

# *Tux Paint “Magic” Tool Plug-in API*

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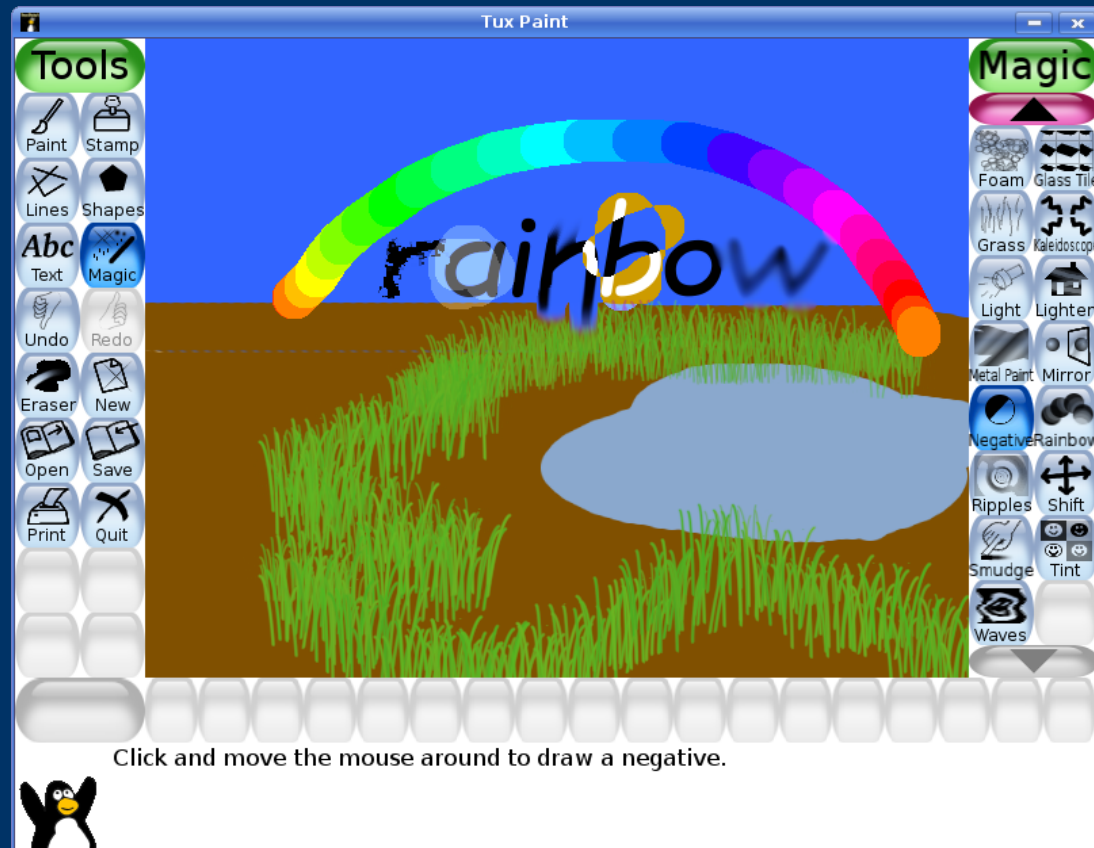
# What is Tux Paint?

- Drawing software
- For kids age 3yrs & up
- Open Source
- Linux/Windows/Mac
- Written in C
- Based on libSDL
- 2000+ downloads/day
- Too many lines of code :)



# What are “Magic” Tools?

- Special drawing tools
  - Rainbow
  - Bricks
  - Grass
- Effect-applying tools
  - Blur
  - Smudge
  - Tint
- Full-image effects
  - Mirror
  - Flip



# *Why a Plug-in API?*

- Tux Paint is a *lot* of code
- “Magic” tools were entrenched
- Had to rebuild all of Tux Paint to create & test new effects
- Making it easy makes it more fun & accessible!
- *More people will be able to contribute!*

*(Idea came to me after a double-shot mocha, while biking to work...  
It was just a 'sick joke' at first.  
But here we are!)*

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# *What you need to know*

## *(or will learn by doing)*

- C programming language
- Simple DirectMedia Layer library
- Pointers
- Callbacks
- Event-driven programming
- Graphics programming

Current API was designed around what all of the  
“Magic” tools in Tux Paint version 0.9.17  
needed...

