



EXCERPTED FROM

STEPHEN
WOLFRAM
A NEW
KIND OF
SCIENCE

SECTION 10.1

Introduction



Processes of Perception and Analysis

Introduction

In the course of the past several chapters, we have discussed the basic mechanisms responsible for a variety of phenomena that occur in nature. But in trying to explain our actual experience of the natural world, we need to consider not only how phenomena are produced in nature, but also how we perceive and analyze these phenomena. For inevitably our experience of the natural world is based in the end not directly on behavior that occurs in nature, but rather on the results of our perception and analysis of this behavior.

Thus, for example, when we look at the behavior of a particular natural system, there will be certain features that we notice with our eyes, and certain features, perhaps different, that we can detect by doing various kinds of mathematical or other analysis.

In previous chapters, I have argued that the basic mechanisms responsible for many processes that occur in nature can be captured by simple computer programs based on simple rules. But what about the processes that are involved in perception and analysis?

Particularly when it comes to the higher levels of perception, there is much that we do not know for certain about this. But what I will argue in this chapter is that the evidence we have suggests that the basic mechanisms at work can once again successfully be captured by simple programs based on simple rules.

In the traditional sciences, it has rarely been thought necessary to discuss in any explicit kind of way the processes that are involved in perception and analysis. For in most cases all that one studies are rather simple features that can readily be extracted by very straightforward processes—and which can for example be described by just a few numbers or by a simple mathematical formula.

But as soon as one tries to investigate behavior of any substantial complexity, the processes of perception and analysis that one needs to use are no longer so straightforward. And the results one gets can then depend on these processes.

In the traditional sciences it has usually been assumed that any result that is not essentially independent of the processes of perception and analysis used to obtain it cannot be definite or objective enough to be of much scientific value. But the point is that if one explicitly studies processes of perception and analysis, then it becomes possible to make quite definite and objective statements even in such cases.

And indeed some of the most significant conclusions that I will reach at the end of this book are based precisely on comparing the processes that are involved in the production of certain forms of behavior with the processes involved in their perception and analysis.

What Perception and Analysis Do

In everyday life we are continually bombarded by huge amounts of data, in the form of images, sounds, and so on. To be able to make use of this data we must reduce it to more manageable proportions. And this is what perception and analysis attempt to do. Their role in effect is to take large volumes of raw data and extract from it summaries that we can use.

At the level of raw data the picture at the top of the facing page, for example, can be thought of as consisting of many thousands of individual black and white cells. But with our powers of visual perception and analysis we can immediately see that the picture can be summarized just by saying that it consists essentially of an array of repeated black diamond shapes.