User Manual – Contents

1. Purpose of this Document

The purpose of this document is to explain the functionality of the project from a user's point-of-view. This manual is intended only for the Softimage|3D implementation of the project. It includes software requirements, installation procedures and instructions on how to use the trueFlock custom effect. Limitations of the tool and some suggestions for achieving better results are also included.

2. Introduction

This project is a custom tool for the Softimage animation system which allows you to easily animate flocks of objects. That is, with minimal effort, you can create an animation which resembles the motion of a flock of birds in nature.

It is believed that flocks of birds do not simply follow a single leader. Rather, it is the collection of every individual bird's decision which creates the pattern. This is what is known as "decentralization". Each bird follows its own set of rules or instincts without regard to what any other particular bird is doing.

Softimage already includes a flocking tool. However, this tool is limited and does not create "real-looking" flocks because it does not attempt to accurately simulate the birds' decentralized behaviours. This project aims to fix these shortcomings and is therefore called "trueFlock".

This project manifests itself as a custom plug-in effect for Softimage. This means you can flock whatever objects or models you choose. You can flock a bunch of bananas, space ships or even create a flock of Ferraris. Your imagination and creativity is the only barrier!

3. Requirements

3.1 Softimage

In order to use the trueFlock tool, you must already have Softimage installed. The tool requires Softimage version 3.51 or greater. This document assumes you have already made the required changes to your .cshrc or .Softimage file to get Softimage to run on its own properly.

3.2 SAAPHIRE

This project was developed using the Softimage SDK (Software Developer's Kit) called SAAPHIRE ("Softimage Advanced API for Relations and Elements"). Because of this, you must already have previously installed SAAPHIRE (version 1.1 or greater) or, at the very least, have a copy of libSAA.so, the run-time library required by all tools developed with SAAPHIRE. See the section entitled "Installation" for more information on this run-time library and other files that are required.

4. Installation

As mentioned previously, the file libSAA.so is required in order to run the trueFlock tool. If you have SAAPHIRE already installed, then you must only make sure that your "LD_LIBRARY_PATH" environment variable points to the directory which contains libSAA.so. For example, you could have a line in your .cshrc file which reads:

```
setenv LD_LIBRARY_PATH "$SDK_LOCATION/SAAPHIRE/dso"
```

If you do not have SAAPHIRE installed, you can copy the libSAA.so file to a directory and set the LD_LIBRARY_PATH environment variable to point to that directory.

To use trueFlock, you need two files: trueFlock.cus and trueFlock.so.

The trueFlock.cus file should be placed in the directory pointed to by the SI_CUSTOM_MODEL environment variable. If you do not have write-access to this directory or you do not wish to copy the file there, you can create a directory (e.g. "model") and put the file there. Make sure you point the SI_CUSTOM_MODEL environment variable to this directory. Multiple directories can be separated by semicolons. For example,

```
setenv SI_CUSTOM_MODEL "$SI_LOCATION/model;\
                        $SDK_LOCATION/SAAPHIRE/model;\
                        $HOME/model"
```

Similarly, the trueFlock.so file should be placed in the directory indicated by the LD_LIBRARY_PATH environment variable. Again, if you do not have the required access to this directory, you can save the file in another directory and modify your .cshrc file with a line such as:

```
setenv LD_LIBRARY_PATH "$SDK_LOCATION/SAAPHIRE/dso;\
                        $HOME/dso"
```

5. How to use

To use the tool, load Softimage and create the models you wish to flock. Arrange these models in a hierarchy by creating a null and selecting each model as it's child. To do this, from the Model module, select Get→Primitive→Null. With the null selected (highlighted), click the Parent button at the right of the screen. Then select each model with the left mouse button. If the models you wish to flock are complex ones with children of their own, select the root node of each model.

The tool assumes that, initially, your Actor models are all oriented facing upwards. That is, they should point along the y axis in the positive direction. This orientation is important because the Actor models will automatically be rotated by the tool to face in the direction they are travelling.

You can also specify models that you wish to be considered obstacles. That is, the flock members will avoid colliding with the models you select. Use the same method to indicate obstacles as you did to specify the flock members. That is, collect all obstacle models into a hierarchy under a Null node.

Important Note: Even if you do not wish to have any obstacles in the scene, create a Null object with no children as you will be asked to pick an object anyway as the root of the obstacle tree (see Limitations section).

You also have the option of specifying a path you wish the flock to follow. Technically, this would not be allowed in nature because of the flock members' autonomous natures. However, inside the computer, to give you more control over the animation that is created, you can ask the flock members to try and follow a specified path. The path you select must either be a spline or NURBS curve.

