ReelSmart™ Motion Blur User's Manual

What is ReelSmart Motion Blur?

Automatically add more natural-looking motion blur to a sequence using ReelSmart Motion Blur. Our tracking technology is at the heart of ReelSmart Motion Blur, so there is no handwork involved. Of course you can add as little or as much blurring as you need, and even remove some motion blur. You can even can blur one sequence by using the motion from another for very interesting effects.

To find out more about RE:Vision Effects and our product lines, visit our website at http://www.revisionfx.com and go to our Tutorials / Help section.

ReelSmart Motion Blur (RSMB) is an Autodesk sparks ™ plugin set designed to work with applications that support sparks plug-ins. From RSMB version 4, only Mac and Linux 64b versions are maintained. We also have older version on our website that will support older versions. RSMB comes as 3 plugins: RSMB Desktop, RSMB (Gui+Batch: works as Module and as a Batch Node) AND RSMB + Vectors.

In Version 5, RSMB+Vectors changed how it handles differently inputs due to multiple user requests. This might cause some issues with old projects. Note with sparks you can edit (it's all ASCII) the name in the file and rename the plugin filename as you want. So if you load an old project you will either need to edit it or fix the setup file prior to loading so it loads the old plugin (assuming you have the old plugin).

RSMB Desktop is applied only to reels directly and only supported in Flame and RSMB Gui+Batch works as Module and as a Batch Node.

ReelSmart Motion Blur supports 8, 10,12 bits per pixel processing as well as 16b float Fist we describe optical flow based Motion Blur and at the end the other plugin that allows you to blur an image with a supplied set of motion vectors. The motion vectors are to be authored by you (perhaps with a 3D animation system). The format of the motion vectors will be decribed in the **RSMB + Vectors** section of this manual (as well as on our website with more details).

How ReelSmart Motion Blur (RSMB) works.

> The plug-in calculates the motion between two successive frames in a sequence. It calculates the motion from one frame to the next, and applies per pixel a blur based on the calculated motion. No motion between two frames, no blur. This is useful to understand when trying to figure out why RSMB doesn't apply blur to frames from a 3:2 pulldown sequence or animation done on "2"s, etc.

The plugin expects deinterlaced material. ReelSmart Motion Blur, **SPARKS** should work the same in all Autodesk system products that supports the Sparks api. A particular setup file should be movable around.

The Desktop spark is different. It uses the reel selected and renders a new reel. The Module version (GUI+Batch) allows you to animate the values and as well asks you to select 2 reels: 1) The Color Source 2) For the ALT Motion Source. If you don't have an ALT Motion Source, just select the same reel twice. As long as Motion From Back button is not selected, it will not have any effect.

