. Open Adobe Photoshop.
2. Create a "*New Document"* with the dimensions equal to that of the size you've been consistently using for your images thus far.
   a. Ex. - 4912 x 7360
   b. Additionally, make sure that you select the "*Transparent"* option in the "*Background Contents"* drop-down menu.
3. Drag-and-drop all of the shadow layers you wish to use for the base PSB document into the center of the document.
   a. NOTE - You will have to push your "*Enter"* key as many times as the number of layers you are importing into the document. [THIS WILL TAKE A SIGNIFICANT TIME TO LOAD]
      i. Ex. Load 100 Layers = Push the Enter Key 100 Times
4. Once all layers have been loaded into the document, *"Save"* the document as a "*.psb"* file and title it as you see fit.
   a. For example, we titled our document *"Ran_Match_Shadows".*
5. As explained previously, navigate to the "*Automate→Batch"* window and select "1x*_Ran_Matching_Shadows"* from the *"Action:"* drop-down menu.

a. The approach to how many files you want to add/match shadows to is entirely up to the individual discretion of you and your team. We recommend that if you intend to subsample from your existing data, you should create a subfolder within "*Round 2 - Backgrounds"* for each species titled "*Species Name_ShadowMB_Copies"* and copy all the existing files you wish to subsample into said folder.
b. In the same window, set the MB "*Destination"* to the "*Round 3 - Shadows"* subfolder under the respective species' file directory.
c. As far as naming convention is concerned, this is also up to your team.
    i. For our use case we chose the naming convention "*Species Name + Shadows".*
    ii. However, one may wish to instead process sub-macro batch sets by species and background type, "*Species Name_Background Type + Shadows"'*
d. For any further clarification on naming convention, refer to the example window provided below, and **repeat this process with the same macro batch action for EACH SPECIES AND BACKGROUND TYPE EXCLUDING *"NULL_PEBBLE_BG"***