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# *How Plug-ins Get Into Tux Paint*

## *(on Linux, as an example)*

- Compile the plugins as a shared object:  
`gcc -shared {...} -o my_plugin.so`
  - Put it where Tux Paint expects to find it:  
`/usr/lib/tuxpaint/plugins/`
  - Tux Paint scans that directory for `.so` files.
  - Object files are opened, and checked for all the functions Tux Paint expects you to have written:  
`my_plugin_init()`  
`my_plugin_getname()`  
`my_plugin_click()`  
*etc.*
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# Sequence of Events

- Tux Paint calls some functions you'll have written:
  - “Are you compatible with this API version?”
  - “Initialize!”  
*(load your icons, sounds, any other data)*
  - “How many tools do you have?”  
*(Plug-ins can include more than one tool; each will appear as a separate “Magic” tool)*
  - For each tool the plug-in includes, the plug-in is asked:
    - “What's the tool's name?” (for the button)
    - “Give me your icon” (for the button)
    - “What's the tool's description?” (for Tux penguin to say)
    - “Do you support colors?”  
*(e.g., 'Blur' and 'Smudge' do not, but 'Bricks' and 'Grass' do)*

# All loaded, time to draw!

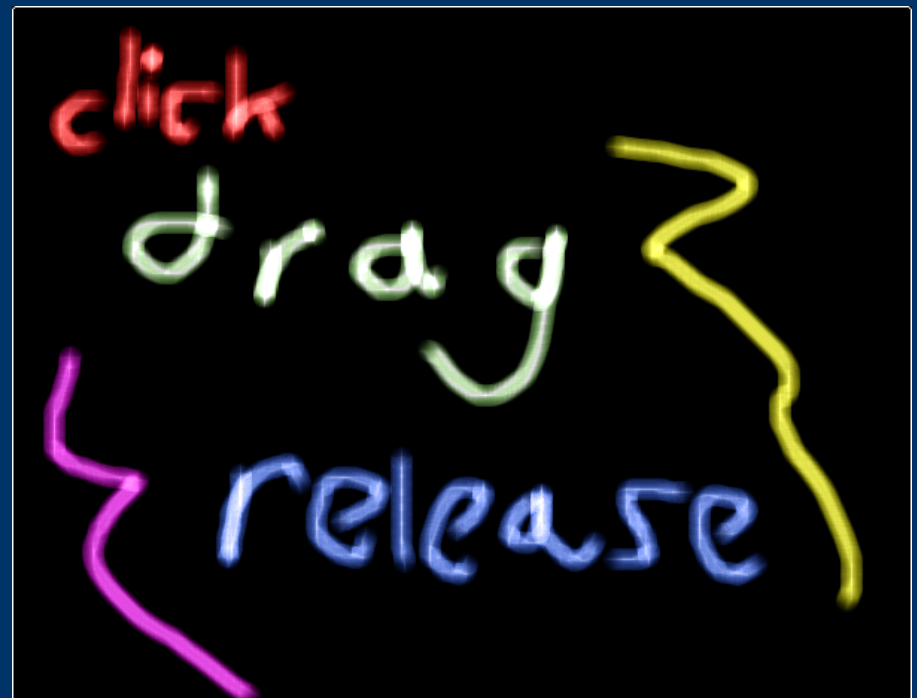
- Click the “Magic” button under “Tools”
- The bar on the right will show buttons for each tool, including name and icon
- Click a “Magic” tool's icon on the right to activate it
- The tool's description is shown at the bottom, next to Tux the penguin
- The tool is informed of the current color (if applicable)
- ... *and now we wait!*





# Events to Expect

- Color choice changes
- Clicks
- Drags
- Releases
- ... *that's all, folks!*  
(for now)



# Dealing with Events

Your functions...

*(named after your plug-in, to avoid namespace collisions):*

- `foo_set_color()`
- `foo_click()`
- `foo_drag()`
- `foo_release()`

...accept various arguments from TP, including:

- Pointer to a “Magic” tool API structure
  - Which of the plug-in's tools is being utilized
  - Snapshot of canvas prior to the last click
  - Current canvas (where you draw)
  - Old and New X & Y coordinates
  - An “update rectangle” structure, to tell Tux Paint what part of the canvas was just updated
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# “Magic” Tool API Structure

- Most of your functions are sent a pointer to the “`tp_magic_api`” structure
  - It contains pointers to functions *inside* Tux Paint, as well as some C macros. For example:
    - Get a pixel, put a pixel
    - Scale an entire surface
    - Test whether a coordinate is within a circle  
*(good for effects that want to have a round brush)*
    - Calculate a line  
*(this needs explaining)*
    - Draw the progress bar
    - Convert sRGB to linear & back
    - Convert HSV to RGB and back
    - `min()`, `max()`, `clamp()`
    - Play a sound effect
    - *etc.*
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# *Lines & Callbacks*

