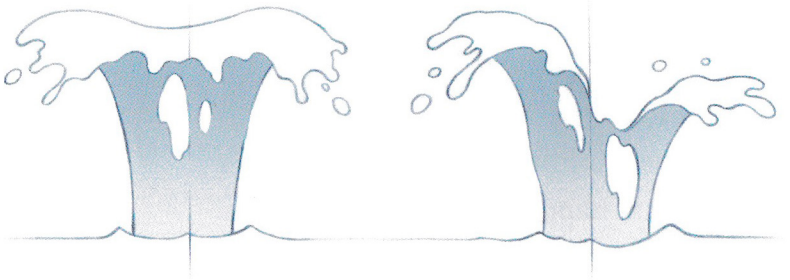
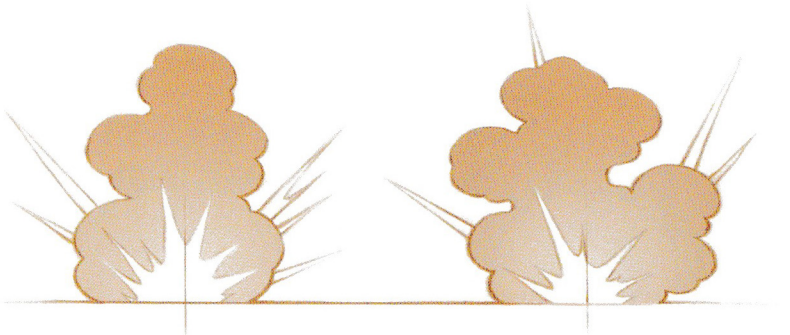
On the left we see an iconic symbol for water, with its scalloped, repetitive shapes, as we might see on a theatre set, or in a children's story book. Real water looks more like the random shapes on the right.

Here on the left we see the iconified "hot-rod" flames that we typically see on the gas tank of a motorcycle, or a pair of surf shorts. Real fire has far more chunky and unusual shapes!

The popcorn cloud on the left is very typical of a graphic cloud representation. Its shapes are repetitive and uninteresting. The cloud on the right is far more realistic, its shapes are more random.

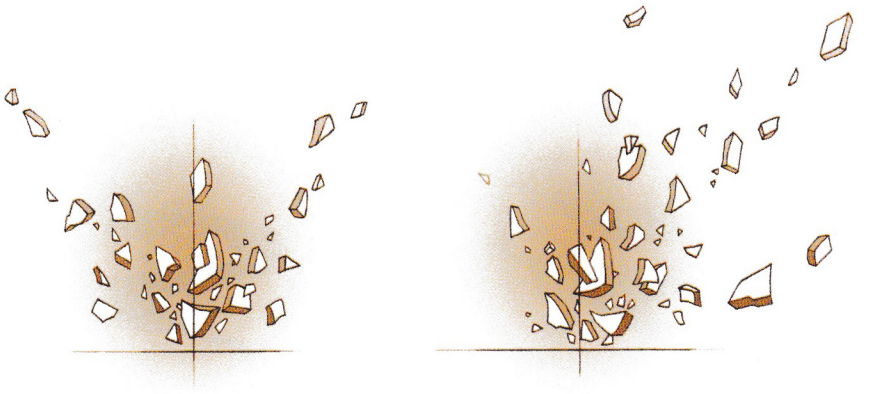


It is important to avoid symmetry when designing or animating special effects. Although in nature we may sometimes observe fairly symmetrical shapes in a splash or a puff of smoke, in order to create appealing, dynamic, and visually interesting special effects drawings we must exaggerate and stylize. The drawing on the far left contains some details which are not symmetrical, but the overall silhouette of the design is quite symmetrical. The overall silhouette as well as the details should be asymmetrical, as in the example on the right.