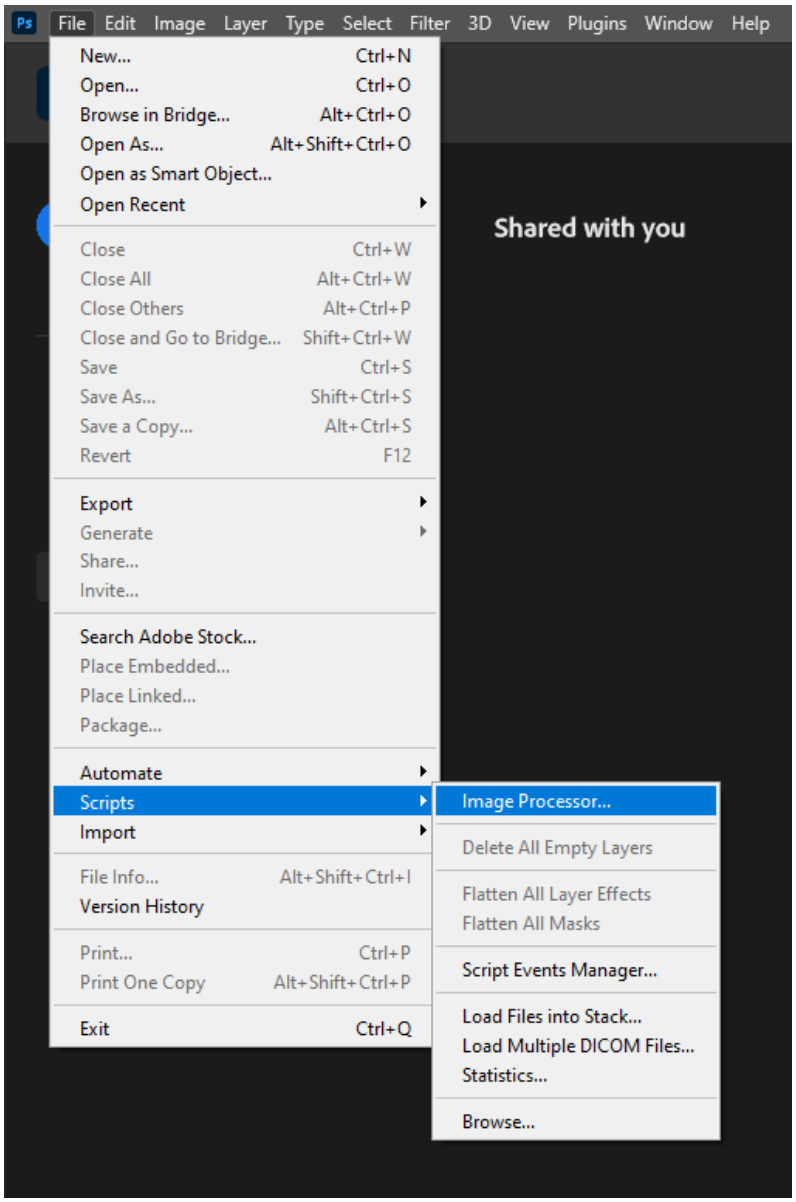


6. ***[IMPORTANT] - For the "NULL_PEBBLE_BG" files you will need to process them using the "1x_Ran_Matching_PEBBLE_BG + Shadows" action provided to you.***

-Using Photoshop "*Image Processor*" to Resize and Convert Completed ATD to JPGs -

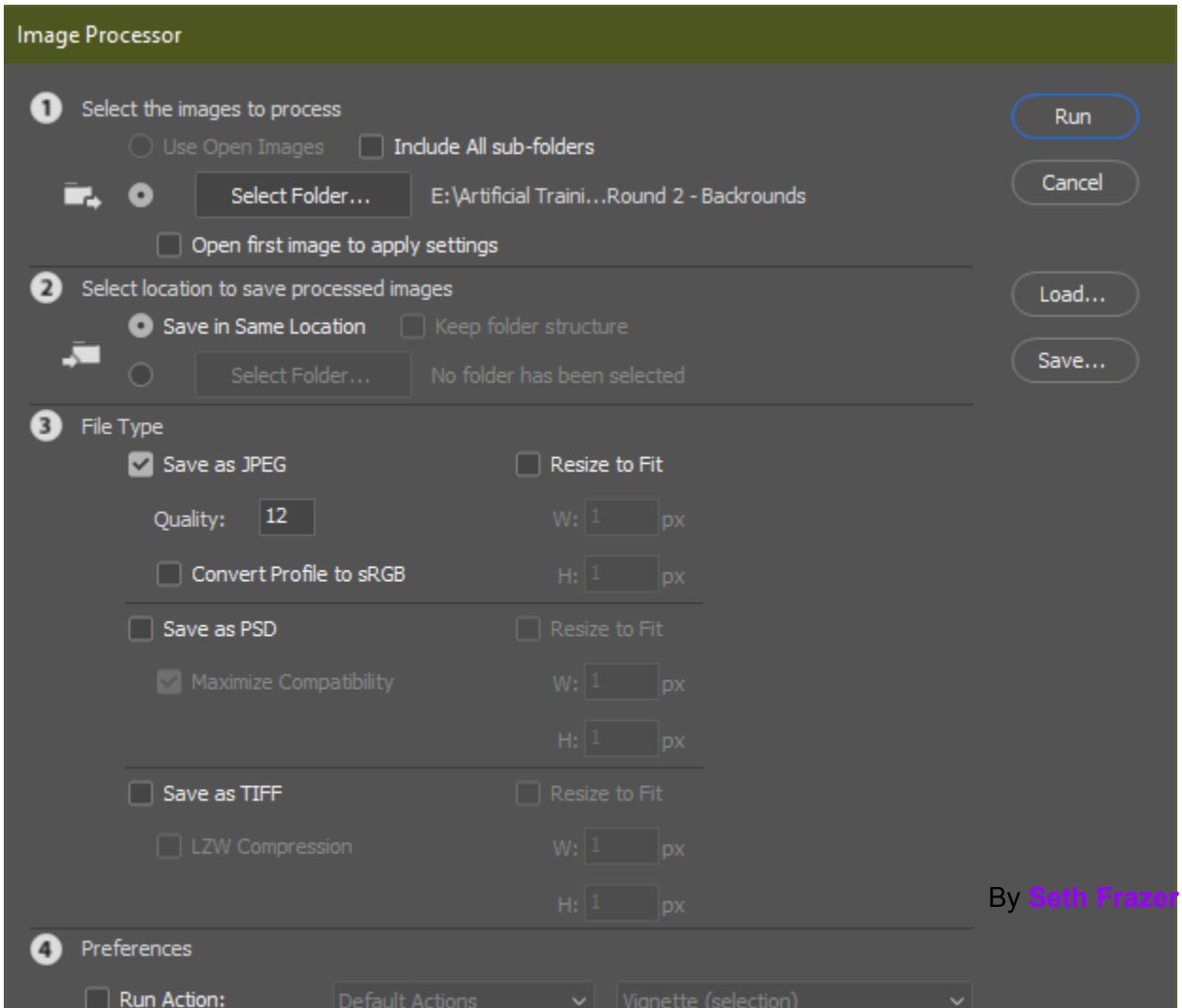
*****NOTE - There is an automatically built in JPG conversion built in to both "*Round 2*" and "*Round 3*" processing. This method is meant to be used in cases of converting "*Null_BGs*" from PS to JPEG files before uploading them to the Google Cloud Platform (GCP).**
OR you can use this as a method of resizing already existing JPG files (of any output step) to the desired (Width x Height) pixels before uploading to GCP.***

