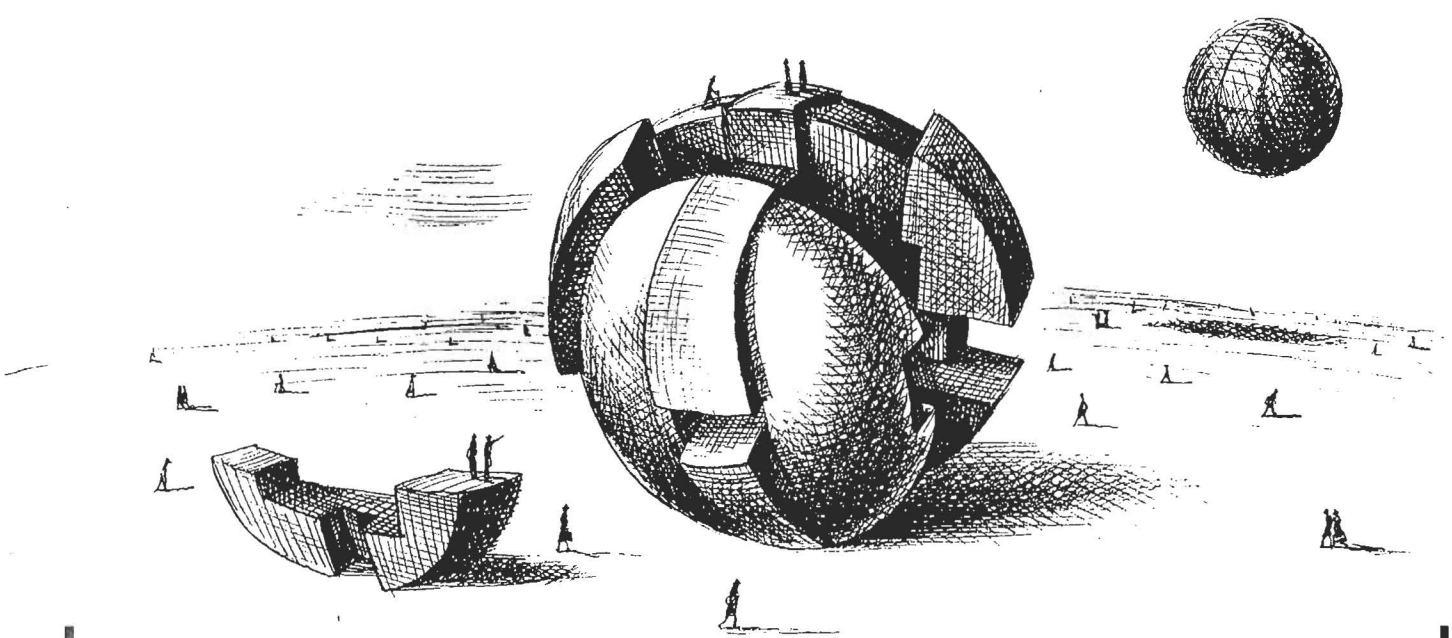
THE SOCIETY OF MIND

"270 brilliantly original essays on...how the mind works."
—Isaac Asimov, Information Week

MARVIN MINSKY

COFOUNDER OF THE ARTIFICIAL INTELLIGENCE LABORATORY, MIT



First Touchstone Edition, 1988

Published by Simon & Schuster, Inc.
Simon & Schuster Building
Rockefeller Center
1230 Avenue of the Americas
New York, NY 10020

TOUCHSTONE and colophon are registered trademarks
of Simon & Schuster, Inc.

Designed by Irving Perkins Associates
Manufactured in the United States of America

3 5 7 9 10 8 6 4 2
1 3 5 7 9 10 8 6 4 2 Pbk.

Library of Congress Cataloging in Publication Data

Minsky, Marvin Lee, date.
The society of mind.

Includes index.
1. Intellect. 2. Human information processing.
3. Science—Philosophy. I. Title.
BF431.M553 1986 153 86-20322
ISBN 0-671-60740-5
ISBN 0-671-65713-5 Pbk.