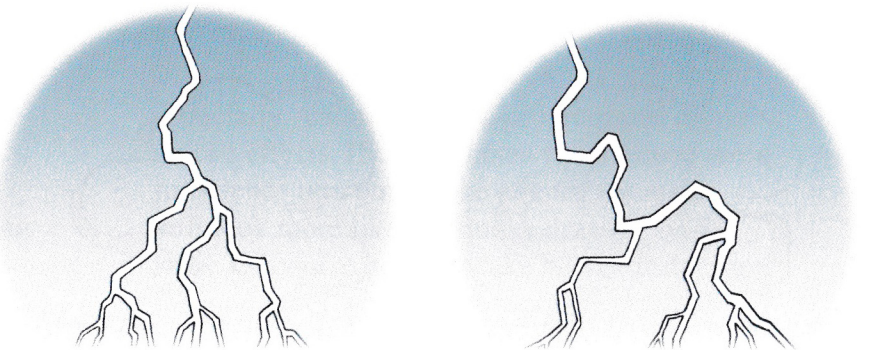


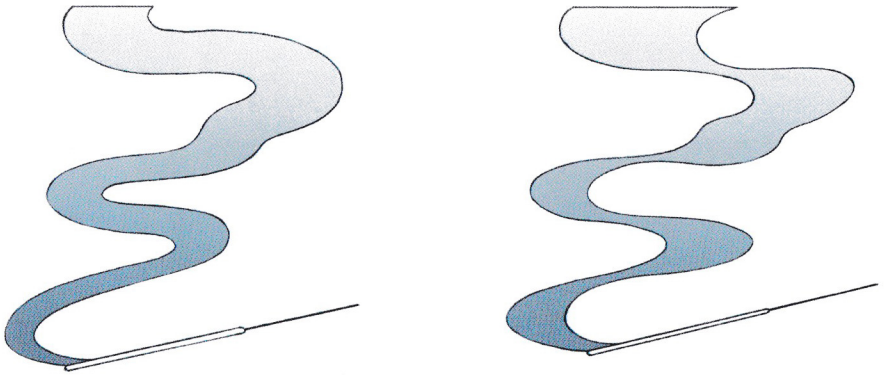
The explosion drawings here illustrate the same symmetry problems and solutions as the splash drawings above. The explosion on the left does have some very minor differences in its details, but overall its silhouette is extremely symmetrical, somewhat resembling a snowman. Although the energy of an explosion actually radiates outward in every direction at almost the exact same velocity, breaking up its silhouette asymmetrically, and overlapping its animation timing, creates a far more interesting and appealing drawing.

Here are two simple drawings of what could be a piece of ice or a ceramic bowl, smashing upon impact with the ground. Again, the example on the left contains elements which aren't entirely symmetrical, but overall the design's silhouette is quite symmetrical. Anyone who has dropped a bowl or a glass on the floor, has witnessed the way a few pieces always end up several feet away from the point of impact. The pattern of pieces left over is not symmetrical, nor is the splashing pattern of pieces emanating outward upon impact.