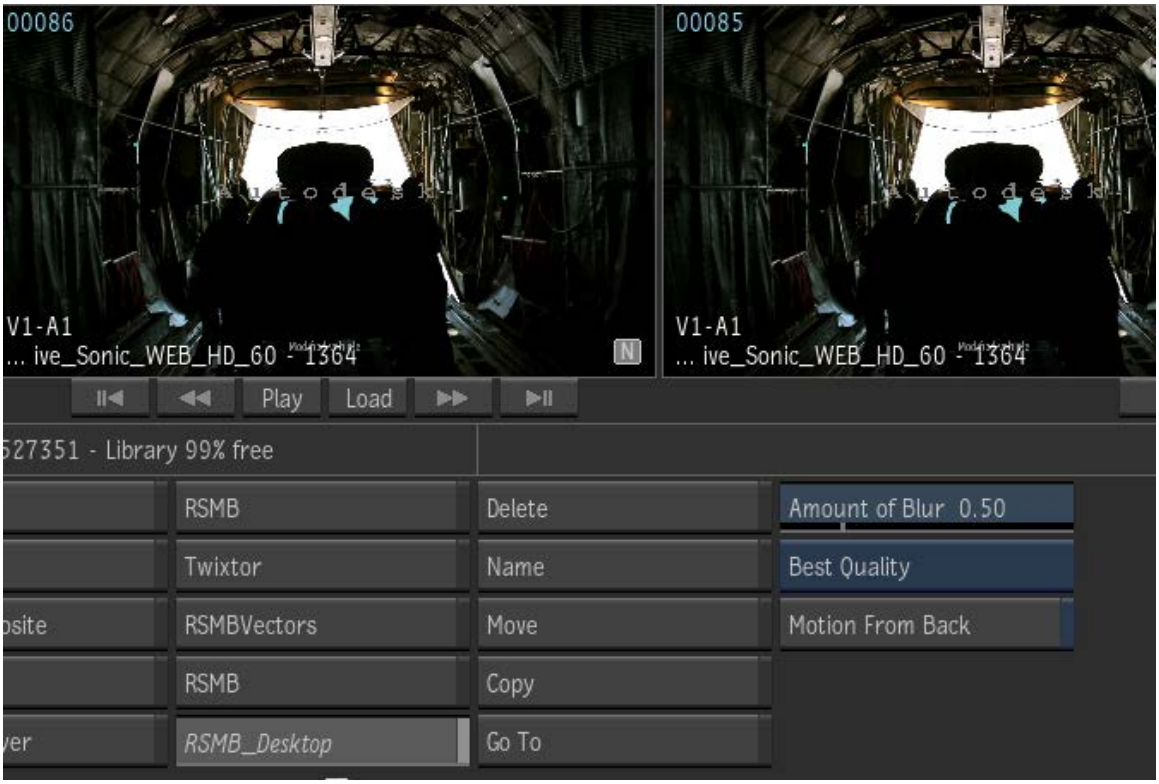
GPU Support

New in version 5, we added the option to run on a GPU. The primary thing to understand is you can work in CPU mode or GPU mode. There is a third option (named "If Available") that is for people who have CPU burn nodes. The results will not be identical due to lower floating point precision on graphics cards. It's not that one is better, it's only to warn you that for something like Twixtor it's a good idea to not mix and match CPU rendered frames and GPU rendered frames in a same sequence. This is particularly important to understand if you use BURN to batch render sequences. And some clients don't have GPU (or useful ones) on their render farms. So this is why there is two GPU options, one that allows you to go fast in interactive session (GPU) but still render on CPU when through Burn.

Processing video sequences on graphic cards has substantially increase in capacity in recent years, so the value of running on GPU will vary a lot with newer cards versus older ones. Also, for users running an older graphics card like the Quadro FX 5800 and similar, you might need to upgrade the driver to a version that at least support OpenCL 1.1.

You will find more info on our website here.

RSMB Desktop



Parameters

Blur Amount: This presents a slider for the amount of blur. 0, means no blur. 1 means blur the "standard" amount (blur using the direction and amount of motion found). You can consider 0.5 as adding 180 deg shutter angle. Of course you may add in as much or as little as desired. To remove a bit of motion blur, you can provide a negative amount of blur. Keep in mind that ReelSmart Motion Blur may not be very effective in imagery that has large amounts of motion blur to start.

TIP: When the sequence being processed has a cut or dissolve embedded, you may want to reduce the motion blur amount (or even set it to zero) during the transition.

Use Motion From: By default a layer's own motion is used to blur the layer. However for effects or technical purposes you might want to use the motion form another clip. On some sequences you might say to yourself, "if only I could enhance the colors used in the tracking process, but then use the colors from the original sequence for the motion blurred sequence." For example, the tracking of **RSMB** does not work particularly well on a low contrast or dark sequence. Or, the reverse, you might have heavily filtered the original , but you think you might get better tracking results by using the original footage as the imagery to be tracked. For these reasons we allow you to change the source that is used for tracking purposes. If Motion From Back is set to "OFF" then the source that **RSMB** is applied to is used for both tracking and the color of the **RSMB** sequence.

However, if Motion From Back clip is specified, then this sequence is used for tracking while the color is still retrieved from the clip that RSMB is applied to. Of course, **RSMB** assumes that both clips line up exactly in time.

