FLOWER WORLD VARIATIONS

A SEQUENCE OF SONGS FROM THE YAQUI DEER DANCE

EXPANDED EDITION

POEMS BY JEROME ROTHENBERG
DRAWINGS BY HAROLD COHEN

FLOWER
WORLD
VARIATIONS

15 flower world variations: a pre-face

The exciting thing about all this is that as it is new it is old & as it is old it is new, but now really we have come to be in our way which is an entirely different way.

(Gertrude Stein, from *Narration*)

The work as such goes back to the late 1970s, a time for me of exploration into the ethno-poetic sources of poetry & for Harold Cohen an investigation of the nature of artmaking/markmaking through a new computer technology & his pointed observations of marks left behind by the oldest "technicians of the sacred." In either case, to use Harold's words, what we were after, each in his own way, was "a sort of minimum configuration of deep-level behavioral mechanisms" as the basis for new work still to come – "from the Californian petroglyphs at one extreme to my own drawing at the other." It was that, with an abiding sense of friendship & kinship, that brought us together on a small book of poems with computer-generated drawings – not illustrations so much as testimony to a similarity of procedures & concerns. For this our vehicle was a book published by Karl Young's Membrane Press in the rough & tumble style of so much small press publication then – the images, all black & white, chosen from the drawings that Harold's program "Aaron" was already pouring out in great profusion. The combination of new & old was critical from both sides of our collaboration.

For this the starting point was a Yaqui Easter ceremony that I was privileged to witness in 1981 through the good offices of Anselmo Valencia, the leader of the New Pas-

cua Pueblo in Tucson. Here the principal ceremonial presences – the sacred Deer Dancer & the Pascola Clowns – came from what the Yaquis called "flower world," "enchanted world" & "wilderness world," among the English terms used to describe the other-than-human domain surrounding the settled Yaqui villages: "a region of untamed things into which man's influence does not extend" (Edward Spicer). In mythic times that world (*huya aniya*) may have been *everything*, later reduced (so Spicer tells us) "to a specialized part of a larger whole, rather than the whole itself . . . . Not replaced, as the Jesuits would have wished ... it became the other world, the wild world surrounding the towns." Within the frame of a native & independent Catholicism, it persists in the present, into which it brings the mythic figures of Dancer & Clowns. The songs accompanying the very taut, very classical Deer Dance are, in their totality, an extraordinary example of traditional poesis: the cumulative construction by word & image of that Flower World from which the Dancer comes.

As a follow-up to that I turned to earlier ("literal") translations of some of those songs in Carleton S. Wilder's 1963 book *The Yaqui Deer Dance*, which presented me with the gist of what the songs were saying & some sense of how they were treated in actual performance. My intention, as with other "total translations" I was then attempting, was to compose poems in which all such features were immediately apparent, not only the meanings but the ways in which phrases repeated & reinforced each other between & within songs, so that the rhythms of the original Yaqui were present enough to create new forms & sounds in English. The proof of that of course was intended both for the written page & for subsequent performance – to lay bare in the process the fundamentals of poetry (*poesis*) wherever found.

It was a similar concern that Harold applied to his own work & to its relation to the petroglyphs we both observed on nearby cave & rock walls in southern California. And his own first move was to bring his new computer program to the same level of performance – labeled "primitive" but, as he noted, far from that – as a starter. "In other words," he wrote, "the choice of mechanisms [for programming the computer] was largely intuitive & arbitrary. I suspected that I would be on reasonably safe ground if I limited myself, at the outset at least, to what I assumed to be perceptual primitives, & I selected three: the ability to differentiate between figure & ground, to differentiate between open forms & closed forms, & to differentiate between insideness & outsideness." The computer-generated drawings at that point were abstract, though over time they would be programmed to show "real-world"/ "flower world" images & often dazzling colors, the cover image for the present volume a wonderful example.