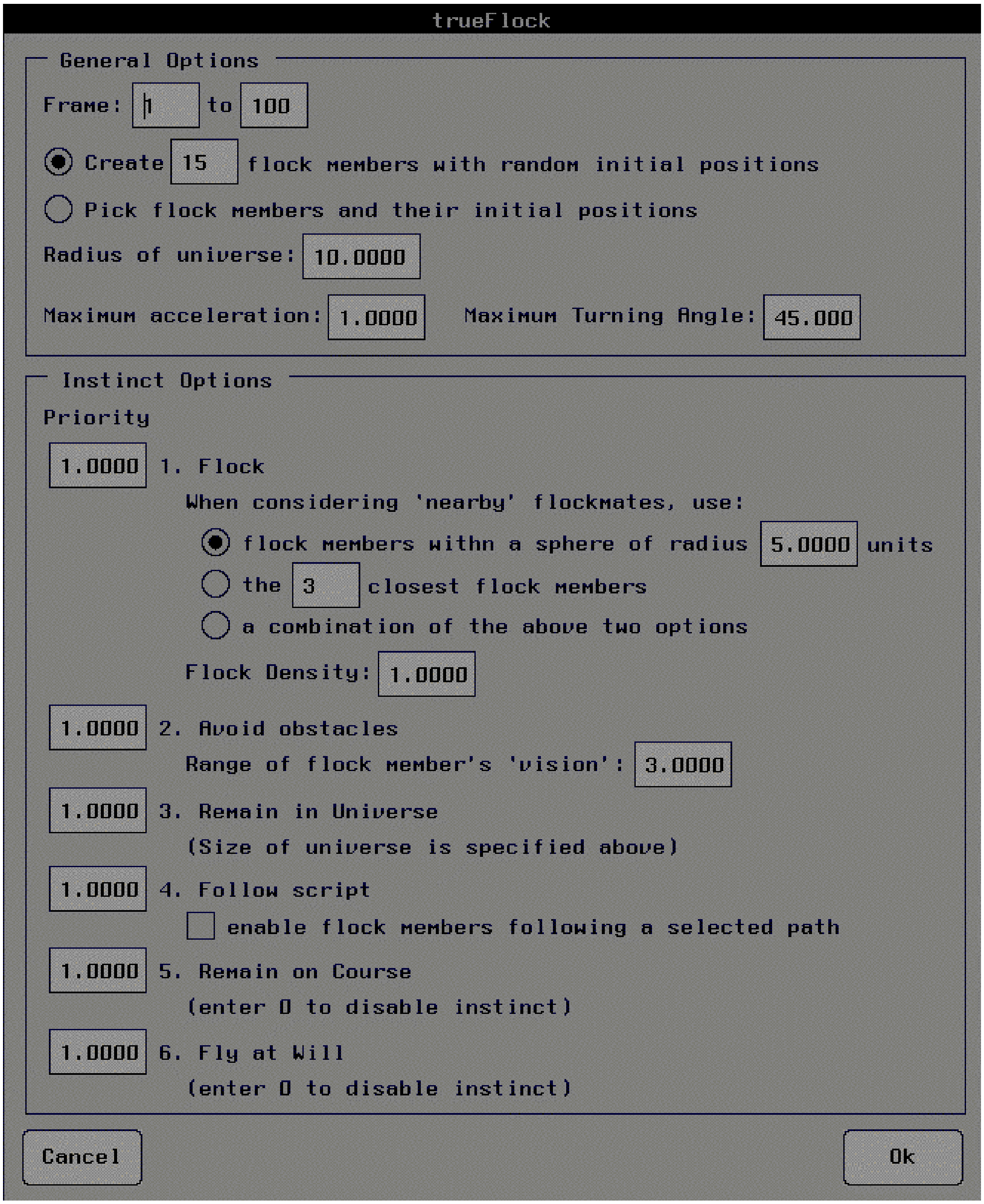
Important Note: Even if you do not wish to specify a path for the flock to follow, create a Null object as you will be asked to pick a path anyway (see Limitations section).

5.1 Dialog options

After collecting the models you wish to flock and the models you wish to consider obstacles into trees and creating a path for the flock to follow (or a Null object), go to the Model module and choose Effect→trueFlock+.

Note: The plus sign following the effect name signifies that this is a custom effect that did not originally come with Softimage.

You will then be presented with a dialog box that looks like this:



The following describes the purpose of each option and what range of values it may take:

General Options:

- Starting frame – first frame of generated animation (positive integer)
- Ending frame – last frame of generated animation (positive integer greater than the starting frame)
- Create flock members – create the specified number of duplicates of the chosen model to be the Actors of the animation. This and the following option are part of a set of mutually exclusive radio buttons
- Pick flock members – pick the root of a tree of models to be the Actors of the animation
- Radius of Universe – the radius of the sphere to be considered the Actors' universe (positive floating-point value)
- Maximum Acceleration – maximum distance each Actor can travel per frame (positive floating-point value)
- Maximum Turning Angle – maximum angle each Actor can turn per frame (floating-point angle between 0 and 180 degrees)

Instinct Options:

- Priorities – set the priority of each instinct. A value of zero (0.0) disables the instinct altogether (non-negative floating-point value)
- "Nearby" flockmates – mutually exclusive set of radio buttons. You can set the size of a sphere which surrounds the Actor- any Actors inside this sphere are considered "nearby". Or, you can set a maximum number of Actors- the closest Actors up to this number are considered "nearby". Or, you can set both options and use a combination of the two (sphere radius is a positive floating-point value; maximum number is a positive integer)
- Flock Density – how tight the flock is. To keep Actors close together, enter a small value (e.g. 1.0). To keep the Actors further away from one another, enter a larger value (e.g. 2.0) (positive floating-point value)
- Range of Actor's "vision" – Actor can only see Obstacle within the distance you specify here (positive floating-point value)
- Enable script following – Check this box to select a spline or NURBS curve for the Actors to follow

Other:

- Cancel – dismiss the dialog box without executing the effect
- Ok – dismiss the dialog box, ask for arguments and execute the effect

5.2 Picking arguments

Once you have set the options as desired on the dialog box, click the "Ok" button. You will then be asked to pick three arguments: the root of a tree of Actors, the root of a tree of Obstacles and a path for the flock to follow. Note that even though you may not wish to specify any obstacles or choose a path to follow, you will still be prompted to pick an object. In this case, simply pick a Null primitive with no children (see Limitations section).

After picking these three arguments, you will be prompted to pick three more objects. This is a fault with version 1.1 of SAAPHIRE and cannot be ignored (see Limitations section). Simply pick some object (a Null) three times to finish picking arguments.

Also note that when you are asked to pick the arguments, you can click the right mouse button to cancel the effect.

5.3 Results

After setting the options on the dialog box, clicking Ok and picking the arguments, the tool will execute. Depending on how many Actors and Obstacles you picked and the length of the animation to be generated, the tool may take a few moments to finish computing. Note that selecting obstacles to avoid can significantly increase computation time.

Remember to set the ending frame of the animation (in the bottom-right corner of the screen) to the value you specified on the dialog box so you can see the entire animation before pressing the Play button.

You will notice that the Actor models move depending on the options you chose. The models also rotate to face the direction they are travelling. If you did not initially orient your models properly, the rotations will appear incorrect.

If you wish to modify the position or rotation of one of the Actor models, make your changes and save a new key-frame for that model. With the model selected, from the Motion module, choose SaveKey→Object→Translation, SaveKey→Object→Rotation, SaveKey→Object→Transformation or SaveKey→Object→All.

6. Limitations

Because this tool was created using version 1.1 of SAAPHIRE, there are a few annoyances for the user. Particularly, picking arguments can prove confusing. You are forced to pick three arguments each time you use the tool, even though you may not wish to choose any Obstacles to avoid or to pick a path for the flock to follow. And following this, you are forced to pick three "dummy" arguments.

It should be noted that SAAPHIRE version 1.7 fixes some of these problems and if ever this project is compiled and updated using that version of SAAPHIRE, these troubles should disappear.

SAAPHIRE, annoyingly, does not provide a simple method of creating a duplicate of a particular model. This means that the "Create _x_ flock members with random initial positions" option is disabled for the current implementation of the project. You, the user, must duplicate the Actor models yourself, collect them into a hierarchy and ensure that the "Pick flock members and their initial positions" option is selected.

Fortunately, Softimage provides several commands to duplicate models. From the Model module, click the *Duplicate* menu cell. Choosing *Immediate* creates a single duplicate of the currently selected models. You may see a *Duplicator+* option which will display a dialog box and provide a more sophisticated method of duplicating models.

7. Tips/Suggestions

Here are some tips to get better results with trueFlock:

- Ensure your Actors can fit inside the universe. If the radius of the universe is too small, the Actors will be cramped and won't be able to create a good flocking motion.
- Set the Maximum Acceleration value according to two properties: the size of your Actor models and the length of your animation.
- Minimizing the Maximum Turning Angle creates a smoother animation. However, if you set this value too small, the Actor's will be unable to properly follow their instincts and the flocking motion will suffer.
- Set the priority of an instinct to zero will effectively disable it. This allows you to try "what if" scenarios by only enabling certain instincts.

- If your flock is too bunched together, try increasing the Flock Density option. This value is a multiple of the size of your Actor models. A value of 1.5 or 2 should suffice but you can play with this option to get the motion you're looking for.
- If you set the Actor's range of vision too low, you'll effectively make them "blind" and the Avoid Obstacles instinct will be useless.
- If you want the flock to follow a script, ensure that the checkbox under that instinct is marked on the dialog box. Even if it isn't, you will still be asked to pick a path as an argument. This could deceive you into thinking that you don't need to select the checkbox but you actually must.
- Because the Avoid Obstacles instinct is based upon the bounding sphere of the Obstacle models, choose models which are "nicely contained" within a sphere. For example, choosing objects such as a long rectangle will confuse the program's simple collision avoidance algorithm and will not yield good results.
- You can create animations with multiple flocks by creating two hierarchies of Actors. Use the trueFlock tool on one of the trees. Then, run the tool again on the other tree but, this time, select the first tree of Actors to be Obstacles. The result is two separate flocks which try to avoid colliding with one another.