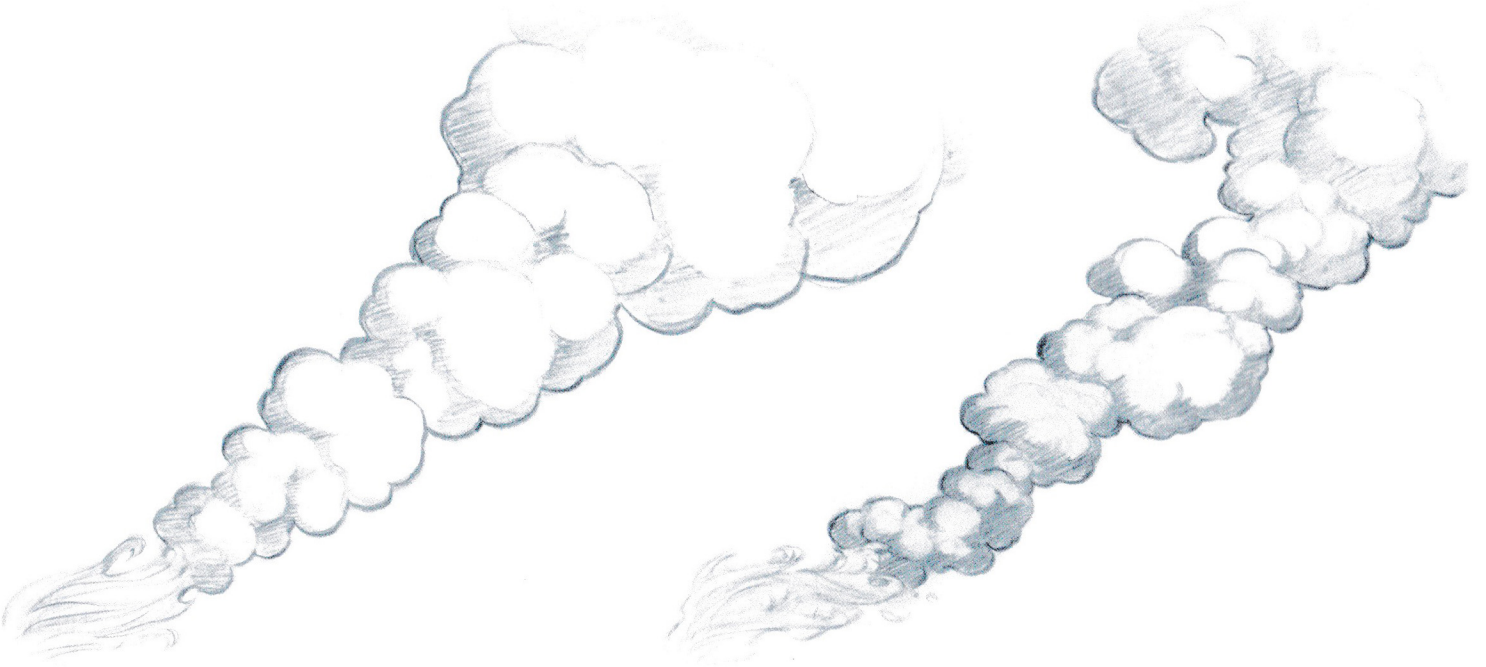
In these two examples we see a bolt of lightning, or electricity. The example on the left is offset a little, but is quite symmetrical. Observing hundreds of photographs of lightning bolts, we may actually see quite a few bolts which are pretty symmetrical looking, like the example on the left. However, when we animate electricity, we want to "push the drawing" and render our drawings far more dramatically than reality. Breaking up symmetry, we avoid "twinning" our shapes, and we push our designs as far as possible to keep things interesting.