When Harold Cohen died a year ago the original *Flower World Variations* had been out of print for some time & the idea of bringing his new color work into the mix had long been forgotten. It was through the intervention of Lynne DeSilva-Johnson & The Operating System that the idea of the present volume emerged: an enhanced version of the 1984 edition, which it supplements with a color cover & an essay/manifesto of Harold's that I published at about the same time in *New Wilderness Letter*, a magazine I had just started as the continuation of *Alcheringa Ethnopoetics*, an earlier joint venture with the anthropologist & poet Dennis Tedlock. That it may also serve as a memorial & tribute brings a certain sadness but a hope as well of other things to come.

<div align="right">

Jerome Rothenberg
Encinitas, California
May 2017

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The small nouns

Crying faith
In this which the wild deer
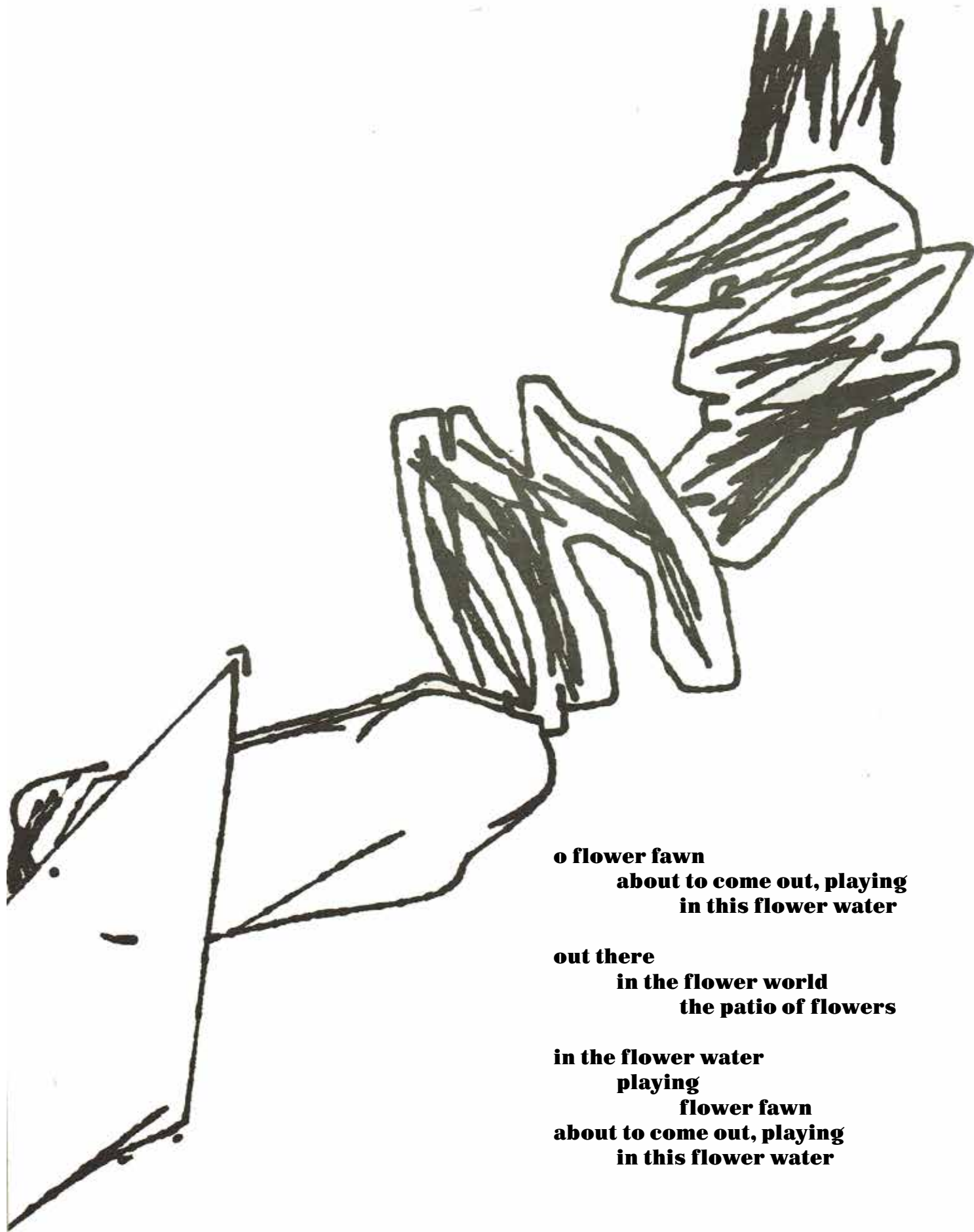Startle, and stare out.

