Afterword

> Our acceptance of an ontology is, I think, similar in principle to our acceptance of a scientific theory, say a system of physics; we adopt, at least insofar as we are reasonable, the simplest conceptual scheme into which the disordered fragments of raw experience can be fitted and arranged.
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> —*Willard V. O. Quine*

> Thus the order and regularity in the appearances, which we entitle *nature,* we ourselves introduce.
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> —*Immanuel Kant*

Representation and feature extraction are fundamental to intelligence. The ideas we have been considering in a very tightly-constrained model underlie most of human cognition. Therefore, it is important to consider the place of this discussion in the big picture. Early in life, we learn to categorize our perceptions in order to interact successfully with our world. For example, we become sensitized to the speech sounds which occur in our native tongue, and to the visual stimuli of our parents' faces. As we grow, we learn "what to look for" in order to perform various tasks, learning which data are relevant to our needs. We learn to categorize the world according to our goals, and this categorization reduces the complexity of our world to manageable levels, enabling us to act intelligently. But since this categorization filters our view of the world, it removes us from reality itself.

In Zen and the Art of Motorcycle Maintenance, Robert Pirsig describes this categorization as the action of a knife which we use to slice reality:

> The application of this knife, the division of the world into parts and the building of this structure, is something everybody does. All the time we are aware of millions of things around us—these changing shapes, these burning hills, the sound of the engine, the feel of the throttle, each rock and weed and fence post and piece of debris beside the road—aware of these things but not really conscious of them unless there is something unusual or unless they reflect something we are predisposed to see. We could not possibly be conscious of these things and remember all of them because our mind would be so full of useless details we would be unable to think. From all this awareness we must select, and what we select and call consciousness is never the same as the awareness because the process of selection mutates it. We take a handful of sand from the endless landscape of awareness around us and call that handful of sand the world.
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> Once we have the handful of sand, the world of which we are conscious, a process of discrimination goes to work on it. This is the knife. We divide the sand into parts. This and that. Here and there. Black and white. Now and then. The discrimination is the division of the conscious universe into parts.

He goes on to describe how each "grain of sand" is unique, and we can sort them into piles on the basis of all kinds of different properties. And the properties we choose for this sorting depend on the analogs we have acquired from our experience, and from the collective experience passed on to us through human society.

The Zen approach to categorization is to refuse to separate the sand into piles, since

doing so inevitably removes us from Reality. For then we no longer see the world—only the categories. As a result, the world we interact with is an artificial construct, designed according to our needs and concerns. But, to a large extent, we cannot help it—we cannot survive without doing so. Most of our education and growth concerns our ability to categorize, and to discern the connections between categories. If these categories are poorly chosen, we make mistakes, or else we work much harder than necessary to make correct decisions. Therefore, we must be prepared to throw away our categories and to re-categorize experience when our representation proves to be inadequate.

If I claim that reward-maximization and cognitive economy govern human decision-making, I must be quick to point out that these are only part of the picture. My model is based on the rewards experienced by an agent as the result of its actions, but says nothing at all about the source of those rewards, or how they are determined. The rewards appear to encapsulate everything that is involved in being human. Having bodies, we experience rewards from sensations such as pleasure and pain, and find that our actions are constrained by the limitations of our bodies. Living in families and societies, we experience other types of rewards based on social interaction. Religious faith allows for a transcendent source of reward and value. Clearly, the desirability of various experiences and states depends on a complex web of environmental, social, cultural and spiritual stimuli and rewards. All of this is outside my model of information processing—and possibly beyond formal description. This dissertation has studied some of the central issues of cognition, but only in a very limited model. It is a beginning, but the kind of categorization which we take for granted as human beings going about our normal lives will probably always be seen as art.