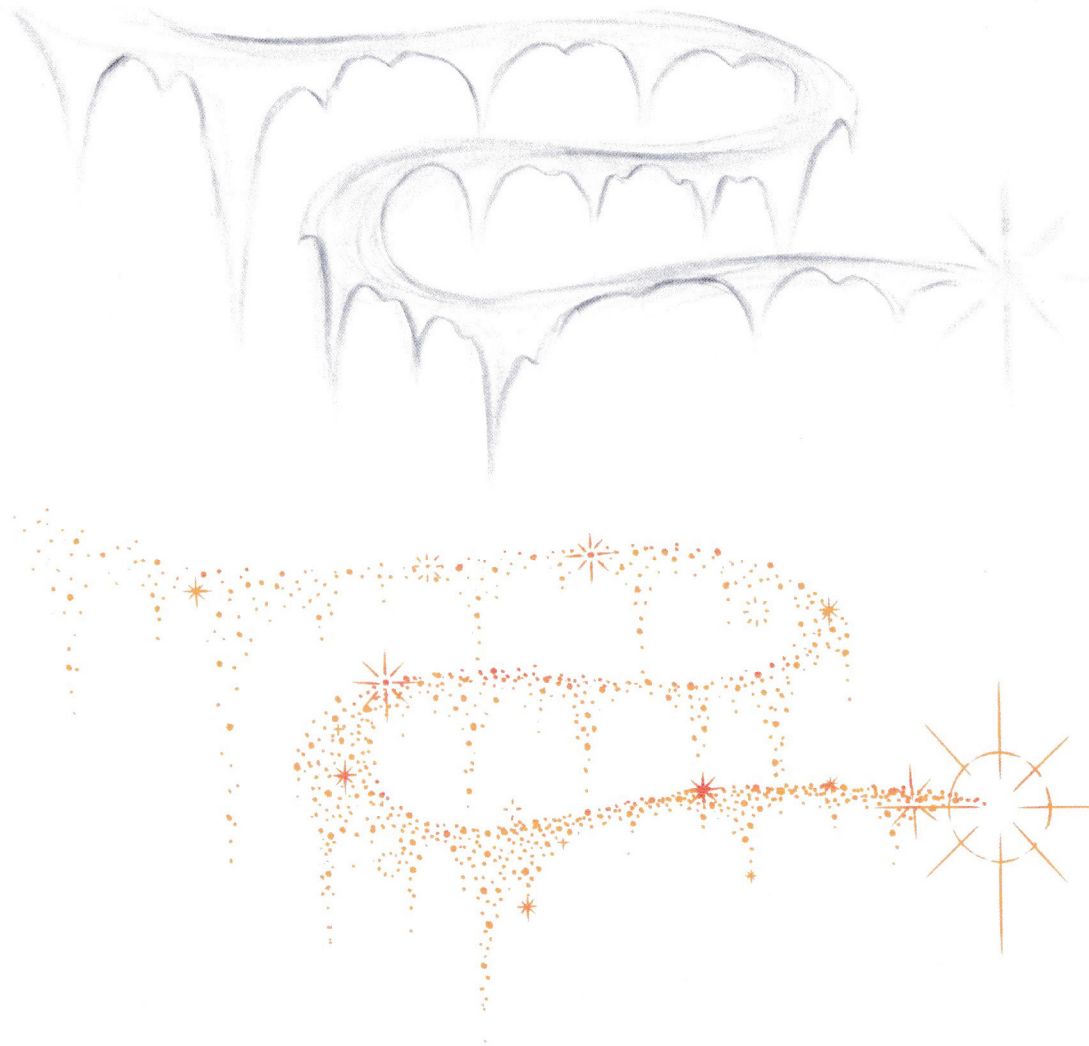


Another important principle important in the designing of good special effects animation is to avoid parallel lines as much as possible. Patterns in nature are rarely if ever truly parallel, and once again, we use exaggeration to add drama to our drawing designs. The incense smoke on the left tapers gently as it rises, but it is far too parallel. Using the same line on the left of the design, the smoke on the right is pinched tighter and spread wider in different areas, making for a much more interesting, realistic, and dynamic shape to animate.

The tonal areas of these two very similar smoke designs illustrate once again where we often see a tendency to draw parallel lines in special effects, and miss out on a chance to add weight and volume to our drawings. The tonal or shadow areas of the drawing on the left, closely follow the outline, and do little to describe the mass of the smoke, whereas the tonal designs on the right vary greatly in width, and describe far more dynamically the actual volumes of the smoke effects. These are simple, yet highly effective drawing principles.



Here is an example of symmetry and parallelism being detrimental to a special effects design. In this case, a large plume of smoke like we might see rising from a burning building. In the drawing on the left we see the smoke expanding upwards and outwards very evenly. If we were to turn this smoke on end so that it was perfectly vertical, we would see that it is almost perfectly symmetrical and quite parallel as well. This is a common problem with smoke effects design, and it is often seen today in digitally created particle effects smoke, especially "canned" or pre-programmed digital smoke effects. If care is taken to introduce more turbulence into our smoke effects, the result will look more like the smoke drawing on the right. Of course we must take into consideration the amount of wind in our scene, as well as how much heat the fire is generating. The asymmetrical qualities of a plume of smoke such as this can vary greatly, but even on a dead calm windless day, a plume of smoke should demonstrate far more turbulence and asymmetry than the drawing on the left.



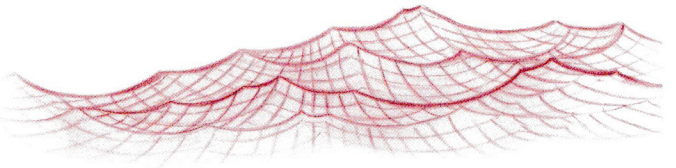
The principles we have discussed in this chapter thus far can be applied to any and all special effects elements, including magical effects like pixie dust. In the drawings here we see a loose, "ruff" drawing, demonstrating good fractal randomness, which avoids symmetry, repetition, and parallel lines. There is a feeling of directional energy in the drawing as well, which gives our pixie dust effects a sense of purpose, as if it is going somewhere for a reason, not just randomly traveling across our field of vision.

Whether we are drawing or animating liquids, waves, splashes, fire, smoke, electricity, lighting, breaking objects, waving grass or a flapping flag, slowly crawling mist or a dynamic explosion, you name it—*these basic principles should be applied to our special effects animation*. These principles apply equally to the creation of digital special effects, if we want to imbue our effects with "The Illusion of Life" to borrow from Frank & Ollie's timeless book on animation.