-- George Oppen

one

o flower fawn
        about to come out, playing
                in this flower water

out there
        in the flower world
                the patio of flowers

in the flower water
        playing
                flower fawn
about to come out, playing
        in this flower water

two

in wilderness I am
     that only melon
         flowering
& splitting
     sending vines out
         everywhere
you are
     in wilderness
         I am that only
melon flowering
     & splitting
         sending vines out
in the flower world
     out there
         under the dawn
a pale blue cloud
     will be grey water
         at its peak
the mist will reach
     will rain down
         on the flower
ground
& shining
     reaching bottom
         where you are
in wilderness
     that only melon flowering
         I am
& splitting
     sending vines out
         everywhere

three
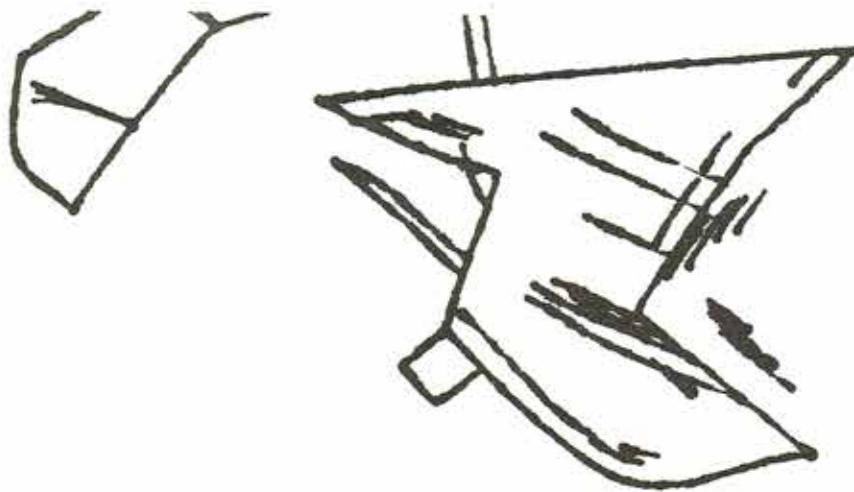
when the fresh night comes
  o night hawk
    you fly up
o night hawk
  out there
    in the flower world
under the dawn
  the light beyond us
    you fly up
o night hawk
 from a branch of mesquite
    you fly up
o night hawk