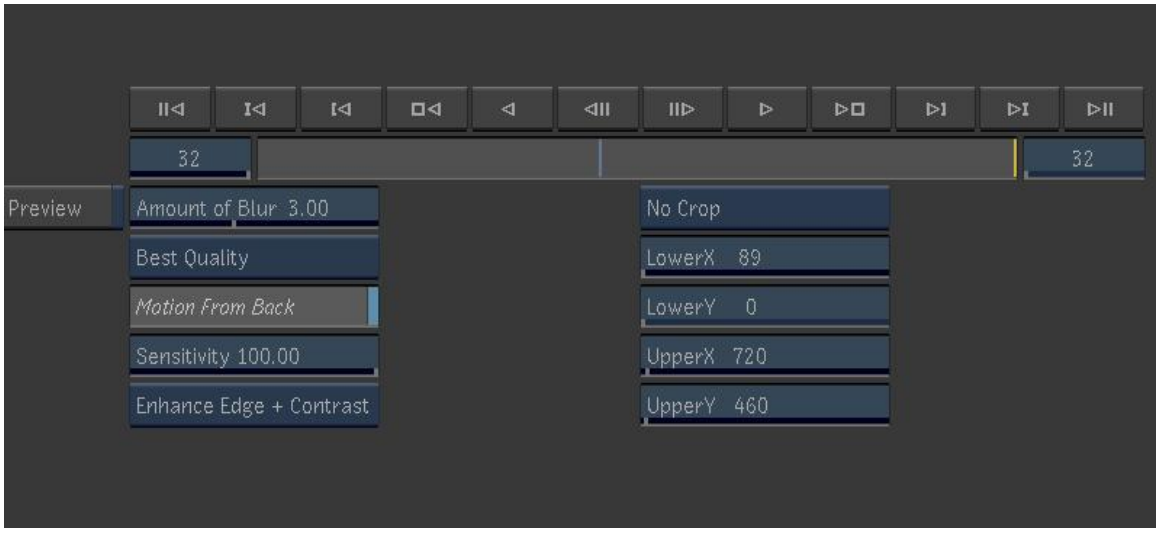
If an alternate motion clip is supplied, then it must have the same pixel dimensions as the color source; otherwise you will receive a message in the GUI.

			
Figure 1	Figure 2	Figure 3	Figure 4

Using an alternate motion source:

- Figure 1: Original low contrast sequence
- Figure 2: Blurred frame using original sequence. The whole image is moving but the low contrast and luminance causes poor performance of **RSMB**'s tracking.
- Figure 3: Image enhanced, but used only for the tracking portion of **RSMB** by specifying it as the Motion Src.
- Figure 4: The original colors in Figure 1 are used for the blurred sequence, but the tracking is performed on a sequence represented by Figure 3. Note that the whole image is blurred as expected.

MODULE MODE (Gui + Batch) Additional Controls



Motion Sensitivity: This is a form of threshold that represents some maximum allowable motion (as in 0 = No Motion, 100 = Max Motion computed). The idea behind this slider is simply to provide an additional scale control on the motion estimation. This proves useful if you have a quick transition in the middle of your clip as you can just animate this down to avoid overblurring it during that segment. Note: The Motion Sensitivity (as defined below) is set to 70% in Desktop mode. You might want to get it up to 100% if you don't see any significant edge problems. It is however often not critical as we are blurring.

With respect to supplying a separate piece of footage to track you might say "I don't have time to experiment with image processing my footage to specify an alternate motion source," or worse, "I try to color correct my footage and it does not help the tracking!" If objects still "gloop" together when they shouldn't, then you can try manipulating the Motion Sensitivity parameter. Motion Sensitivity limits how much pixels can move. A value of zero assures that pixels can't move very much, and a value of 100 allows pixels to move as much as the motion estimator can calculate. The default value of 70 might sometimes be a bit too "ambitious" for some material... by reducing the sensitivity you might be able to create a more satisfactory result where there is large motion rather then some sort of inappropriate swirl that **RSMB** might introduce. Conversely, if there is only one object in the scene and it moves in large amounts, the default value of 70 may not be ambitious enough.

This control is different than the amount of blur that is applied after motion estimation.... Motion Sensitivity actually limits how far pixels are tracked, and the Blur Amt controls how much blur is added based on the tracking.