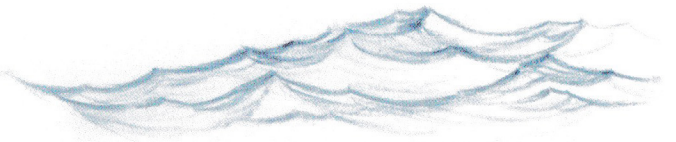
This could be a drawing of ice, rocks, wood, hard-packed snow, smashing porcelain or glass. Reflecting the design principles outlined in this chapter, every individual chunk avoids parallel lines as well as symmetry, and the overall placement of the pieces carefully avoids a symmetrical silhouette as well as demonstrating a great variance of sizes and shapes. Even though we have no idea why these shapes are placed as they are, or what outside energy force is at work, there is a sense of natural energy in this drawing. Underneath the details there is a lot of information—energy informing the drawing and making it speak to us of its origins.

This is actually a drawing of smashing ice chunks. Much observation and research went into examining the subtleties that differentiate the shapes that one might find in the elements mentioned above. Ice breaks up somewhat differently than glass, or wood, or rocks. It also breaks up differently depending on how dense it is, what impurities are in it, and what the water was doing when it began freezing. There is no end to the research we can do to make our effects animation look fantastic!

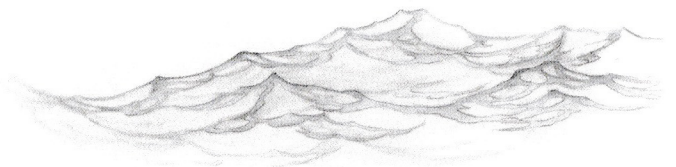
Every good effects drawing must begin with a solid foundation. This requires an understanding of the environment and its proper perspective. An accurate perspective grid can be immensely helpful at this point.



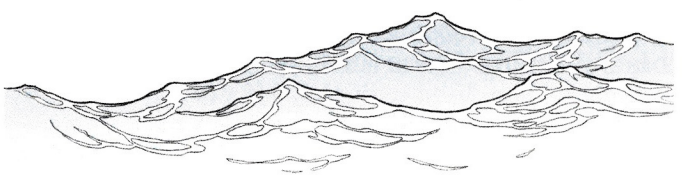
Working with this strong underlying foundation, the effects artist can now relax and feel out the style and details of the drawing, with a loose, easygoing pencil stroke. No worries about details at this stage. The energy is what's important.



Drawing over the loose, naturally flowing energy of the rough sketch, the tighter details can now be added, keeping with the directional flow and fluidity of the rough drawing. All the details can be finessed and noodled with!



The final clean line can now be applied. The style, line quality and look of the drawing at this stage depends entirely on the look of the specific show the animation is needed for. But the steps leading up to this point should be the same.