four

(where is the rotted stick that screeches lying?)
the screeching rotted stick is lying over there
(where is the rotted stick that screeches lying?)
the screeching rotted stick is lying over there
there in the flower world
                    beyond us
                                    in the tree world
the screeching rotted stick
                    is lying
                                    over there the screeching
rotted stick is lying
                    over there
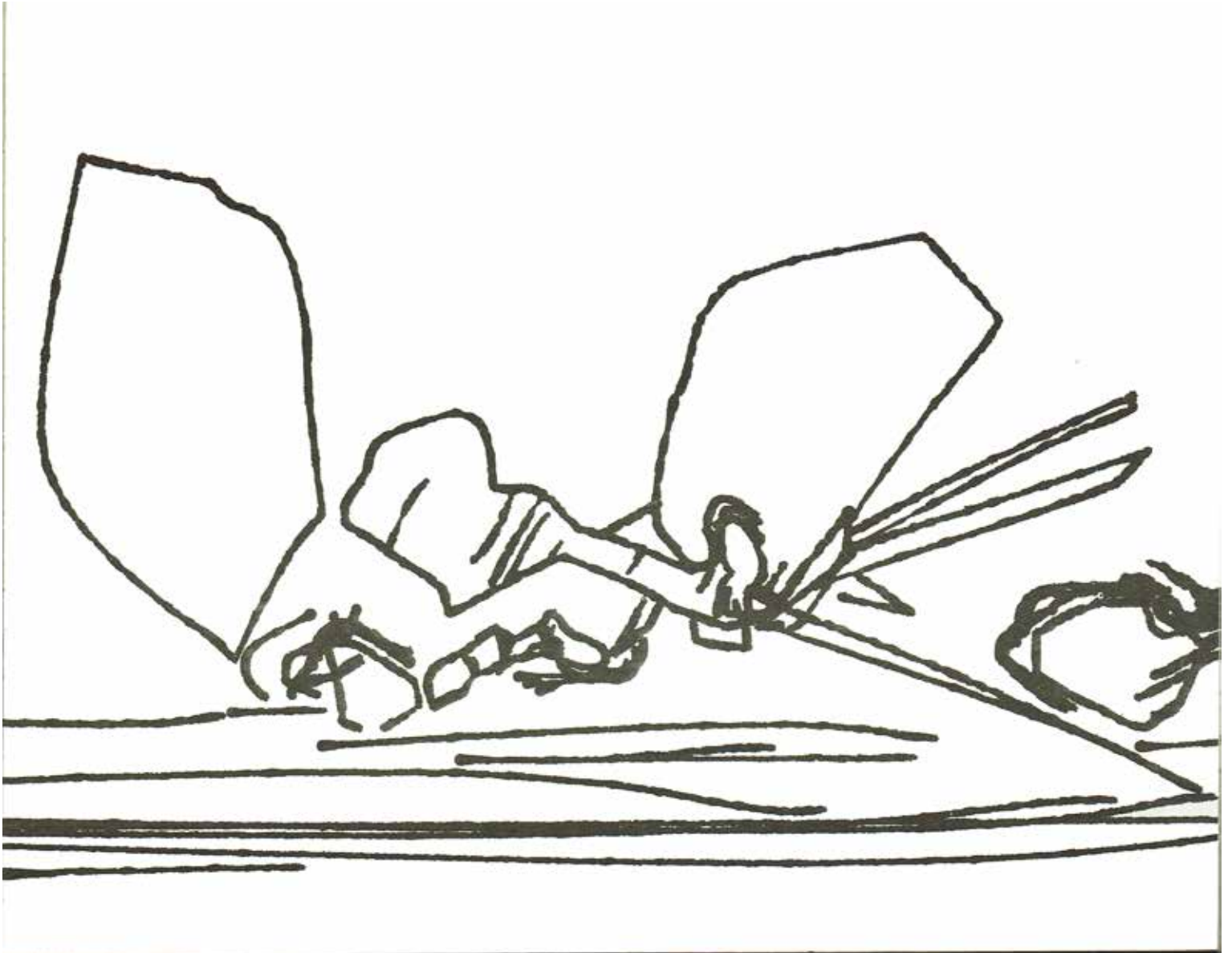
five