1. Open Adobe Photoshop.
2. Navigate to the *File→Scripts→Image Processor* tab.



By **Seth Frazer**

3. In the *"Image Processor"* window…
    a. Select the folder(s) you wish to process into JPEGS
        i. Note - The originals will remain following the processing, so no need to worry about backing-up the PS files.
        ii. You may also choose to select "*Include All sub-folders",* which is highly recommended for time-saving purposes if you're converting several folders within one larger folder.
    b. Select the location to save the processed images.
        i. This is up to the individual, however we recommend saving the files in the same location as the original files as they will automatically be saved into a subfolder labeled "*JPEGs"* (which you can modify later at your leisure).
    c. Select the file type option "*Save as JPEG"*
        i. We recommend saving these JPEGs at the maximum quality of "12".
        ii. You can also select "*Resize to Fit"*, and resize the image to a desired pixel dimension (Width x Height).
    d. Select "*Run",* and wait for all images to be processed.

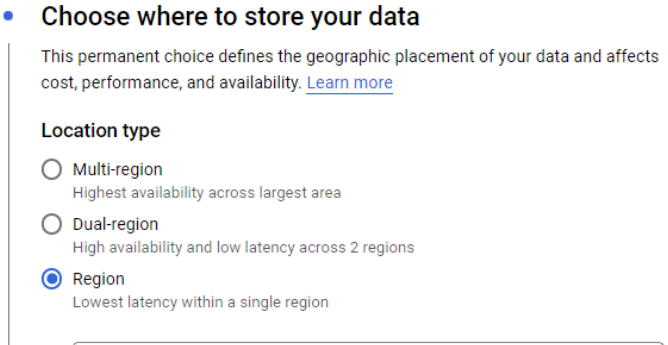


-Using Google Cloud Platform (GCP) Vertex AI For ML Model Creation-

[Using 3Sp. Model As Ex.]

*****We do not create the ML software, we train on the AutoML training method to build our ML Image Classifier Model (Via A Form of Transfer Learning)*****

1. Access Google Cloud Platform, and create a new project.
2. Navigate to the "*Vertex AI"* API by using the search tab.
3. Click-on the "*Datasets"* tab on the left-hand column.
    a. If you haven't already, enable the "*Auto-ML"* API to get started…
4. Select "*Add new data set"*
    a. Provide a name to the data set - *i.e - "3sp_model_dset"*
    b. Select "*Single-Label-Classification"* under "*Model Objectives"*
    c. Click "*Create Dataset"*
5. Under the "*Select Files to Import"* option, click the *"Upload from computer"* option.
    a. Upload a **MINIMUM of 100 images** for **each species** class.
        i. ***For this part, we HIGHLY recommend that you upload the images for a single class in bulk! This will make labeling the training data (TD) for each class much easier.***
        ii. ***Ex. Upload 100 images of S. Occidentalis, and immediately navigate to the "Images" tab to assign those images to a corresponding label of "S_Occi".***
            ***1. To mass label, click the "Select All" box* and then select "Label Images" ….**
        iii. ******Note - You will need to make a label for each species under the "Images"* tab by selecting "Add New Label".**
        iv. *****Note - There should be a generally equal amount of images of each background type for each species.***
    b. If this is your first time uploading files to GCP, you will need to create a "*bucket*" which will act as a storage directory for these files.
        i. After confirming the name of your bucket, change your "Storage Location" setting to a "Single Region" storage, and select the option you desire. (Just remember that all future buckets should be saved in the same region as this first one)