This setting is most useful when there are passing objects and a background object is blurred too much by the foreground motion. If objects in the foreground and background

pick up each other's motion when they shouldn't then you can try changing the Motion Sensitivity setting to a lower value.

The **Enhance option** : We provide one Enhancing mode tailored to images with low-contrast imagery which is the most common case where RSMB can have misregistration issues sufficient to cause RSMB to perform poorly. Normally the best for Twixtor is that the image be using the whole spectrum so the edges are best defined. You can play with other schemes by creating your own Back image and use the Motion From Back setting.

The **Crop** option: Since some video images can come with a black abyss around the edge, we provide a crop option. The crop is defined by 2 points. the lower point (left, bottom) and the higher point (right, top). The current motion estimation engine does not usually have problems with the black crap at the edges, however if there is a large motion, the black values could end up affecting the result motion blur streak. Setting a Crop Value (and choosing the option **Use Crop**) will provide edge colors mixing instead of black so it will look better.

Special Notes

Autodesk Discreet product line does not support rgba buffers Therefore if you have to apply the effect to the alpha also, you will have to run the effect twice, once on the RGB image and once on the alpha setting that time the RGB image as motion source. In both cases using the same clip as Motion source.

Bug reports

Please report bug reports to techsupport@revisionfx.com.
Ideally send a 5 frames image sequence with a setup so we can recreate your problem.

Updates

Updated and bug fixed versions of ReelSmart Motion Blur may periodically published on the www.revisionfx.com website.

Before You Start, EXTREMELY IMPORTANT.
Common problems discussed here!

For all applications

- **ReelSmart Motion Blur** works most intuitively on progressive material and in image sequences - clips that are specified to be progressive.

  Another note on fields... if you have 3:2 pulldown in your source footage, you will want to **remove 3:2 pulldown** before processing with **RSMB**. If

there is no motion between two frames then there will be no blur. This is useful to know when trying to figure out why RSMB doesn't apply blur to frames from a 3:2 pulldown sequence or animation done on "2"s, etc. \

Potentially Problematic Footage

If you have not used **RSMB** yet, this section might prove to be a little bit esoteric. This information will be of more use to you as you become more familiar with **RSMB** and want to understand how to generate the best possible results.

Much like any tracking techniques, it might happen that **RSMB** might do poorly in specific instances (the technique is motion estimation). The idea here is not to discourage you and tell you it does not work but, rather, to give truth in advertising. As you become an expert user, you learn to predict the kind of material that can cause problems.

1. "Picket Fence": A very regular pattern in motion (for example someone wearing a t-shirt with fine stripes) with an object moving in front of it (e.g. the same person hand for instance) might confuse the motion vector calculation. Any very structured pattern rotating can cause "blind spots" for the analyzer.

2. "Transparency": Overlay of semi-opaque surfaces might create unexpected results. Some cameras for example will streak under fast motion and that can create disappointing tracking results.

3. "Short Interval Defects" : Sudden global illumination change (e.g., a flash), strobing, dust, ... can create unexpected / undesired results. Also, if there is a piece of hair or a scratch on the scanned film for a frame this would influence the tracking so you really should try to clean such defects before processing.

4. "Duplicated Frames": **RSMB** does not provide automatic duplicated frame detection support. As such, you will need to remove duplicated frames before the application of **RSMB**. Also, you should be aware that if your material has 3:2 pulldown you should remove it beforehand. The same applies to animations on 2's. If you leave the duplicate frames (or fields, in the case of 3:2 pulldown) the freeze-frame, inherent in the duplication of the frames, will be stretched (or sped up, as appropriate).

5. "Alternate Motions": When motions going in different direction are layered it is possible that the dominant motion affects (spills into) the background motion.

6. "Specular Highlights": If you have moving lights, e.g., a shiny object that reflects the light as it moves, it might cause problems because when the motion estimator attempts to match two images, as the motion estimator will tend to follow the highlight as if it was an object. (of course, sometimes this is what you want).

