Chapter 11
Line Drawings that Appear Unsharp

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ABSTRACT

A straight line, pen-drawn and executed on a pen-plotter, is by default sharp and crisp. This is the nature of a straight line between two points. Likewise, drawings generated from such lines are by definition sharp. This paper considers generative line drawings, executed on a pen-plotter which appears to be wholly or in part unsharp when viewed. Described here are some strategies based on systematic experiments with geometric transformations to produce such drawings. The topic is approached from an artist's point of view with a focus on the generative and algorithmic issues involved, and the results are demonstrated by examples.

INTRODUCTION

Walking on a windy evening in winter at twilight, all trees without leaves, the landscape almost entirely gray, and the scene dominated by lines. Lines are everywhere. But the images are soft, often with unsharp contours. Although in reality, all these images are crisp and sharp, we see them blurred and soft, their shadows even more so. Viewing such scenes creates a specific mood in

the viewer and therefore it is not surprising that artists have recognized the particular and interesting characteristics of such situations, and have tried to devise techniques to generate those effects.

Although a line is by definition *sharp*, and it seems to be illogical to imagine it otherwise, we attempt the generation of line-oriented images that *appear unsharp* to the viewer. This is an artistic challenge, and we will approach it experimentally. Being interested in computer generated algorithmic work, we restrict our experiments to pen-drawn, line-oriented drawings, coded as

Figure 1. Two unsharp photographic images of part of a tree in winter, photographed under insufficient light and strong wind
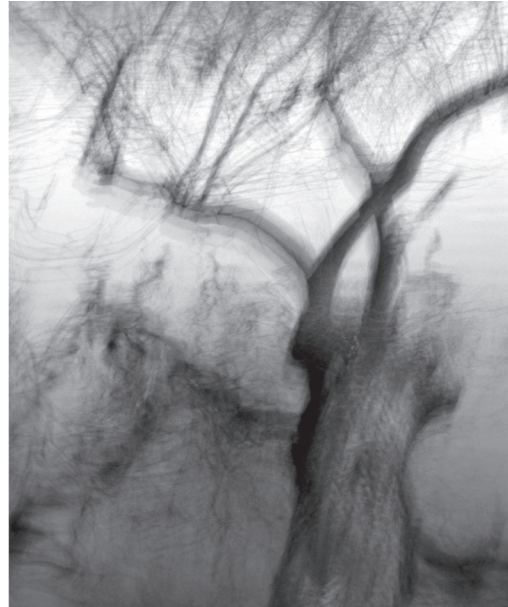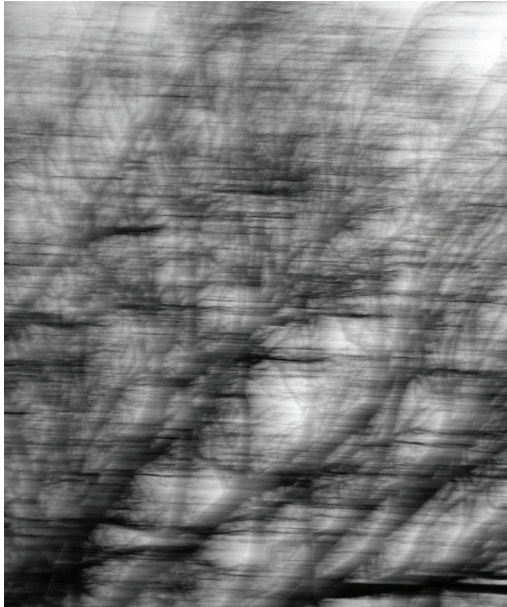
vectors and executed on pen-plotters. Such an unsharp line-drawing seems to be a contradiction in itself because it is composed of lines, which are always drawn as sharp and precise entities. In the light of such logic it is a particular challenge we try to achieve, and we follow this line of investigation out of artistic interest. In nature, due to conditions, unsharp images may be experienced in abundance. The two images in Figure 1, part of a tree photographed in insufficient light on a windy winter evening, and a willow tree, photographed under similar conditions may serve as examples. There is motion blur, transparency and gray-scaling, all contributing to the unsharp expression of the images. Unsharp images and images out of focus are known in contexts such as digital imagery, photography, painting, advertising, and science for example. When we talk about "unsharp vector-line-images", we always talk about images that *appear* unsharp. On close inspection their constituting entities, the lines are definitely sharp, as long as we view them under normal circumstances. The effect of "unsharpness"

is caused by insufficiencies of our perceptual systems to separate them properly, because of distance, interlacing, interferences and other factors. For the main topic of interest here – unsharp, line-oriented pen-drawn vector images, executed on pen-plotters – no algorithms formulated by computational experts are available, to the best of our knowledge. This is one of the reasons to choose an experimental approach, which seems justified as a beginning.

REMARKS ON THE PROBLEM

The systematic investigation of the problem in form of a sequence of experiments, carried out in 2009, can be seen as a follow-up on a few earlier attempts by the author: One of them exhibited at "intersections", the SIGGRAPH 2006 Art Show in Boston (http://www.siggraph.org/artdesign/gallery/S06/index.html), and others reported in Lieser (2009). The experiments were set up to systematically explore unsharp line drawings restricted

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