ah brother

look at you

a deer with flowers

brother

shake your antlers

little brother

shake your antlers

deer with flowers

why not let your belt

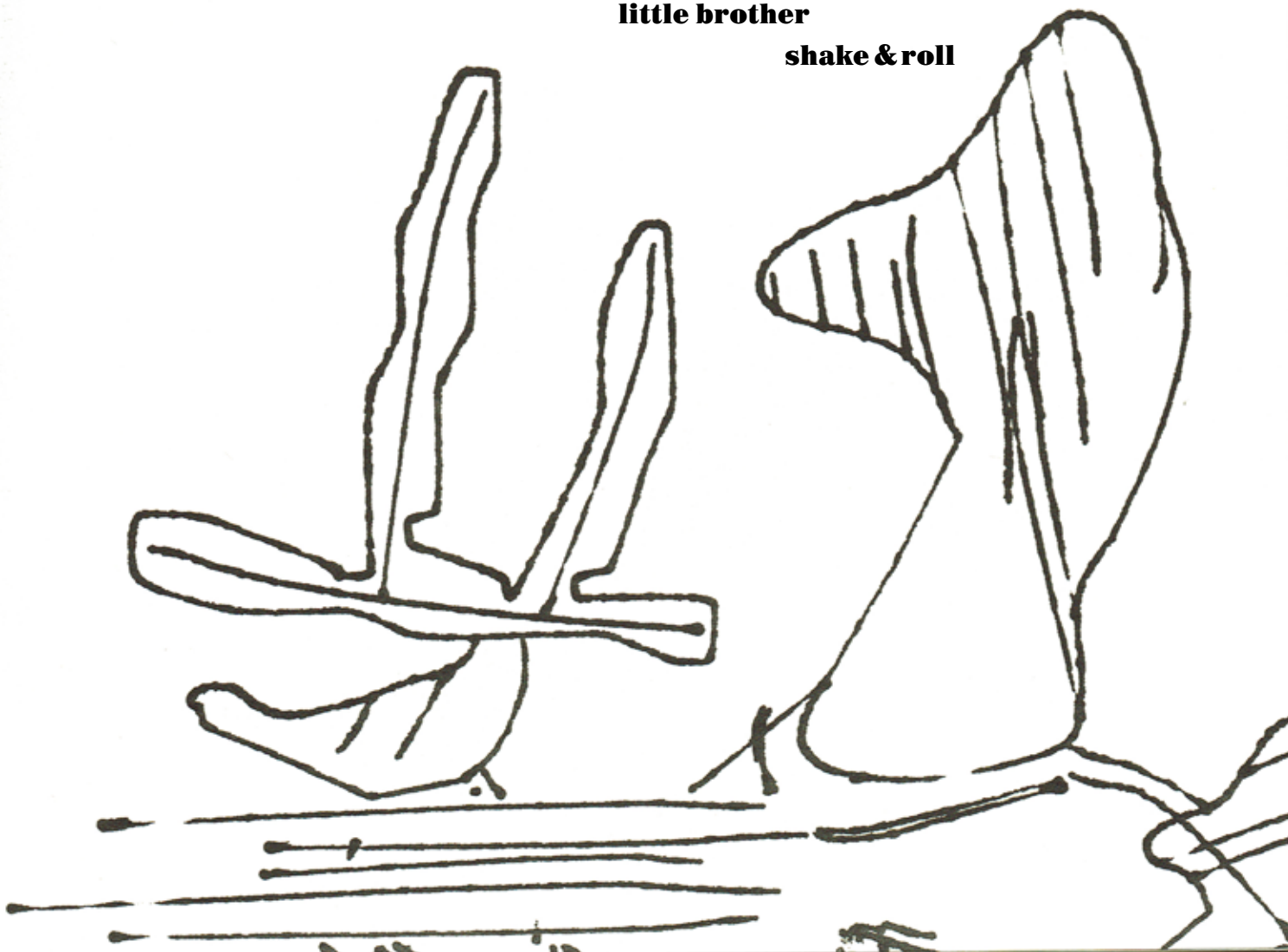your deer hoofs

shake? why not vibrate

cocoons

strapped to your ankles

brother

shake them

little brother

shake & roll

six

in one tree

        one stick

               who makes the sound of cracking

cracking wood?

        in one tree

           one stick

who makes the sound of cracking

        cracking wood?