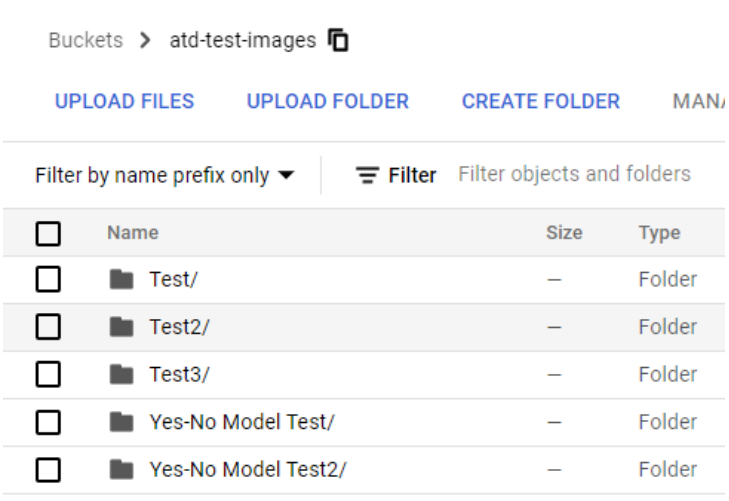
ii. **It’s recommended that you create subfolder directories within this bucket that are at minimum separated by species…**

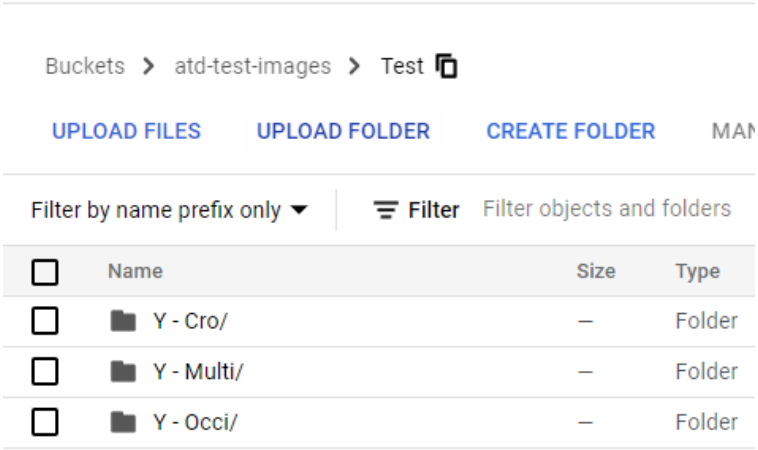
6. Once all the images have been uploaded and labeled select the “*Train New Model”* option in the top right corner of the UI.
    a. Leave the “*Model Training Method”* set to “*AutoML”*.
    b. Under the *“Model Details”* tab, select “*Train new model”/*
        i. In the same tab, name the model and add a description if needed.
    c. In the “*Explainability”* tab, select the “*Generate…bitmaps”* box.
        i. Under the “XRAI” settings, set “*Clip Below”* to 50 AND *“Overlay Type”* to “*Grayscale”.*
    d. Under the “*Compute and Pricing”* tab set the “*Node Budget”* to the desired hours, with a minimum of 15 node hours.
        i. Ensure “*Early Stoppage”* is enabled.

-Setting Up Batch Prediction Processing in Google Cloud Platform Vertex AI-

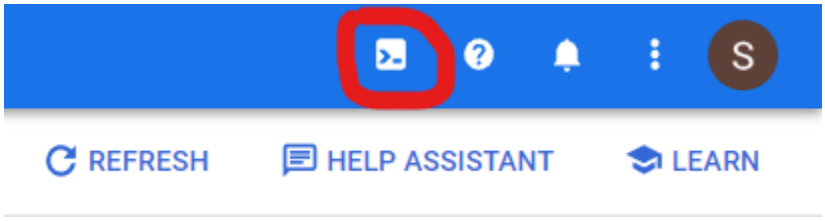
Section 1 - Uploading Test Images & Generating a ‘list.txt’ in Cloud Shell

1. Navigate to the “Cloud Storage” API.
2. Create a new bucket.
    a. This new bucket will be the location for all “real life” test image sets used to test the model.
    b. Ex. “*atd-test-images”*
3. ***It’s highly recommended that you create a subfolder for each test that you choose to run, further subdivided into folders by species. This will make processing the data between tests and species much easier.**

