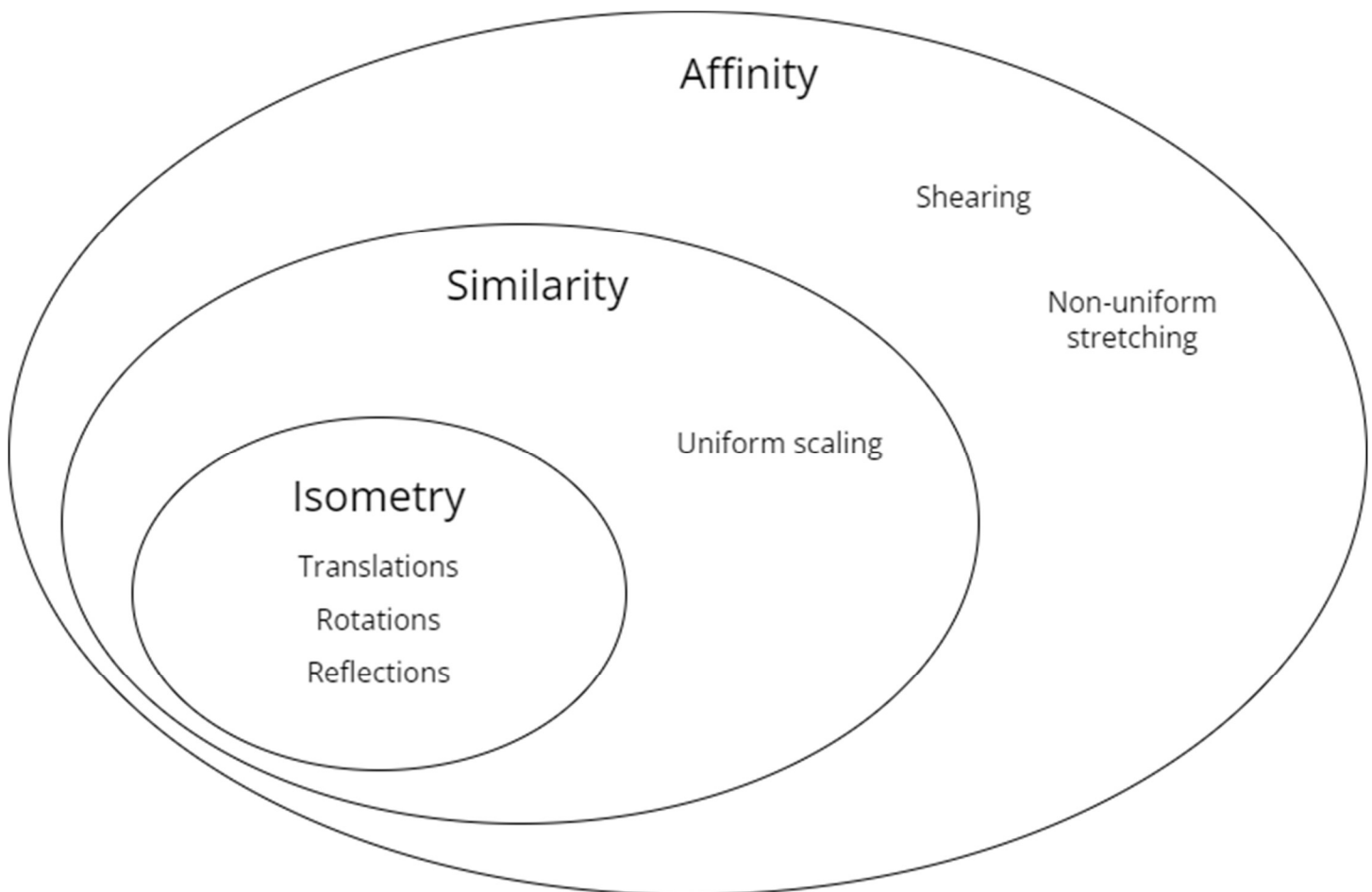


Shape Machine Cheat Sheet

Resources

All up-to-date Shape Machine resources can be found in the SharePoint [\[found here\]](#). This includes the most recent version of the Rhino plugin as well as templates and tutorials.