## *(I promised I'd explain)*

- Mice move quickly
  - Brush effects need to include everything between two mouse positions, or they'd often be dotted lines
  - You can ask Tux Paint to calculate a line between  $(X_1, Y_1)$  and  $(X_2, Y_2)$
  - Tux Paint will calculate the line, and for each step position between the points, it calls a *callback* function, that you write!
  - For brush-like effects, you usually just call Tux Paint's `line()` inside your `drag()` function. It, in turn, calls whatever function you wrote that actually *does* your effect.
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# Compiling & Installing

- Many Open Source projects include “-config” tools to help you compile & install stuff. (SDL, Gimp, etc.)
  - Tux Paint “Magic” tool API does, too:  
`tp-magic-config`
  - Use grave/backtick ( ` ) on the shell to get what you need:
    - `gcc --shared `tp-magic-config --cflags` \`  
`my_plugin.c -o my_plugin.so`
    - `sudo cp my_plugin.so \`  
``tp-magic-config --pluginprefix``
    - `sudo cp my_plugin_icon.png \`  
``tp-magic-config --dataprefix` /images/magic`
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# *Example Code (“ex”) Plug-in*

```
// So we recognize TP's Magic API
#include "tp_magic_api.h"

// For loading our PNG icon
#include "SDL_image.h"

// For loading our sound effect
#include "SDL_mixer.h"

// Place to hold sound effect:
Mix_Chunk * snd_effect;

// Place to hold current color
Uint8 ex_r, ex_g, ex_b;
```

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# *Example Code (“ex”) Plug-in*

```
// Tell Tux Paint which plug-in API we were
// built against. (We pick up the value
// as a #define from "tp_magic_api.h")
Uint32 ex_api_version(void)
{
    return (TP_MAGIC_API_VERSION);
}

// Our initialization routine.
// Just load our sfx from TP's data folder:
int ex_init(magic_api * api)
{
    char fname[1024];
    sprintf(fname, "%s/sounds/magic/ex.wav",
           api->data_directory);
    snd_effect = Mix_LoadWAV(fname);
    return(snd_effect != NULL); // Success?
}
```

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# Example Code (“ex”) Plug-in

```
// Tell Tux Paint we have but one tool:
int ex_get_tool_count(magic_api * api)
{
    return(1);
}

// Load our tool's icon and give to Tux Paint:
// Note: We only have one tool, so are assured
// that 'which' will always be '0' (zero)
SDL_Surface * ex_get_icon(magic_api * api,
                          int which)
{
    char fname[1024];
    sprintf(fname, "%s/images/magic/ex.png",
            api->data_directory);
    return(IMG_Load(fname)); // Return the icon!
}
```

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# *Example Code (“ex”) Plug-in*

```
// Give Tux Paint our tool's name
char * ex_get_name(magic_api * api, int which)
{
    // Copying it (with 'strdup()'), because
    // Tux Paint will free it when the user quits
    return(strdup("Example"));
}

// Give Tux Paint our tool's description
char * ex_get_description(magic_api * api,
                          int which)
{
    // Copying with 'strdup()' here, too
    return(strdup("An example tool!"));
}
```

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# *Example Code (“ex”) Plug-in*

```
// Tell Tux Paint that we utilize colors
// (the color palette below the canvas will
// become/remain active when our tool is used)
int ex_requires_colors(magic_api * api,
                       int which)
{
    return(1); // AKA 'true'
}

// Clean up after ourselves when TP quits:
void ex_shutdown(magic_api * api)
{
    // Release RAM used by our sfx:
    Mix_FreeChunk(snd_effect);
}
```

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# *Example Code (“ex”) Plug-in*

```
// Respond to clicks (mouse button down event)
void ex_click(magic_api * api, int which,
              SDL_Surface * canvas,
              SDL_Surface * snapshot,
              int x, int y,
              SDL_Rect * update_rect)
{
    // Cheating!!! For our effect, a click is
    // the same as a drag, so just send “x,y” as
    // the start and end points:

    ex_drag(api, which, canvas, snapshot,
            x, y, x, y, update_rect);
}
```