            there in the flower world

the tree world

        you do not have my

           long grey body

in one tree
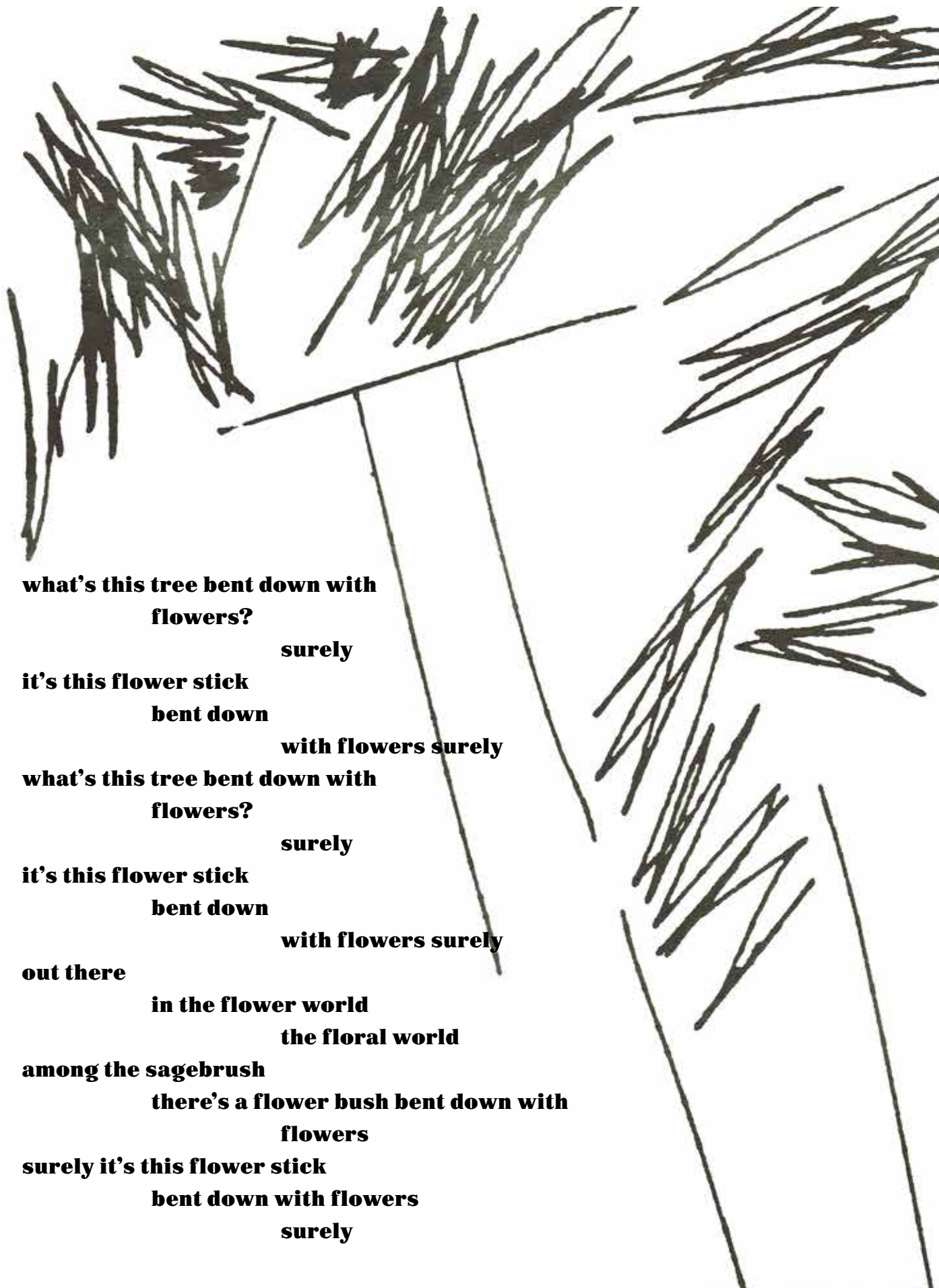
        one stick

           who makes the sound of cracking

cracking wood?