7. "Ultra-Fast Structured Motion": We are very particularly perceptive to human actions. We have sometimes seen that certain complex rapid motion such as someone doing a frenetic dance creates interframe displacements that are just too big for our motion estimator to resolve satisfactorily. When planning a shoot for an effect that involves **RSMB** in the pipeline, consider that for **RSMB** fast articulated motion should be easier for front facing subject then sideway views as there will be less pixels traveled per frame on the screen, which is really the only thing that **RSMB** cares about.

9. "Fast Cuts": When blurring footage, **RSMB** does not "see" cuts in your footage. As such, you should work with **RSMB** on each portion of a cut individually. That is, if you apply **RSNB** on some finished footage with fast-cut advertising content or some MTV like action that has dissolves and multi-layered of actions going in and out, it will do something but the result might be more predictable if used on the unprocessed (before doing dissolves...) source elements individually (or you might prefer to animate the Motion Sensitivity in phase with your dissolve).

10. "Occlusions": Problems caused by object motions tend to be one frame problems and localized in an area of the frame which is called an occlusion, which is some pixels that you see on one frame but are not visible on the other as a result of camera and/or that object motion.

11. “Limited Reach”: As a rule of thumb considers that **RSMB** will be most accurate for pixel displacements that are a maximum of 5% of your image resolution (for 720x486, this comes to a maximum horizontal displacement of 35 pixels or so). With displacements larger than that **RSMB** will start to become less precise as it tries to separate motions from one another in an image sequence.

12. "Compression Artifacts": Certain video coding techniques such as DV compressors use 8 by 8 pixels blocks (intraframe) based compression. What this means for you is that if for instance you have a sharp edge that moves, it will switch of 8 by 8 block and therefore locally it's neighbor values will be all different (substantially not like 2-3 values over 255 but sometimes 40 off near an edge). This is why green screen like setups perform badly with DV... Without smoothing the source, this can sometimes certainly create tracking problems. As such you probably should set Motion Src to a slightly gaussian blurred version of the input sequence.

ReelSmart Motion Blur™ using Vectors

ReelSmart (RSMB) Vectors

The ReelSmart Motion Blur "Vectors" **(RSMB Vectors**) plugin blurs images using vector images that you give to it. We advise you to always work with at least 12 bit sources as the Motion Vectors are already pretty compressed within 12 bits. 16 bit float is a bit better.

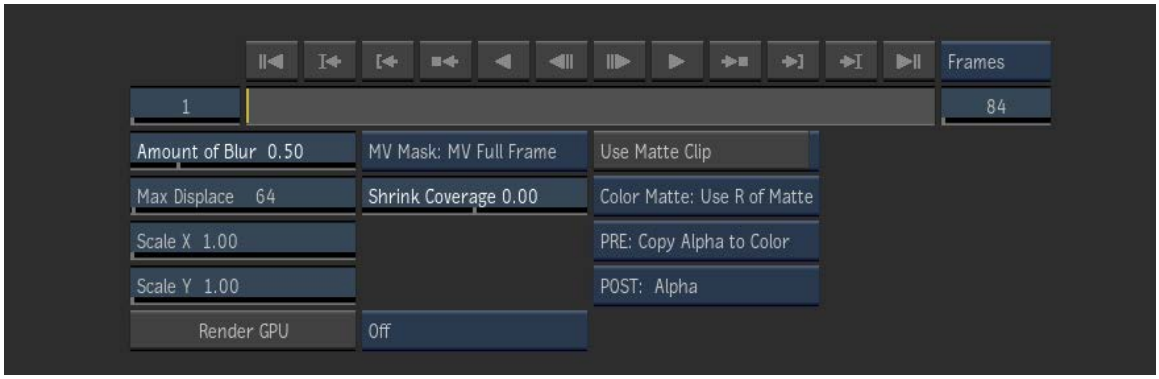
Inputs: This effect since version 5 has 4 input clips: 1) the Color Source; 2) the Motion Vectors and 3) Optional Matte channel and 4) The Motion Vectors Alpha. If you don't need the last two inputs select anything of the same dimension including the first clip.