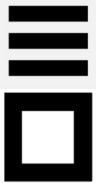
Transformations



Technical notes:

- Isometries preserve areas, angles, and parallel lines, much like tracing paper.
- Similarities preserve angles and parallel lines. A square remains a square under similarity, but it can be larger or smaller when matched.
- Affinities preserve parallel lines. All triangles can be matched with each other under affinity. All parallelograms (including squares and rectangles) can be matched with each other under affinity. Shape Machine does not support matching of arcs under affinity.

Commands

ICON	COMMAND	DESCRIPTION
	SMS1	Shape Machine Seeing 1: Search for a shape in a design under isometry . Right click to run SMS1D. (Right-click behavior may not work on macs).
	SMS1D	Shape Machine Seeing 1 (Direct): Search for a shape in a design under direct isometry (no reflections allowed).
	SMS1R	Shape Machine Seeing 1 (Reflect): Search for a shape in a design under indirect isometry (force a reflection before matching).
	SMS2	Shape Machine Seeing 2: Search for a shape in a design under similarity . Right click to run SMS2D. (Right-click behavior may not work on macs).
	SMS2D	Shape Machine Seeing 2 (Direct): Search for a shape in a design under direct similarity (no reflections allowed).
	SMS2R	Shape Machine Seeing 2 (Reflect): Search for a shape in a design under indirect similarity (force a reflection before matching).
	SMS3	Shape Machine Seeing 3: Search for a shape in a design under isometry . Right click to run SMS3D. (Right-click behavior may not work on macs).
	SMS3D	Shape Machine Seeing 3 (Direct): Search for a shape in a design under direct affinity (no reflections allowed).
	SMS3R	Shape Machine Seeing 3 (Reflect): Search for a shape in a design under indirect affinity (force a reflection before matching).
	SMD1	Shape Machine Doing 1: Replace a shape in a design under isometry . Right click to run SMD1D. (Right-click behavior may not work on macs).
	SMD1D	Shape Machine Doing 1 (Direct): Replace a shape in a design under direct isometry (no reflections allowed).
	SMD1R	Shape Machine Doing 1 (Reflect): Replace a shape in a design under indirect isometry (force a reflection before matching).
	SMD2	Shape Machine Doing 2: Replace a shape in a design under similarity . Right click to run SMD2D. (Right-click behavior may not work on macs).
	SMD2D	Shape Machine Doing 2 (Direct): Replace a shape in a design under direct similarity (no reflections allowed).
	SMD2R	Shape Machine Doing 2 (Reflect): Replace a shape in a design under indirect similarity (force a reflection before matching).
	SMD3	Shape Machine Doing 3: Replace a shape in a design under affinity . Right click to run SMD3D. (Right-click behavior may not work on macs).
	SMD3D	Shape Machine Doing 3 (Direct): Replace a shape in a design under direct affinity (no reflections allowed).
	SMD3R	Shape Machine Doing 1 (Reflect): Replace a shape in a design under indirect affinity (force a reflection before matching).
	SMAL	Shape Machine ALgorithmic: Run a Drawscript program.
	SMAL2	Shape Machine ALgorithmic 2: Run a Drawscript+ program.

Commands with an icon can be run by pressing the corresponding button in the toolbar. Commands without will need to be run manually in the command bar.

Replacement Rules (Tips and Tricks)

- The scale of the rule template does not matter. Scale it however you want.
- Rules have an infinite vertical extent. The LHS and RHS extend infinitely to the left and right.
- Shape Machine can use **layer name**, **linetype**, **color**, and **object name** to narrow searches.