seven

what's this tree bent down with
        flowers?
                surely
it's this flower stick
        bent down
                with flowers surely
what's this tree bent down with
        flowers?
                surely
it's this flower stick
        bent down
                with flowers surely
out there
        in the flower world
                the floral world
among the sagebrush
        there's a flower bush bent down with
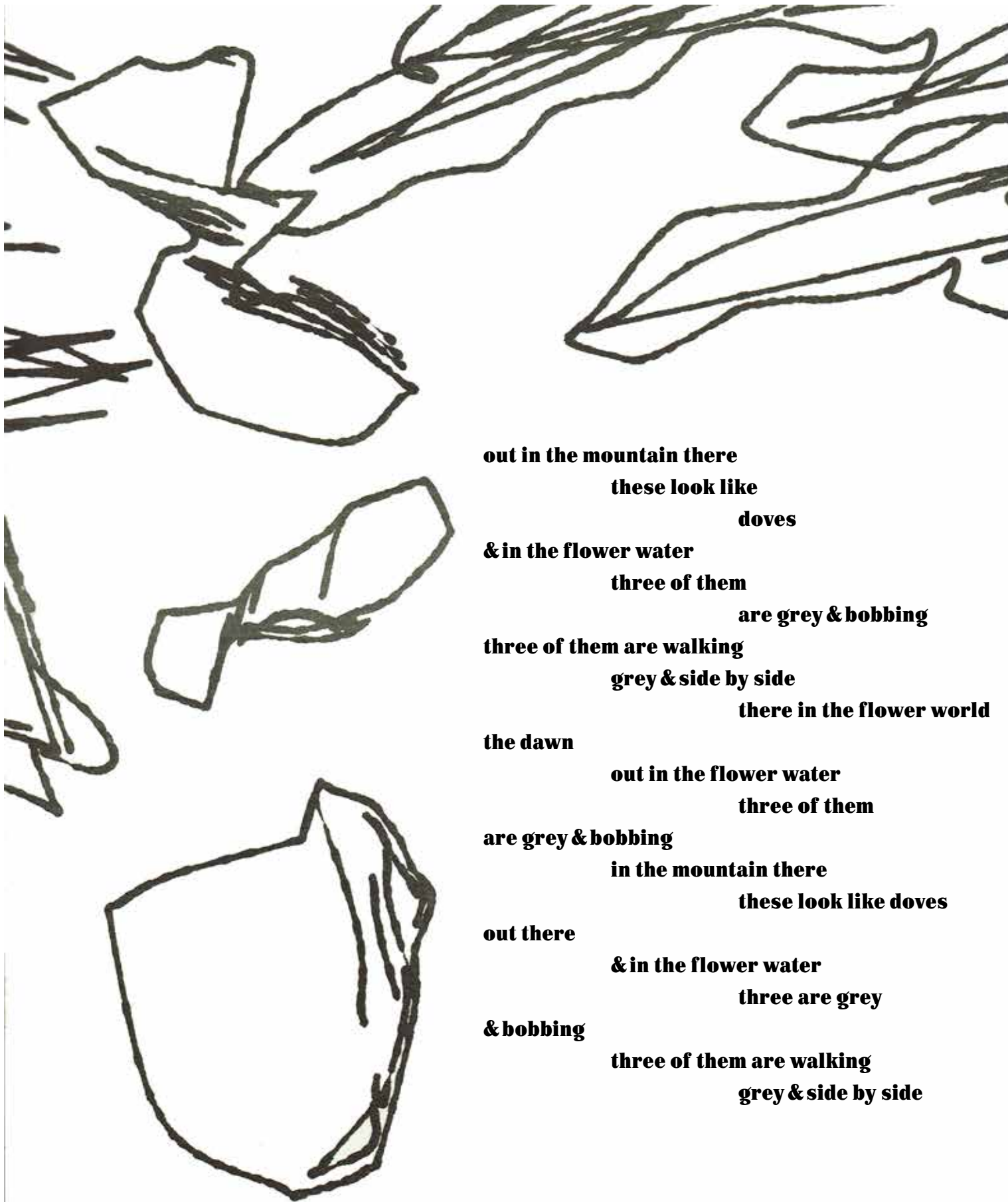   flowers
surely it's this flower stick
        bent down with flowers
                surely

eight

out in the mountain there
     these look like
          doves
& in the flower water
     three of them
          are grey & bobbing
three of them are walking
     grey & side by side
          there in the flower world
the dawn
     out in the flower water
          three of them
are grey & bobbing
     in the mountain there
          these look like doves
out there
     & in the flower water
          three are grey
& bobbing
     three of them are walking
          grey & side by side

