# backproject

| | | | |
|---|---|---|---|
| **keys:** | **[from]** | *<number>* | source picture |
| | **[to]** | *<number>* | output picture |
| | **with** | *<number>* | 1-D picture to be back-projected |
| | **angle** | *<number>* | back-projection direction in radians, anti-clockwise from the positive *x* axis |
| **options:** | **[add]/multiply** | | add the back-projected data to the source or multiply the data onto the source |

The **backproject** command alters a source picture by sweeping a 1-D picture across it. It adds or multiplies pixels from the 1-D picture to the source picture. **backproject** performs the opposite of a projection operation (see **project**).

## Examples

```
backproject 1 with 10 angle pi/4
```

This command sweeps the 1-D picture 10 across picture 1 from bottom left to top right, adding pixels to picture 1 as it does so.

```
backproject multiply 1 with 10
```

This command backprojects the 1-D picture 10 'on its end' horizontally across picture 1, multiplying pixels rather than adding.

## Description

The key **with** is used with the command **backproject** to specify the 1-D picture to be backprojected. Choose one of the following operating options:

- **backproject add**
- **backproject multiply**

**backproject add** is the default (so there is no need to type **add** in the command). This adds the projection picture to the source. **backproject multiply** multiplies the projection onto the source.

Use the **angle** key to specify the projection in radians. The angle is measured anti-clockwise from the positive *x* axis. The projection is positioned so that the source picture origin projects into its own coordinate origin. Source pixels projecting outside the 1-D picture are treated as though they are projected onto the nearer end of the picture.

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## Notes

| | |
|---|---|
| display marking: | projection direction and width of output |
| multi-layer pictures: | faulted |
| forms used internally: | complex |
| see also: | **project** |

## Defaults and Ranges

| keys/options | defaults | range |
|---|---|---|
| **[from]** | current picture number, held in the variable *select* | valid picture number |
| **[to]** | source picture | valid picture number |
| **with** | *none* | valid picture number |
| **angle** | angle 0 | real number in range 0 to $2\pi$ |
| **[add]/multiply** | add the pixels to the source | |