ANIMATION FOUNDATION

IK AND FK

IK Speeds up animation in characters that need to walk, stand or interact with objects in their environment. You set the goals of the effector or IK handle and by doing this you place the hands or feet in the desired position. The software finds the "in-betweens" and figures out the way to calculate the angles of the joints. This gives our knees or elbows the natural bending that we are looking for.

For example if we place a characters body or torso in space and place the hand away from body we notice how the arm moves by itself between the body and the hand. The computer is interpolating the rotations of the arms for us. Let's use a marionette or string puppet as an example. The body of the puppet hangs from a string and another string controls the hand. As we move the string controlling the hand away from the body the jointed links of elbow open and close as the arm and the hand extends. When the angle is at its most open (180 degrees) the arm is straight and visa versa when you place the hand close to the "shoulder" the angle is close to 0 degrees the arm is most bent. The computer likewise calculates the elbow position based on the "length" of the arm and the distance between 2 points. We'll talk more about how this happens in our next installment.

But why and when should I use IK?

Imagine you want to have a character's feet on the ground instead of floating above it or going through it, remember in computer animation unlike a marionette objects do not obey the laws of gravity or solid objects. With IK if you place the foot on the ground save a key, save another key a few frames later with the foot in the same position. Now move the body around. If your hierarchy is set up correctly the root of the joints should move but the effector will not. The knees absorb the distance between the body and the foot, notice how the foot stays locked on the ground. See Movie 1.

But what about FK?

When we look at FK we are speaking of simple joint rotations. Imagine this time a jointed action figure like a GI Joe or Barbie. You rotate the arm at the shoulder then you rotate the forearm to get the hand in the position you want. This is great for waving or doing motion where the hand does not have contact with a rigid surface. Ok lets try this with the foot on the ground as the previous example, but with simple joint rotations. Pose the foot, rotating the leg joints until the foot contacts the ground. Set some keys When you play it back the foot goes through the floor, at the inbetweens. You set some more keys to put the foot back, pretty soon you have keys on

every frame. Well you are figuring the joint rotations to lock that foot on the ground every frame without the computers' help! See Movie 2. Of course its a lot more work and as you can see by the way my foot is sliding around on the ground, I have alot of work left to do. In this case it would be better suited to use IK.

Summary - Making the Choice between IK and FK

Choice must be determined by the animation you want to do. As a general rule I always use IK for the legs unless I know my character is not going to be using his or her feet to contact the ground. As for the arms this comes down to a personal decision. I know many great animators that use FK for the arms and many others that use IK. As golden rule though if the character's hand is going to come in contact with an object in the scene it will be much more efficient to use IK. So more often than not I am having a character interacting with something in the scene. Therefore I tend to use IK for my arms more than FK. If it comes down to a choice go with what works for you.

Next Installment - How IK works and what to do about those pesky IK problems Special Thanks to Sylvia Wong at ILM for help in putting this segment together.

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