INPUT 1: Main Color Source (Beauty)

INPUT 2: Motion Vectors pass

INPUT 3: Alpha of Beauty

INPUT 4: Coverage Matte of Motion Vectors pass



The settings of **RSMB Vectors** are:

Blur Amt: The amount to blur. The default of 0.5 corresponds to a 180 degree shutter angle. A negative value removes motion blur (see the regular **RSMB** manual for more info).

Max Displace: The maximum displacement used when you created the motion vector image files (see the above discussion on the file format). (Max Displace is a scale which

is needed to pack motion vectors into 16 bits per channel of data, internally we are passed by discreet systems 12 bits per channel which we simply rescale to a -1 to 1 range and then apply MaxDisplace amount to. That value is typically the same that was used in a shader in a 3D system to generate the motion vectors in the first place).

Vec Scale X, Vec Scale Y: Used to scale the motion vectors internally once they've been converted to floating point. Note: a -1 value for Vec Scale Y can correct for the Y component of your motion vectors pointing in the incorrect direction.

MV Mask: We need to know the region of the image that has valid motion vectors data. Since discreet systems maintain 3 channels images, and the Motion Vector Coverage Mask is usually stored in the alpha channel of the Alpha Channel. This menu tells us where that Coverage mask/alpha channel is. FULL ignores the MV Mask.

MV Shrink: You can bring this value down to shrink the motion vectors edges to help avoid edge artifacts.

Use Matte Clip: If you turn this button on then we will use the matte clip (parameters below it).

Color Matte: This tells us from which channel the matte comes from. In this version single channel alpha are not yet supported.

Pre and Post MB: Since we don't know if your input clip is premultiplied or not and we process everything here assuming premultiplied images, you will need to select if the source is premultiplied or not. If it is premultiplied already you simply set this menu to "Copy Alpha" else you select "Non Premult to Premult". It should be obvious as you will then get crap or not on the edges. Then you have 3 render output options: 1) to output the alpha channel motion blurred as a separate clip 2) to render over the source but using the matte channel as alpha of the Color source 3) to render over black. So if you want to defer compositing to later, you will need to render twice, that is render an additional pass to get an alpha/matte render.

Motion Vector Format

In this section we describe our motion vector format. On our website you will find in the FAQ section many relevant document. For users of a 3D rendering system, please consult : http://revisionfx.com/support/faqs/generalfaqs/motion_vectors/

We assume that X is positive going from left to right. And the positivie Y designates motion going UP (which is the opposite of After Effect's coordinate system, for example).

We assume that X,Y vector information is encoded in the red and green channels of the image. In addition we assume the vector information has been normalized so that both X and Y range from -1 to 1, presumably using some constant value to divide the X and Y component values. We'll call this normalization value the Max Displace value.

In 8 bits per channel, we assume that -1 corresponds to pixel value of 0 and that +1 corresponds to 254. We have chosen to mapp (-1,+1) to (0,254) because with this scheme we can represent a 0 displacement with a pixel value of 127 (in a scheme that maps (-1,+1) to (0, 255), a 0 displacement value corresponds to pixel value of 127.5, which cannot be represented exactly).

So you can convert floating point motion vectors X,Y to 8 bit red,green values with the following pseudo-code:

- // We wish to map (-MaxDisplace, +MaxDisplace) to (0,254)

  //First, map (-MaxDisplace to +MaxDisplace) to (0, 1)
  float fred = ((x/MaxDisplace)+1)*0.5;

  /* clamp values if needed */
  if (fred<0) fred = 0;
  if (fred>1) fred = 1;

  /* assign pixel value */
  unsigned char red = fred*254.0 + 0.5; /* rounding is preferred to truncation, but this is your choice */

- float fgreen = ((y/MaxDisplace)+1)*0.5;
  if (fgreen<0) fgreen = 0;
  if (fgreen>1) fgreen = 1;
  unsigned char green = fgreen*254.0 + 0.5; /* rounding is preferred to truncation, but that's your choice */

HOWEVER, it is not advised to use 8 bits per channel to store your motion vectors. We highly recommend using 16 bits per channel capabilities. In 16 bpc, you should map (-MaxDisplace,+MaxDispalce) to (0, 65534) (note: the maximum is 64434 and not 65535). When saving 16 bits per channel the formulae become:

- // First, map -MaxDisplace to MaxDisplace to 0 to 1
  float fred = ((x/MaxDisplace)+1)*0.5;

  /* clamp values if needed */
  if (fred<0) fred = 0;
  if (fred>1) fred = 1;

  /* assign pixel value */
  unsigned short red = fred*65534.0 + 0.5; /* rounding is preferred to truncation, but that's your choice */

- float fgreen = ((y/MaxDisplace)+1)*0.5;
  if (fgreen<0) fgreen = 0;
  if (fgreen>1) fgreen = 1;
  unsigned short green = fgreen*65534.0+0.5.