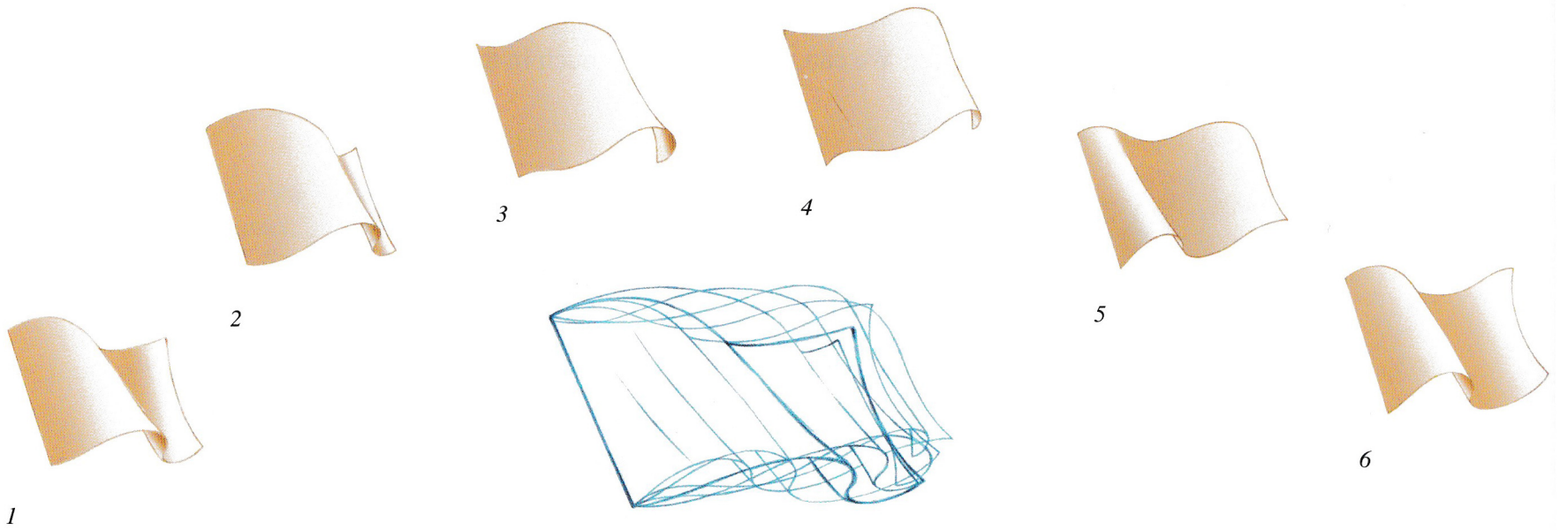


The "Whip" and "Wave" Effects

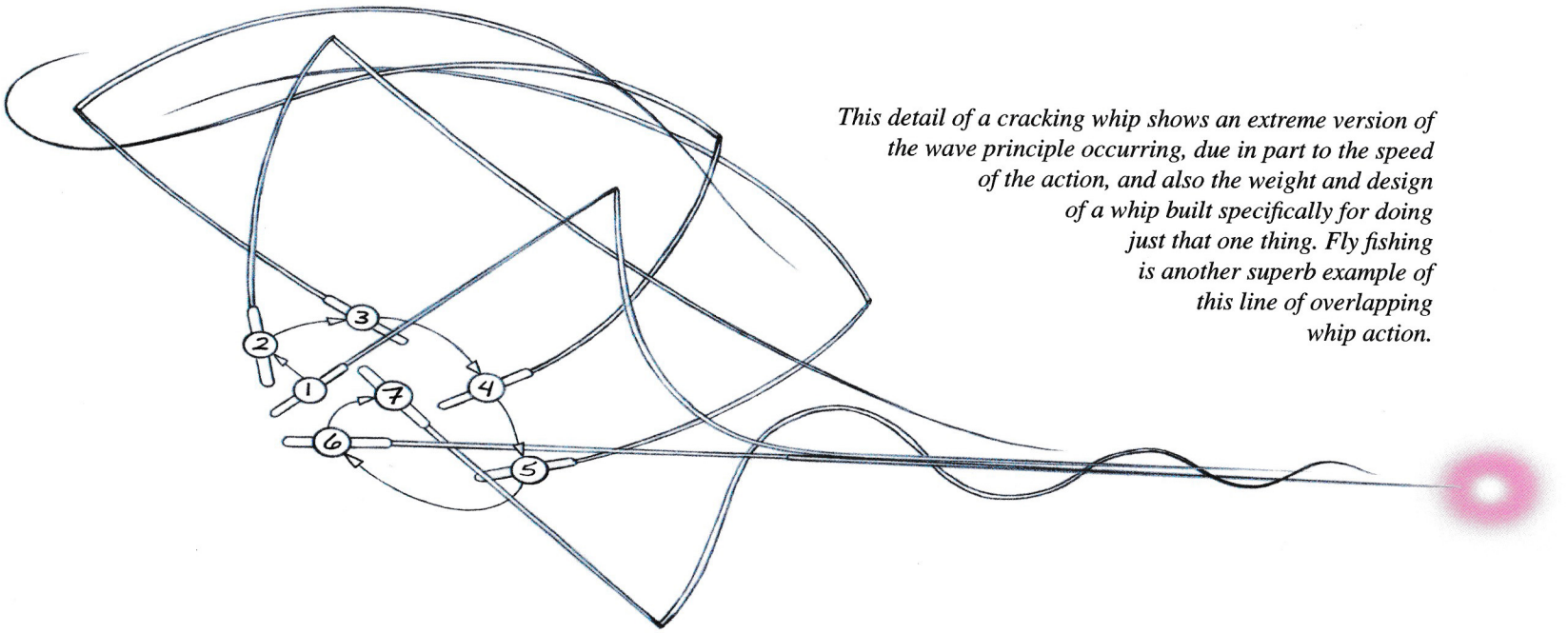
Whether you are animating smoke, fire, water, dust, snow, branches, leaves, a dangling rope, a fluttering cape, a curtain swinging closed, a dog wagging his tail, or a billowing dress, all of these effects have within them the basic whip/wave principle. It is a simple flowing, overlapping action that occurs wherever energy interacts with matter which is not entirely rigid. Just take a piece of rope maybe a few feet long, or a garden hose, lift it up quickly and then snap it back down even quicker, and you will see a wave travel through the rope or hose, just like a wave travels through the water. We can move our arms much in the same way,