Drawscript

Drawscript rules include extra information above the replacement rule that specify parameters used in the matching process. These parameters are described below:

PARAMETER	DESCRIPTION
Transformation	Which transformation type to match under. 1 : Isometry, 2 : Similarity, 3 : Affinity, 10 : Direct Isometry, 20 : Direct Similarity, 30 : Direct Affinity, 11 : Indirect Isometry, 21 : Indirect Similarity, 31 : Indirect Affinity.
Loop	How many times to apply the rule. 0 means the rule will not be applied.
Selection	Which match to apply the rule to. 1 : Apply to a random match, 2 : Apply to all matches in parallel, 3 : Manually select the application as if you ran a single shape replacement command.
Degree	When the LHS is a single line and the transformation is similarity or affinity , how should the scaling be applied? 1 : Stretch along the line, 2 : Scale uniformly.
Max	When the LHS is a single line and the transformation is similarity or affinity , should the line be stretched as much as possible during matching? 0 : No, 1 : Yes.
Scale	When the LHS is indeterminate with respect to its scale and the transformation is similarity , fix the scaling to a specific factor. When the LHS is a single line and the transformation is similarity or affinity and Max is 0 , this will be the scaling factor applied.
Angle	When the LHS is a single point or circle , what angle should the RHS be output at? When the LHS is a single arc that can be matched onto a circle in the design , what angle should the arc be matched at?

The last 4 parameters only apply when the query on the LHS of a rule is indeterminate with respect to the transformation (cases indicated in bold).

Tips and tricks for Drawscript:

- All tips and tricks for single rules apply to Drawscript, with the exception that the vertical extent of rules is bound by the horizontal template lines.
- The horizontal lines in the template can be as long as you want and as far apart vertically as you want. This means you can still make rules as tall as you want, you just need them to be sandwiched between two lines.
- Selection mode 3 can be helpful when debugging.

Drawscript+

Drawscript+ introduces a new rule type: conditionals. When nothing is on the LHS, execution will always jump over to the indicated block. When conditional true or conditional false blocks are included on the LHS, the following behavior is followed:

- Any geometry within a conditional true block needs to be found in the design to jump. An empty true block forces a jump. (FOUND → TRUE)
- Any geometry within a conditional false block needs to not be found in the design to jump. An empty false block forces no jump. (NOT FOUND → TRUE)
- Multiple conditional blocks can be provided on the LHS, allowing for multiple conditions to apply at once. All must evaluate to TRUE (explained above) to make the jump.

The loop parameter of the conditional rule specifies how many times the jump will be attempted. The conditions are reevaluated each time. Each conditional block can include a number in the “conditional_transformation” layer to specify the transformation used when searching for the geometry inside the block. These numbers are the same as used in the transformation parameter of Drawscript (1: Isometry, 2: Similarity, etc.).

Tips and tricks for Drawscript+:

- All tips and tricks for Drawscript apply to Drawscript+, with the exception that the horizontal extent of rules is bound by the block border.
- **Block labels can be anything you want. Shape Machine searches for a block labeled 0 to serve as the starting block.** If no such label is found, you will be asked to type out which block you want to use as the starting block.
- The width and height of block borders can be whatever you want, as long as the border is a rectangle.
- If you want to repeat a sequence of rules in a particular order, consider using a looping jump.
- If you want to repeat a conditional jump but only evaluate the condition the first time, you can make the conditional jump loop once and go to another block that loops an unconditional jump to whatever you want to loop.

Limitations

- Shape Machine is currently limited to shapes made of lines, points, and circular arcs. Any other type of geometry will result in undefined behavior (crashing, outputting nonsense, etc.).
- Arcs cannot be matched or replaced under affinity. This would require elliptical arcs, which have not been implemented yet.
- If your geometry is not all coplanar with the plane at Z=0, you will likely run into issues. Shape Machine tries to compensate for this, but it can't handle everything.