The blue channel is ignored.

IMPORTANT: Alpha Channel Info.
RSMB Vectors assumes that the vector information at a particular pixel is not valid if the the alpha

channel **in the motion vector image** is less than full-on at a particular pixel. Note that transparent source imagery (not motion vector imagery) will be blurred properly, because the alpha for the color source is independent of the alpha for the motion vector image sequence.

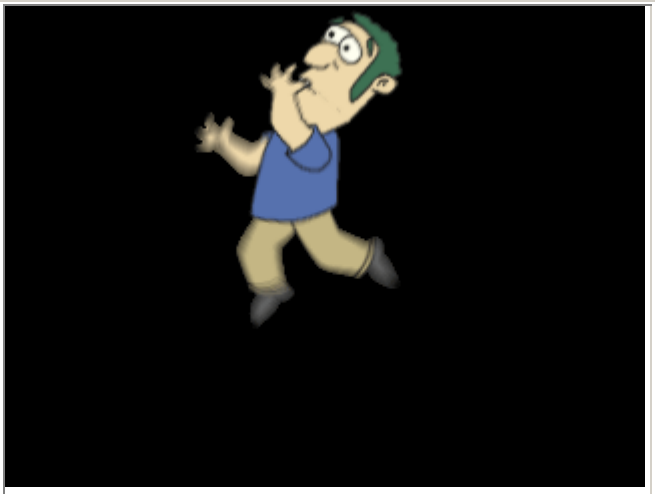
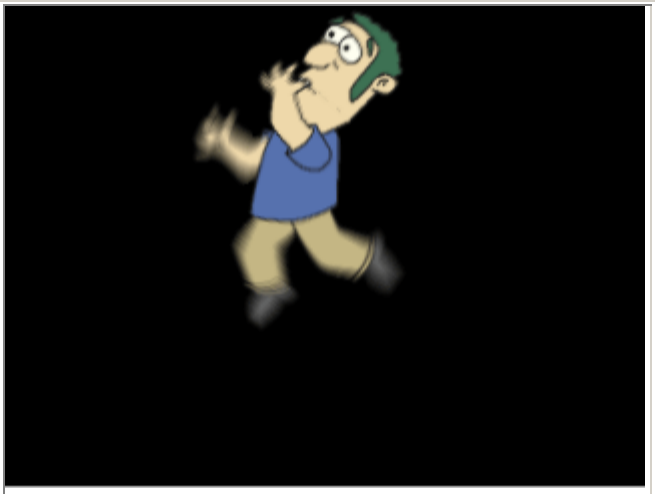
It is important to set the alpha to full-on values for the motion vector images where motion vectors are known to be valid. Areas of the motion vector image where the motion vectors are not known (or are known to be bad) should have alpha set to zero or any value other than full-on. It is imporant to categorize each pixel in the motion vector file as good or bad for **RSMB Vectors** to work properly. For example, when rendering vectors from a 3D animation system it is useful to set the alpha channel to the same alpha channel that is used for compositing the element.

For example, lets say we have the following image created from an animation system.

Examples of incorrect and correct setup of motion vector files for use in **RSMB Vectors**.

Incorrect Motion Vector creation: Areas of unknown motion vector data set to (0,0) displacement.

Correct Motion Vector creation: **Alpha** of areas of unknown vector data set to 0.

	
Animation blurred with motion vector image above. Areas with (0,0) displacement do not get blurred. As such, notice the harsh edges around the hand and right foot.	Animation blurred with vector file above. Areas where the vector information not known are now blurred appropriately.

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