We've all seen those imitation flames made out of flimsy fabric, which have a fan blowing straight up from underneath them. This is a perfect example of energy, in this case wind, creating a wave effects in matter. Hot and cool air creates wind that creates the shapes we see in a real fire, which is why this illusion works relatively well. I have actually been fooled by one of these novelties (for a second or two!)

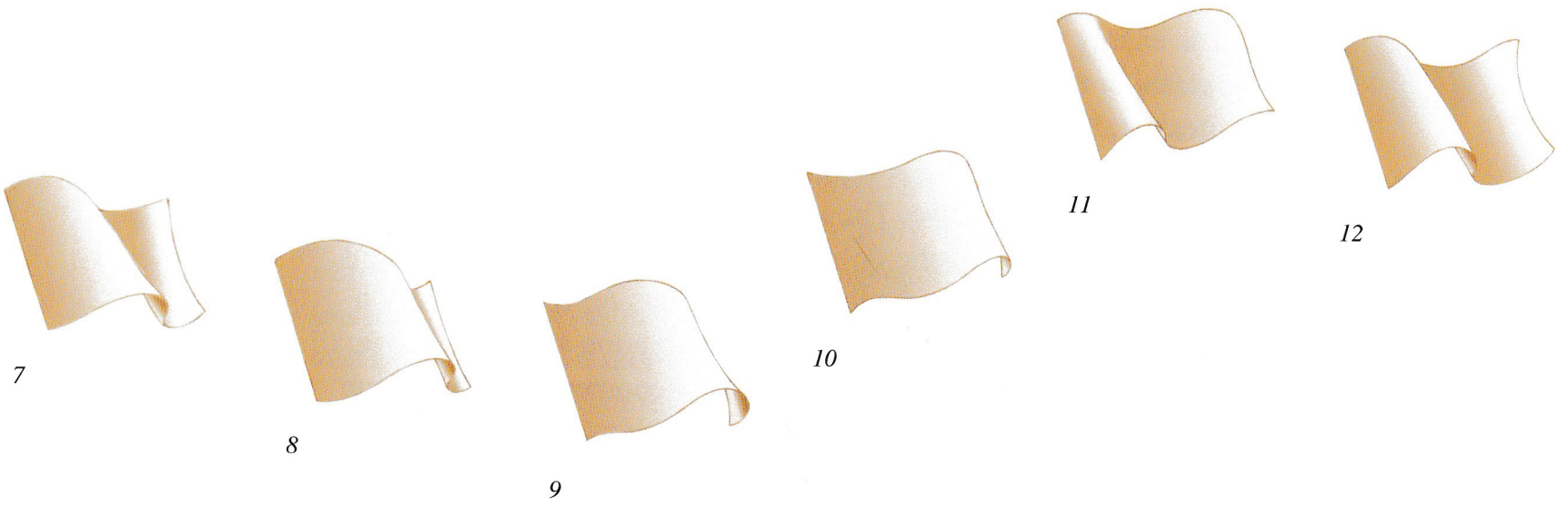
like the dancers who seem to be so rubbery and can make a wave appear to travel across their body. Interestingly, even a perfectly rigid object can appear to move with a wave action, as with the old trick of making a rigid pencil appear to be rubbery and bendy. Simply by shaking a pencil up and down, but also applying a rotational movement with the hand and wrist, the rotation causes the illusion of a wave. Our eye sees the circular motion of our hand transferred to the rigid pencil.