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## Example Code (“ex”) Plug-in

```
// Respond to drags (mouse motion events while
// user is clicking)
void ex_drag(magic_api * api, int which,
            SDL_Surface * canvas,
            SDL_Surface * snapshot,
            int ox, int oy, int x, int y,
            SDL_Rect * update_rect)
{
    // Tell Tux Paint to calculate a line between
    // the two points (ox,oy) and (x,y),
    // calling our callback function every step
    api->line((void *) api, which,
            canvas, snapshot,
            ox, oy, x, y, 1, // old, new, step
            ex_line_callback); // our function!

    // there's more...
```

## *Example Code (“ex”) Plug-in*

```
// (after api->line() is called...)

// We'll want to tell Tux Paint what part
// of the canvas changed; let's make sure
// we send top/left and bottom/right:
if (ox > x) { int tmp=ox; ox=x; x=tmp; }
if (oy > y) { int tmp=oy; oy=y; y=tmp; }

// Fill in the (x,y) and (w,h) elements of
// the update rectangle for Tux Paint:
// (Our brush is 9x9, centered around (x,y))
update_rect->x = ox - 4;
update_rect->y = oy - 4;
update_rect->w = (x + 4) - update_rect->x;
update_rect->h = (y + 4) - update_rect->y;

// still a little more...
```

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# Example Code (“ex”) Plug-in

```
// (after update_rect is filled in...)

// Play our sound effect as the user drags
// (and since we call 'ex_drag()' for clicks,
// it plays for single clicks, too!)

api->playsound(snd_effect,
               (x * 255) / canvas->w,
               255);

// What are those values?
// Pan (0=left, 255=right) and
// distance (0=far, 255=near)...
// Tux Paint “Magic” tool sound effects can
// be in stereo!!!
}
```

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# Example Code (“ex”) Plug-in

```
// Respond to releases (mouse button up event)
void ex_release(magic_api * api, int which,
                SDL_Surface * canvas,
                SDL_Surface * snapshot,
                int x, int y,
                SDL_Rect * update_rect)
{} // Noone ever said we had to do anything!

// Accept colors (when tool is first selected,
// or when user picks a different color)
void ex_set_color(magic_api * api,
                  Uint8 r, Uint8 g, Uint8 b)
{
    ex_r = r;
    ex_g = g;
    ex_b = b;
}
```

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## *Example Code (“ex”) Plug-in*

```
// Finally, our own line callback routine.
// It gets called by Tux Paint via api->line(),
// which we invoked in ex_drag().
void ex_line_callback(void * ptr, int which,
                    SDL_Surface * canvas,
                    SDL_Surface * snapshot,
                    int x, int y)
{
    // Need to cast, since we get a void ptr...
    magic_api * api = (magic_api *) ptr;

    // the work happens on the next slide...
```



# Example Code (“ex”) Plug-in

```
// (about to do the line callback work...)

// Quick-and-dirty 9x9 round brush
for (int yy = -4; yy <= 4; yy++)
{
    for (int xx = -4; xx <= 4; xx++)
    {
        if (api->in_circle(xx, yy, 4)) // Round?
        {
            // Ask TP to change the canvas...
            api->putpixel(canvas, x+xx, y+yy,
                // ...to the user's color:
                SDL_MapRGB(canvas->format,
                    ex_r, ex_g, ex_b));
        }
    }
}
}
```

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# *Some Magic Types*

- **click()** only:
    - Full-image effects:
      - Mirror, Flip
  - **click()** and **drag()**:
    - Drawing and effect brushes:
      - Rainbow, Blur, Negative, etc.
    - Full-image effects needing some input:
      - Shift
  - **click()**, **drag()** and **release()**:
    - Multi-step drawing
      - Flower
    - Full-image effects needing input *and* preview:
      - Shift
- 
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# *canvas vs. snapshot*

- **snapshot** is a recording of the drawing canvas when the user first clicked with the “Magic” tool
  - **canvas** is the *live* drawing canvas – your changes go here
  - Sometimes you want to read from **snapshot**  
*(click and scribble with “Negative”, and you negate more of the picture, without un-negating as you drag over the same spot)*
  - Sometimes you want to read from **canvas**, allowing the user to apply more of the effect on the same area without releasing and clicking  
*(click and scribble with “Smudge”, and the pixels smudge around more and more)*
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# *Any more and this'd be overwhelming!*

- Trying to document the API in a human-readable way
- My dream is to have Tux Paint “Magic” tool plug-in API taught to first-time computer graphics programmers (for example, high schoolers!)
- Help is appreciated!

<http://www.tuxpaint.org/>  
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*Thanks!*

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