

# My Favorite Tools—

# Heat, Gravity, & CENTRIFUGAL FORCE

by Eric Goldschmidt

Photography courtesy of  
The Corning Museum of Glass

I am the first person to admit that I love my torch and all the other shiny hand tools I have in my tool bag. However, the tools that I really cannot live without are the most natural ones. Those would be heat, gravity, and centrifugal force. Whenever I am developing a new design or form, I take into consideration how I can best use these forces to bring the piece to fruition. Of the same accord, I must take into account how these forces might hinder my work. As I teach classes, I do my best to impress upon the students that if they can learn to take these forces into consideration, they will be able to make anything. So I would like to delve into some theories behind shaping glass rather than getting into specific techniques and hand tools.

## Heat

This may sound overly simple and obvious, but wherever the glass is hottest is where it will almost always move the most and glow the brightest. It is crucial to develop a keen eye to recognize subtle differences in the glow of the glass. The exception to these rules relates to colored glass. Some colors are stiffer than others, and some colors will glow more brightly than others at the same temperature. Therefore, when working different colored glasses into the same piece, one must first consider this issue. Think about applying more heat to the stiffer glass to work the two colors together.

I often work amber and black tubing into the same incalmo forms. The amber is much softer than the black. As I work the two colors, I tend to focus two thirds of the flame on the black side of the bubble and just one third on the amber side.



I also find it helpful to keep the bubble a bit thicker until I am ready to finalize the shape. It can also be helpful to thicken the lip of the amber bubble before attaching it to the black. To accomplish this, I heat the lip of the amber tube a bit more as I open it. Additional heat and slow turning allow the tube to thicken itself. It also helps to paddle the lip to condense more material on the lip. By the time I finish inflating and shaping, that extra thickness will have stretched more than the black glass, and my walls will be fairly even.



I like to work off the bottom edge of the flame for the most accurate heat control. By



approaching the flame from below,

as soon as the glass hits the flame it starts to glow. If you approach the flame from the top, you cannot always see that the glass has begun to glow as easily . . . or at all. Since heat rises, logic dictates that there is a more severe division between hot and cold at the bottom edge of the flame. Learning to work the glass around the edges of the flame will allow a framemaker to achieve the highest level of detail. It's not always necessary to work the glass in the middle of the flame, which should really just be used for low-detail work. Fine details tend to get destroyed in the middle of the flame.

Thinking about where the hotter and cooler parts of the flame are will also help artists control their forms. When working with thinner hollow forms, I continue to work the glass farther out toward the back of the flame.



This gives the glass a gentle, soaking heat and allows me more time to react to how and where the glass is soaking in the heat. Working too close to an aggressive flame will often overheat certain areas, and the very thrust of the gases coming from the torch can be enough to ruin a delicate form. With thicker hollows or solids, it may be helpful to work closer to the head of the torch. This area of the flame will provide the most intense, aggressive, and focused heat. It is essential to work in this area of the flame for making permanent attachments with borosilicate glass.



One must learn to pay close attention to the glow of the glass. As glass is heated, it will continue to glow more brightly. In order for the glass to move evenly, it must be heated evenly. Therefore, if artists want clean, symmetrical forms, they must make sure that the glass glows with the proper gradation of brightness throughout the areas that need to be affected.

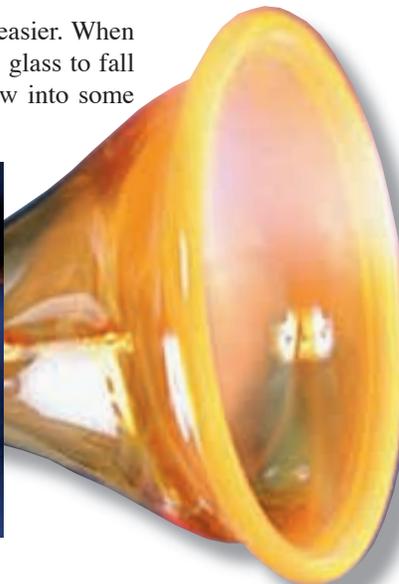


Every time the glass is touched with a tool, the tool draws heat from the glass. This can slow down the melting and shaping process. Of course, there are shapes that require some tooling, but the more efficiently the material is touched by tools, the faster and cleaner the work can be produced.

## Gravity

While it may sound silly to remind people that gravity is pulling downward, I often need to remind my students of this very fact. Thoughtful glassworkers will think about how gravity will help or hinder what they are attempting to accomplish with the material. One may need to hold the glass at very particular angles in order to get it to flow into the desired shapes.

Working with gravity can make life a great deal easier. When trying to create bends, it is always wise to allow the glass to fall into the proper bend. Gravity can help the glass flow into some very graceful forms.