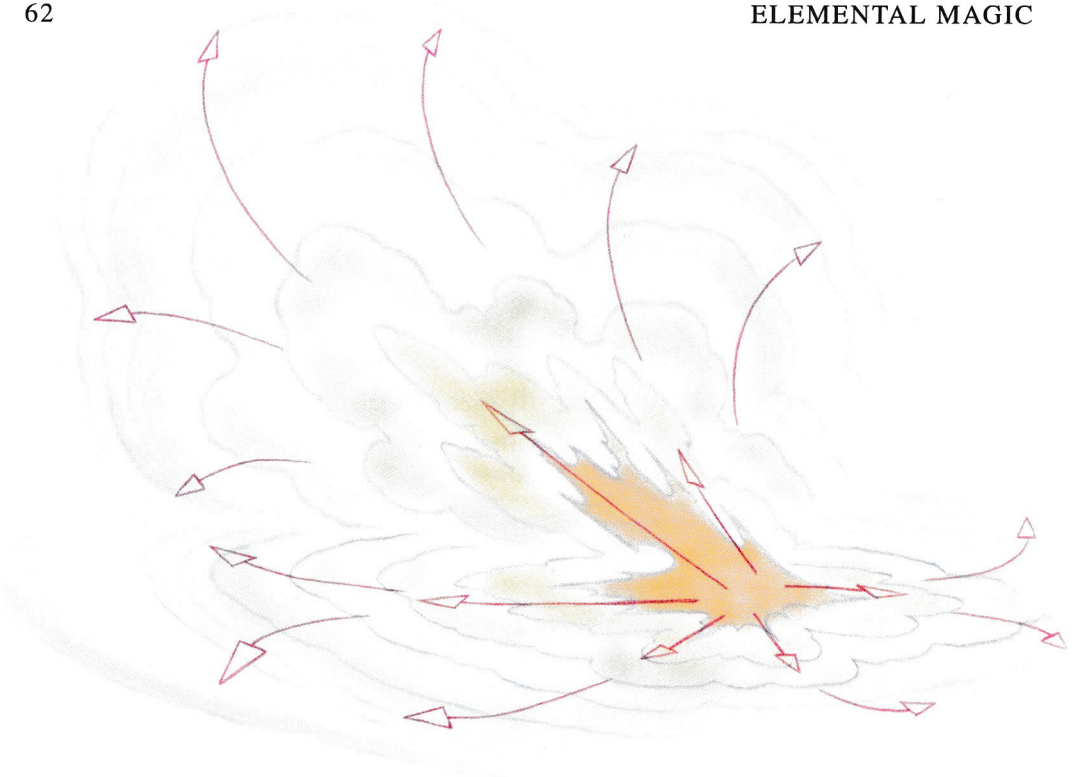


This flag animation illustrates clearly how the energy of wind creates the wave-like motion that causes a flag to flutter so elegantly. This animation is actually a cycle; drawing #7 is actually a repeat of drawing #1, and the subsequent drawings repeat throughout the remainder of the animation.



This detail of a cracking whip shows an extreme version of the wave principle occurring, due in part to the speed of the action, and also the weight and design of a whip built specifically for doing just that one thing. Fly fishing is another superb example of this line of overlapping whip action.





The energy that creates any elemental effect—the impact of a splash, or the sudden combustion of an explosion, has a finite lifespan. What starts out explosively, with very strong directional energy, loses energy as it expands. And as the energy dies out, the shapes it creates evolve. They change, interestingly enough, from sharp, angular, energetic designs to soft, flowing, languid designs. A sudden splash ends in subtle, soft ripples. A violent explosion ends with beautiful shapes of gently dissipating smoke. The overall design and dynamic movement of this phenomenon is the unique fingerprint that pure energy leaves on the elements that it moves.

These two Schlieren photos, one of a candle flame, and one of an ice cube melting in water, show a remarkable similarity in the beautiful energy patterns that occur when hot and cold temperatures intermingle, regardless of the context. Rotating both photos 180 degrees and looking at them next to their opposites, shows us just how uncannily similar these patterns really are. We will find these patterns everywhere the various elements react to the cosmic forces at work in the world as we know it.