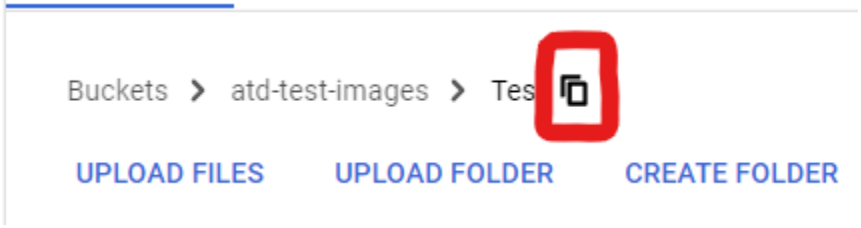




4. According to each folder you create, upload the corresponding images. This can be done by simply dragging and dropping the images into the online folder.
5. Once the images are uploaded navigate to the upper right hand corner of the UI and click on the "Activate Cloud Shell" icon.



6. **Wait for Cloud Shell to boot and enter the following code into the terminal.**
   a. **NOTE - your file directory for the test image sets can be copied from its bucket. Simply click on the 'copy' icon on the directory bar.**



gsutil ls 'gs://YOUR FILE DIRECTORY HERE'> list.txt

[PRESS ENTER]

[THEN TYPE]

cat list.txt

[COPY THE LIST THAT THIS COMMAND GENERATES IN THE TERMINAL]

[PASTE THAT LIST INTO AN ACTUAL .TXT FILE AND SAVE WITH A DESCRIPTIVE NAME]

   b. **IF you decide to make multiple lists in a single Cloud Shell session make sure to iterate the 'list' names within the terminal.**

Ex. Change “gsutil ls 'gs://YOUR FILE DIRECTORY HERE'> list.txt”
To →
“gsutil ls 'gs://YOUR FILE DIRECTORY HERE'> list2.txt”

Section 2 - Formatting and Making a JSONL File From a .TXT

1. Insert the following text on the outside of each file directory name present in the .TXT file.

   {"content":'*INSERT OBJECT DIRECTORY HERE', "mimeType": "image/jpeg"}

   *****This can be accomplished by using the “find and replace” or using “copy and paste”.**

2. Once all objects in the list are formatted, save the document as a JSONL file type.
   a. Ex. save “E.multi_Test_Imgs.txt” as “E_multi_Test_Imgs.jsonl”
3. Take the JSONL file and upload it to the folder containing those images in your cloud Cloud Storage bucket.

Section 3 - Initiating and Processing Data From a Batch Prediction in CMD

1. Navigate to the “*Vertex AI”* API and select the “*Batch Predictions”* tab.
2. Select the “*CREATE”* button.
3. In the batch prediction creation window…

Type a descriptive name for the Batch you are about to run.