The author is grateful for permission to reprint the following material:

Excerpts by Theodore Melnechuk. Reprinted by permission of the author.
Excerpt by Manfred Clynes. Reprinted by permission of the author.
From "Burnt Norton" in *Four Quartets* by T. S. Eliot, © 1943 by T. S. Eliot; renewed 1971 by Esme Valerie Eliot. Reprinted by permission of Harcourt Brace Jovanovich, Inc.
From "Choruses from 'The Rock' " in *Collected Poems 1909–1962* by T. S. Eliot, © 1936 by Harcourt Brace Jovanovich, Inc.

CHAPTER 13

SEEING AND BELIEVING

Cezanne said, "Though the world appears
Complex, it's made of cubes and spheres,
Along with cylinders and cones:
Four fundamentals that, like bones
In flesh, uphold whatever drapes
Variety upon their shapes."

"They're doubly basic," Freud said. "These
Are more than just geometries:
Your simple solids symbolize
The organs that attract our eyes;
The only subject of the arts
Is men's and women's private parts."

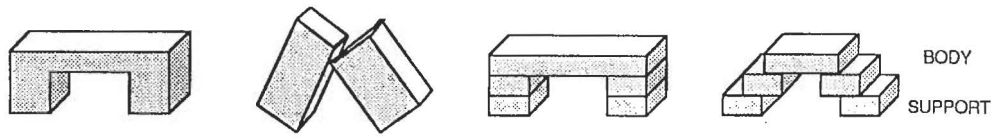
The body can as well express
Our sadness and our happiness
And even sex's mindless dance
Portrays the spirit's circumstance
Of oscillation to and fro
Between the cosmic Yes and No.

"The world," van Gogh said, "is a face
In which I see my soul's grimace."
But has reality become
Merely emotion's medium?
O universe of forms, I ask
Are you a mirror, or a mask?

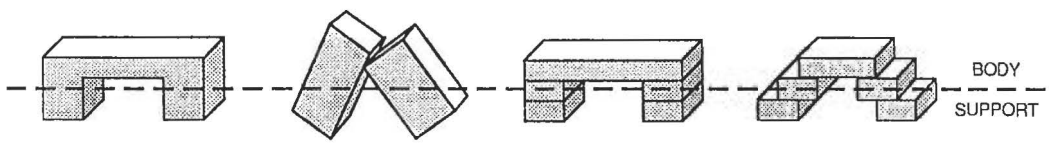
—THEODORE MELNECHUK

13.1 REFORMULATION

Imagine all the kinds of arches one can build.



How could we capture what's common to so many things with just one single uniframe? Impossible—if we were forced to think of them in terms of blocks and how they're placed. Not one of the expressions we used before applies to all of them: neither "three blocks," nor "two blocks standing up," nor "the supports must not touch." How could we make our minds perceive all these arches as the same? One way would be to draw this imaginary line:



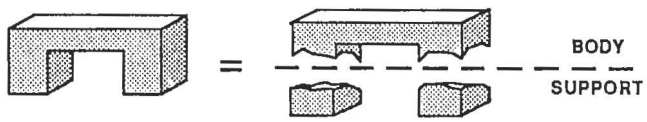
Now, suddenly, all those different arches fit one single frame—of a single Body with two Supports. There are two different ideas here. The first is the idea of dividing an object's description into an "essential" portion, namely the "body," and some auxiliary portions, which correspond to the support. Later we'll see that this is a powerful idea in its own right. The second idea is even more powerful and general: after failing to find a unified description of all those arches, we abandoned the method we were using—and adopted, instead, a quite different style of description. In a word, we *reformulated* the problem in new terms. We started by using a language that was based on expressing the precise shapes of individual blocks. We replaced this by another language in which we can speak of shapes and outlines that are not confined to those of the blocks themselves.

Reformulation is clearly very powerful—but how does one do it? How do people find new styles of description that make their problems seem easier? Does this depend upon some mysterious kind of insight or upon some magically creative gift—or do we simply come upon them by accident? As I said when discussing creativity, these seem to me mere matters of degree, since people are always making reformulations of various sorts. Even when we contemplate those rarest and most revolutionary new ideas that come like revelations, suddenly to shed new light on entire fields of thought—like evolution, gravity, or relativity—we usually see by hindsight that these were variants of things that people knew before that time. Then we have to ask, instead, for reasons why those reformulations were so long postponed.

