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STEPHEN WOLFRAM

A NEW KIND OF SCIENCE

SECTION 10.13

Higher Forms of Perception and Analysis

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In the course of this chapter we have discussed in turn each of the major methods of perception and analysis that we in practice use. And if our goal is to understand the actual experience that we get of the world then there is no reason to go further. But as a matter of principle one can ask whether the methods of perception and analysis that we have discussed in a sense cover what is ultimately possible—or whether instead there are higher and fundamentally more powerful forms of perception and analysis that for some reason we do not at present use.

As we discussed early in this chapter, any method of perception or analysis can at some level be viewed as a way of trying to find simple descriptions for pieces of data. And what we might have assumed in the past is that if a piece of data could be generated from a sufficiently simple description then the data itself would necessarily seem to us quite simple—and would therefore have many regularities that could be recognized by our standard methods of perception and analysis.

But one of the central discoveries of this book is that this is far from true—and that actually it is rather common for rules that have extremely simple descriptions to give rise to data that is highly complex, and that has no regularities that can be recognized by any of our standard methods.

But as we discussed earlier in this chapter the fact that a simple rule can ultimately be responsible for such data means that at some level the data must contain regularities. So the point is that these regularities are just not ones that can be detected by our standard methods of perception and analysis.

Yet the fact that there are in the end regularities means that at least in principle there could exist higher forms of perception and analysis that would succeed in recognizing them.

So might one day some new method of perception and analysis be invented that would in a sense manage to recognize all possible regularities, and thus be able to tell immediately if any particular piece of data could be generated from any kind of simple description?

My strong belief—as I will argue in Chapter 12—is that at least in complete generality this will never be possible. But that does not mean that there cannot exist higher forms of perception and analysis that succeed in recognizing at least some regularities that our existing methods do not.

The results of this chapter, however, might seem to provide some circumstantial evidence that in practice even this might not be possible. For in the course of the chapter we have discussed a whole range of different kinds of perception and analysis, yet in essentially all cases we have found that the overall capabilities they exhibit are rather similar. Most of them, for example, recognize repetition, and some also recognize nesting. But almost none recognize anything more complex.

So what this perhaps suggests is that in the end there might be only certain specific capabilities that can be realized in practical methods of perception and analysis. And certainly it seems not inconceivable that there could be a fundamental result that the only kinds of regularities that both occur frequently in actual systems and can be recognized quickly enough to provide a basis for practical methods of perception and analysis are ones like repetition and nesting.

But there is another possible explanation for what we have seen in this chapter: perhaps it is just that we, as humans, are always very narrow in the methods of perception and analysis that we use. For certainly it is remarkable that none of the methods that we normally use ever in the end seem to manage to get much further than we can already get with our own built-in powers of perception. And what this perhaps suggests is that we choose the methods we use to be essentially those that pick out only regularities with which we are somehow already very familiar from our own built-in powers of perception.

For there is no difficulty in principle in constructing procedures that have capabilities very different from those of our standard methods of perception and analysis. Indeed, as one example, one could imagine just enumerating all possible simple descriptions of some particular type, and then testing in each case to see whether what one gets matches a piece of data that one has.

And in some specific cases, this might well succeed in finding extremely simple descriptions for the data. But to use such a method in

any generality almost inevitably requires computational resources far greater than one would normally consider reasonable in a practical method of perception or analysis.

And in fact there is really no reason to consider such a sophisticated procedure. For in a sense any program—including one that is very simple and runs very quickly—can be thought of as implementing a method of perception or analysis. For if one gives a piece of data as the input to the program, then the output one gets—whatever it may be—can be viewed as corresponding to some kind of description of the data.

But the problem is that under most circumstances this description will not be particularly useful. And indeed what typically seems to be necessary to make it useful is that somehow one is already familiar with similar descriptions, and knows their significance.

A description based on output from a cellular automaton rule that one has never seen before is thus for example not likely to be useful. But a description that picks out a feature like repetition that is already very familiar to us will typically be much more useful.

And potentially therefore our lack of higher forms of perception and analysis might in the end have nothing to do with any difficulty in implementing such forms, but instead may just be a reflection of the fact that we only have enough context to make descriptions of data useful when these descriptions are fairly close to the ones we get from our own built-in human methods of perception.

But why is it then that these methods themselves are not more powerful? After all, one might think that biological evolution would inevitably have made us as good as possible at handling data associated with any of the systems that we commonly encounter in nature.

Yet as we have seen in this book almost whenever there is significant complexity our powers of human perception end up being far from adequate to find any kind of minimal summaries of data.

And with the traditional view that biological evolution is somehow a process of infinite power this seems to leave one little choice but to conclude that there must be fundamental limitations on possible methods of perception that can be useful.

One might imagine perhaps that while there could in principle be methods of perception that would recognize features beyond, say, repetition and nesting, any single such feature might never occur in a sufficiently wide range of systems to make its recognition generally useful to a biological organism.

But as of now I do not know of any fundamental reason why this might be so, and following my arguments in Chapter 8 I would not be at all surprised if the process of biological evolution had simply missed even methods of perception that are, in some sense, fairly obvious.

So what about an extraterrestrial intelligence? Free from any effects of terrestrial biological evolution might it have developed all sorts of higher forms of perception and analysis?

Of course we have no direct information on this. But the very fact that we have so far failed to discover any evidence for extraterrestrial intelligence may itself conceivably already be a sign that higher forms of perception and analysis may be in use.

For as I will discuss in Chapter 12 it seems far from inconceivable that some of the extraterrestrial radio and other signals that we pick up and assume to be random noise could in fact be meaningful messages—but just encoded in a way that can be recognized only by higher forms of perception and analysis than those we have so far applied to them.

Yet whether or not this is so, the capabilities of extraterrestrial intelligence are not in the end directly relevant to an understanding of our own experience of the world. In the future we may well manage to use higher forms of perception and analysis, and as a result our experience of the world will change—no doubt along with certain aspects of our science and mathematics. But for now it is the kinds of methods of perception and analysis that we have discussed in most of this chapter that must form the basis for the conclusions we make about the world.