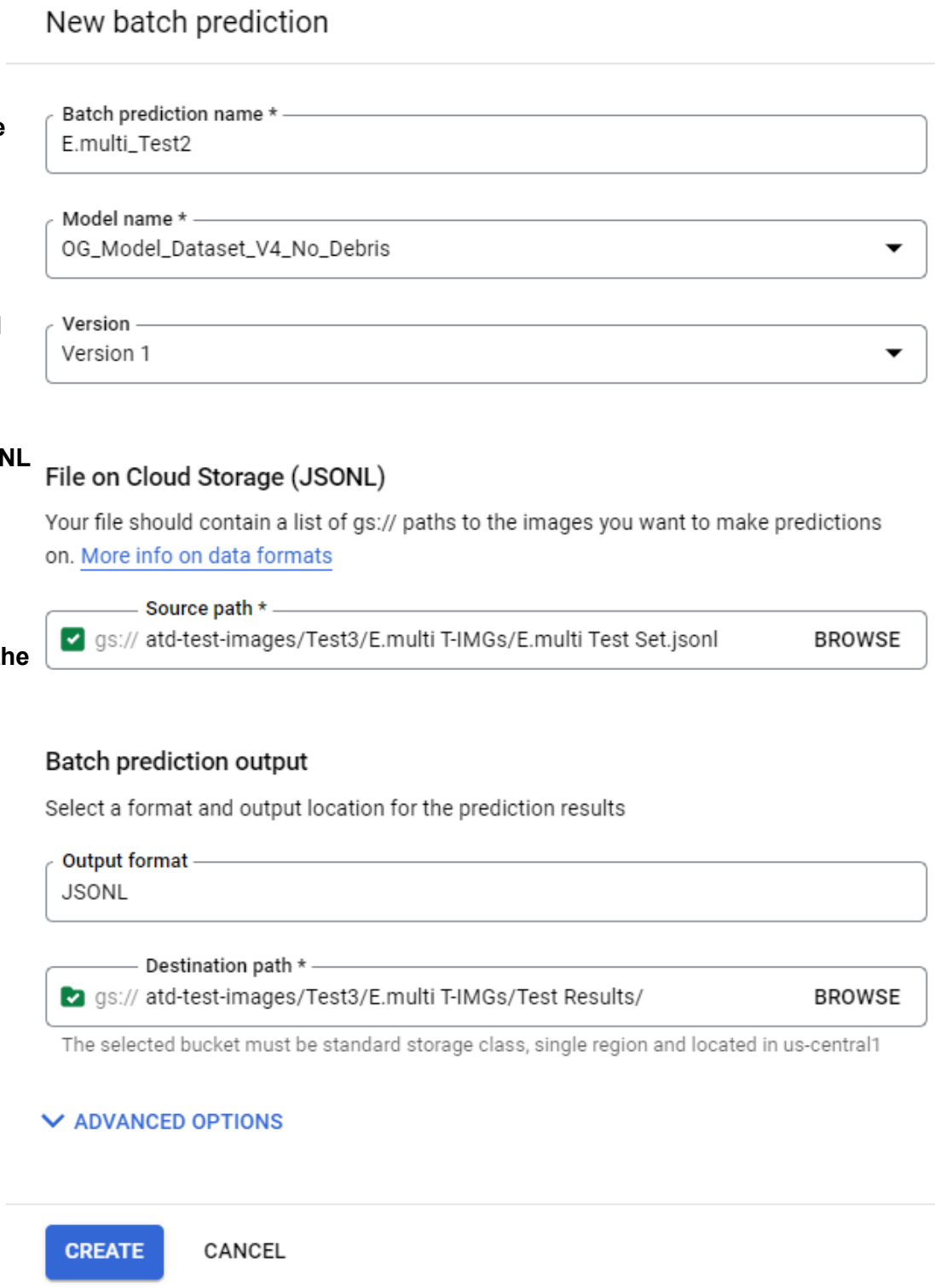
Select the model that you are Testing.

Select the version of the model You wish to use.

Navigate to and select the JSONL File that corresponds with the Test set you wish to process.

Choose a destination path for the JSONL file that the batch Prediction will output.

Select “*CREATE”* and wait…



4. Once the batch processing is complete, you should receive an email. Navigate to the file directory where the results of the batch prediction were saved.
5. Download the JSONL file to your computer.
6. Open and run your computer's CMD as "*Administrator".*
    a. Enter the following code to ensure that you have the proper packages downloaded to run the "*googleparse.py"* script provided to you.

    python3

    pip install pandas
    pip install openpyxl
    pip install et_xmlfile

    b. Once the proper packages are installed, exit out and reboot the CMD. Then enter the following code.
    Ensure that googleparse.py is in the appropriate directory to be accessed by the command prompt

    python3 googleparse.py "INSERT JSONL FILE OUTPUT NAME HERE"

    # You can drag and drop the file into the CMD line to get the absolute directory

    c. This code should output an excel file named "googleparse", which contains the results of your batch prediction partially formatted.
        i. Before running the 'googleparse.py' script on another file, make sure to change the name of the excel file you just created so it doesn't get overwritten…

Section 4 - Formatting Results From a Batch Prediction Excel Sheet

1. Open the excel document generated from the '*googleparse.py*' script.
2. Adjust column size to make data completely visible.
    a. OPTIONAL - Change the accent color of the first column, "displayNames" column and "confidences" column.
3. Enter the following code into adjacent cells to the right of this data.

    Cell 1 - **[Total Correct]** // Cell 2 - **=COUNTIFS(C:C,"CLASS NAME",A:A,"=0")**
    Ex. =COUNTIFS(C:C,"No_Lizard",A:A,"=0")

    Cell 3 - **[Total Tested]** // Cell 4 - **=COUNTIF(A:A,"=0")**

    Cell 5 - **[% Correct]** // Cell 6 - **Simply divide the total correct by total tested.**

4. Do with data what you will.

https://cloud.google.com/ai-platform/prediction/docs/machine-types-online-prediction

https://cloud.google.com/ai-platform/prediction/docs/batch-predict