# ChainLinkSource

## Making the ChainLinkSource only work in one direction

## Applying forces for Pulling In and Pushing Out the Chain

The pushOutForce should be applied in the forward direction of the source as the winch that is in theory pushing out the chain would push it in the forward direction. When pulling in the chain, the force should be applied towards the source as the hole where the chain came out would pull the chain towards it.

The force should be applied at the beginning point of the rope.

## Aligning a ChainLink with the Source

In theory, the first ChainLink should always be aligned with the source. This means that the alignment axis always passes through the source, where the alignment axis is a vector passing through the two connection points of the ChainLink.

After the chain is shortened, then the first ChainLink should always be aligned with the source. When lengthening the chain, you lengthen the current ChainLink to fill in the gap, but don’t rotate it. If there is still more chain to create, then make new ChainLinks and rotate these towards the source.

## Rotating the first ChainLink towards the source

<https://answers.unity.com/questions/217540/getting-a-configurable-joint-to-point-at-another-o.html>

There are three different ways to rotate the first ChainLink towards the source:

* Using the transform of the object
* Using the rigidbody of the object
* Using a ConfigurableJoint

If the chain should be lengthened or shortened is dependent on the orientation of the first ChainLink, and therefore it is important how the first ChainLink is rotated. If the

## Determining if the Chain should be Lengthened

### General requirements

The following requirements must hold for the chain to be lengthened.

#### There is a hook to connect a ChainLink to

If there is no hook then no new ChainLink can be spawned and attached to it. In addition, when there is no hook then there can also be no ChainLink to enlarge since that would be considered a hook as well.

#### The maximumPushOutSpeed is greater than 0

The chain should only be lengthened if the theoretical speed at which the chain can be expelled is positive.

### Case one: There is no first ChainLink

In this case the chain should be lengthened if the following condition holds.

#### There is some distance between the source and the hook to connect a ChainLink to

The chain is just comprised of a hook, and therefore it cannot be shortened. It should be lengthened if there is some gap between the source and the hook.

### Case two: There is a first ChainLink

In this case. The chain cannot just be lengthened when this first ChainLink has some distance to the source as

In this case it is much more difficult to determine if the chain should be lengthened or not.

* Align the first ChainLink with the source
* If it points towards the source, lengthen it.
* If it doesn’t, rotate it back?

## Determining if the Chain should be Shortened

### General requirements

#### There is a first ChainLink

If there was no first ChainLink making up the rope then there would be no ChainLink to shorten or remove.

#### The maximumTakeUpSpeed is greater than 0

Similar to [here](#_The_maximumPushOutSpeed_is), the chain should only be shortened if it is allowed to be taken up.

### Special requirements

##### The first ChainLink points away from the source

## Determining if a ChainLink is oriented towards a point or not

The ChainLink has two connection points: one point where other ChainLinks can connect to it and one point where the ChainLink can connect to other ChainLinks. A ChainLink is defined to be oriented towards a point if the point lies on the positive side of a plane defined by

* The point of the ChainLink where other ChainLinks can connect to, which lies on the plane
* The vector from the point where other ChainLinks connect to the point where the ChainLink connects to other points, which defines the normal of the plane and points to the positive side

The chain should be shortened if one of the following holds:

* There is a previouslySpawnedChainLink AND the source lies in front of it AND the maximumPullInSpeed is greater than 0.

### Lengthening the Chain

When the chain should be lengthened, it should be lengthened as much as possible under the following requirements:

* The chain is not lengthened more than would be possible with the current maximumPushOutSpeed and the time that passed.
* If there is a previouslySpawnedChainLink then the chain is not lengthened more than is needed to connect the positionToLinkToHook with the source in a straight line.
* If there is no previouslySpawnedChainLink then the chain is not lengthened more than the distance to the hookToConnectChainLinkTo.

If lengthening the previouslySpawnedChainLink is not enough to lengthen the rope to the necessary amount, then a new ChainLink is spawned.

### Shortening the Chain

When the chain is shortened, it should be shortened as much as possible under the following requirements:

* The chain is not shortened more than would be possible with the current maximumPullInSpeed and the time that passed.
* The chain is not shortened more than is needed to

If the