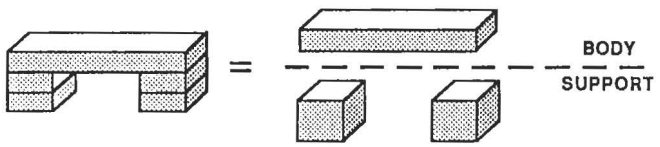
13.2 BOUNDARIES

In the sky there is no distinction of east and west;
people create distinctions out of their own minds and then
believe them to be true.
—BUDDHA

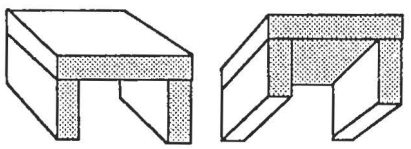
What is creativity? How do people get new ideas? Most thinkers would agree that some of the secret lies in finding "new ways to look at things." We've just seen how to use the Body-Support concept to reformulate descriptions of some spatial forms, and soon we'll see some other ways to reformulate in terms of strength, containment, cause, and chain. But first let's look more carefully at how we made those four different arches seem the same, by making each of them seem to match *"a thing supported by two legs."* In the case of *Single-Arch*, we did this by imagining some boundaries that weren't really there: this served to break a single object into three.



However, we dealt with *Tower-Arch* by doing quite the opposite: we treated some real boundaries as though they did not exist:



How cavalier a way to treat the world, to see three different things as one and to represent one thing as three! We're *always* changing boundaries! Where does an elbow start or end? When does a youth become an adult? Where does an ocean change into a sea? Why must our minds keep drawing lines to structure our reality? The answer is that unless we made those mind-constructed boundaries, we'd never see any "thing" at all! This is because we rarely see anything twice as exactly the same. Each time we're almost certain to be looking from a somewhat different view, perhaps from nearer or farther, higher or lower, in a different color or shade of light, or against a different background. For example, consider these two appearances of the same table.



These are quite different when described in terms of the actual lines and surfaces. But when described in terms of body and support, both pictures are the same!

Unless the mind could thus discard the aspects of each scene that are not essential to its present purposes, we could never learn anything. Otherwise, our recollections would rarely match appearances. Then nothing could make any sense—since nothing would seem permanent.

13.3 SEEING AND BELIEVING

A child was asked to draw a person.

Where is the body? Why are the arms and legs connected to the head?

When questioned, many young children actually prefer these to the drawings most adults like.

We normally assume that children see the same as we do and only lack our tricky muscle skills. But that doesn't explain why so many children produce this particular kind of drawing, nor why they seem so satisfied with them. In any case, this phenomenon makes it seem very unlikely that a child has a realistic, picturelike "image" in mind.

Now let's consider a different idea. We'll suppose that the child does not have anything like a picture in mind, but only some network of relationships that various "features" must satisfy. For example, a child's "person-drawing" feature-network might consist of the following features and relations:

HEAD	*Large closed figure.*
EYES	*Two circles, high in head.*
MOUTH	*Object centered below eyes.*
BODY	*Large closed figure.*
ARMS	*Two lines, attached high on body.*
LEGS	*Two lines, attached low on body.*

To convert this description into an actual drawing, the child must employ some sort of "drawing procedure." Here's one in which the process simply works its way down the feature list, like a little computer program:

1. *Consider the next feature on the list.*
2. *IF such a feature is already drawn, go to step 3. Otherwise draw it.*
3. *IF list is finished, stop. Otherwise, go back to step 1.*

When the child starts to draw, the first item on the list is "large closed figure." Since there isn't any such thing yet, the child draws one: that's the head. Next the eyes and mouth get drawn. But then, when it comes to drawing the body feature, step 2 of the procedure finds that a "large closed figure" has already been drawn. Accordingly, nothing new is required, and the procedure simply advances to step 3. As a result, the child goes on to attach the arms and legs to the feature that has been assigned to both the body and the head.

An adult would never make such a "mistake," since once some feature has been assigned to represent a head, that feature is thereafter regarded as "used up" or "occupied" and cannot represent anything else. But the child has less capacity or inclination for "keeping track." Accordingly, since that "large closed figure" satisfies the description's requirements for both the head and the body—albeit at different moments of time—there is no cause for discontent. The little artist has satisfied all the conditions required by its description!