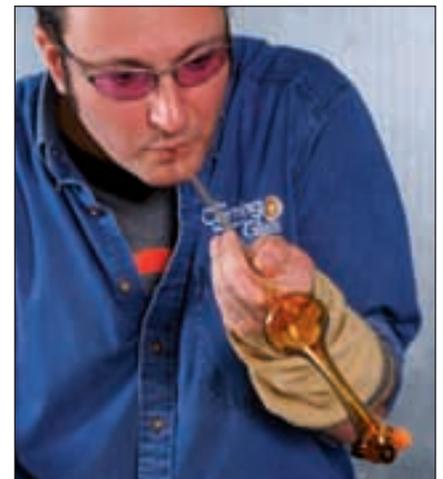


It is easy to lose focus on how gravity is affecting those forms. In order to create a squat blown-bubble shape, it helps to keep the tube as close to a level horizontal as possible while heating and inflating. This can be difficult to do, especially with larger forms. It can be helpful to set up the proper heat in the flame and simply cap the end of the open point with a finger while squeezing the glass into the desired squat form outside of the flame. As I get closer to my



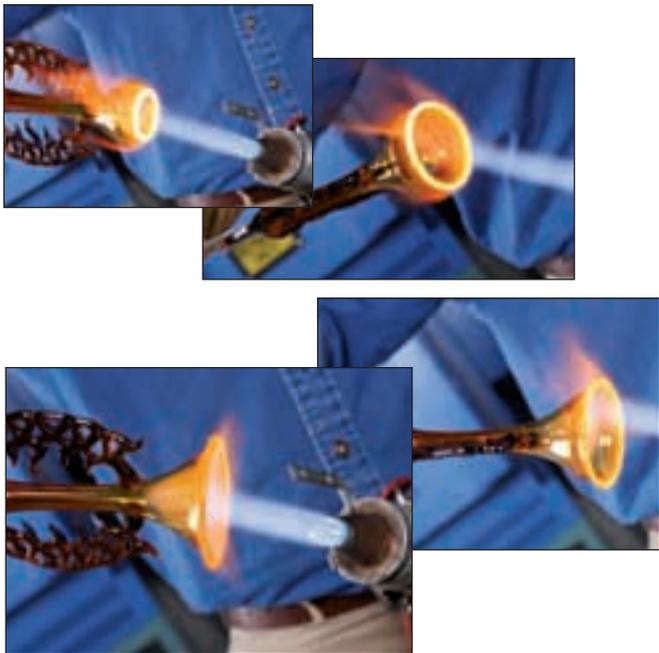
finished form, I find this works better than trying to blow into the bubble. Capping the end of the point will trap enough air pressure to keep the bubble expanded as the shape is adjusted. I often see students holding the bubble at a steep downward angle as they try to inflate it. The glass continues to fall and stretch as this is done. When the students finish inflating, they realize they have created a long, tapered form rather than the squat, bulbous form they truly desired.

Another common mistake I tend to see with students in relation to dealing with gravity is the failure to continue turning the glass evenly as they move it to their mouths to inflate. Even a slight hesitation in the turn before inflating will allow the glass to fall off center. As air is blown into the molten glass, it heats up. Hot air will always rise. Therefore, a pause in the rotation while inflating will cause the top of the bubble to stretch farther than the rest and destroy the symmetry of the bubble. One must be prepared to turn evenly before starting to inflate. There are times when one might want a certain part of the bubble to move more than the rest. In this case, it may be wise to hold that one area at the top of the turn while inflating.



## Centrifugal Force

When the glass is molten, a fast rotation will cause centrifugal force to come into play. This will cause the glass to spread out laterally. This can be incredibly helpful in creating squat and flared forms in hollows and solids. When I am setting up a squat bubble, I continue to turn faster, and the glass naturally stretches into the right form.



Of the same accord, when I create flared forms, it is essential to rotate the glass quickly to help it stretch cleanly. I see some students trying to force the glass into flares with hand tools while not turning quickly enough. Touching the glass with tools at this stage of the process is very likely to leave tool marks. There is also a tendency to push the glass hard enough with the tool so that indentations are created, or the material is pushed off center. Take the time to build your turning skills with the glass, and you will find you do not need to rely on those shiny tools quite so much.

As I have learned to shape glass by finessing it with the natural forces of heat, gravity, and centrifugal force rather than brute force, my work has grown immensely. I can mentally develop the processes necessary for accomplishing my designs much more quickly and more effectively. I can also work the glass much more efficiently, thus saving time and money. My work has grown aesthetically with much cleaner lines, forms, and fewer tool marks. While I certainly use my share of hand tools, my favorite and most important tools are the most natural ones . . . heat, gravity, and centrifugal force.

FLOW

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*Eric Goldschmidt works as a demonstrating artist for The Corning Museum of Glass. He also produces his own artwork and teaches throughout the United States and abroad.*



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