nine

you
        like a mountain squirrel
             old enchanter
sounding large
        & like a mountain squirrel
             old enchanter
sounding large
        & like a mountain squirrel
             old enchanter
there in the flower world
        the dawn
             there in its light
that big place over there
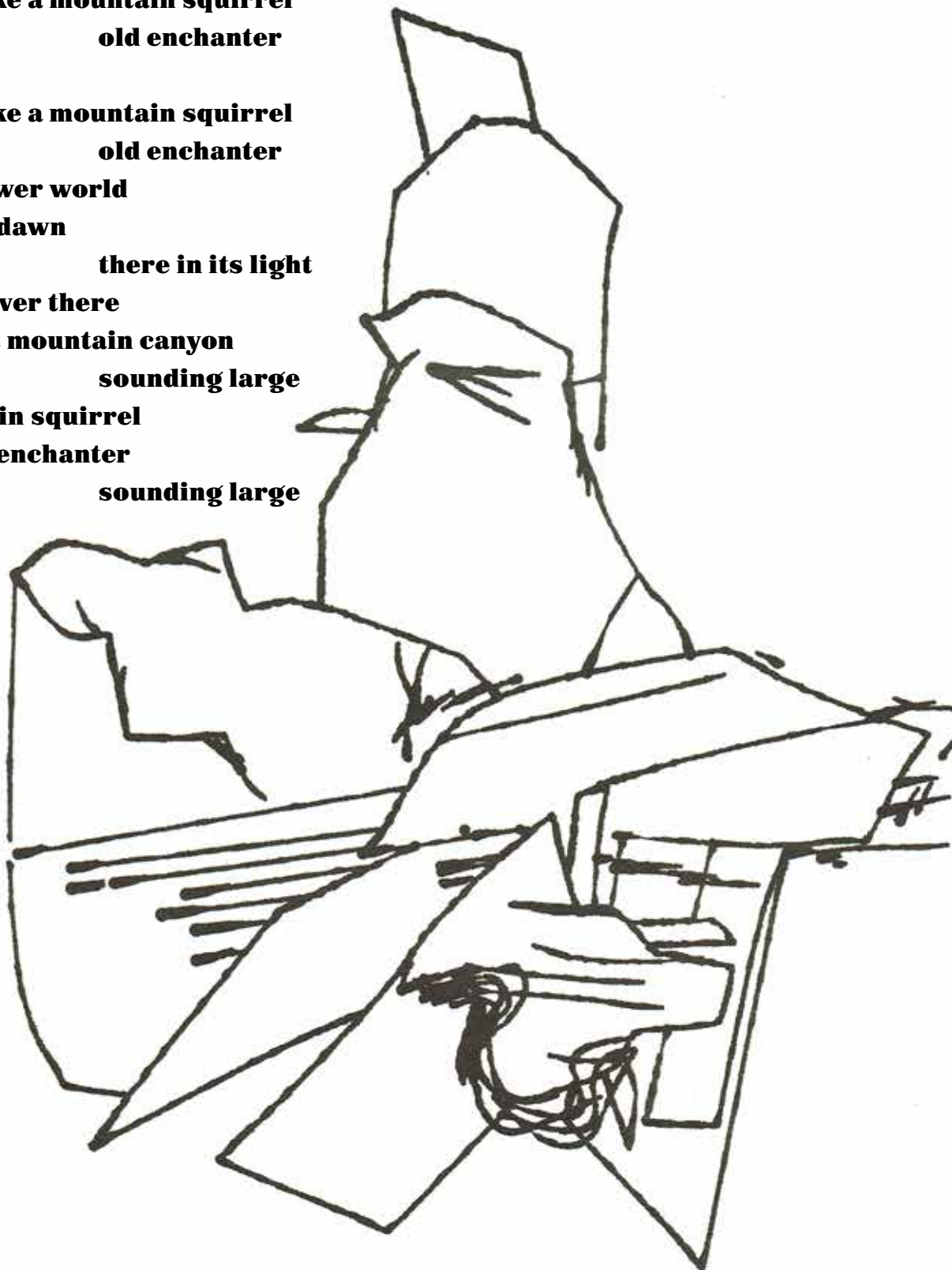   that mountain canyon
             sounding large
& like a mountain squirrel
        old enchanter
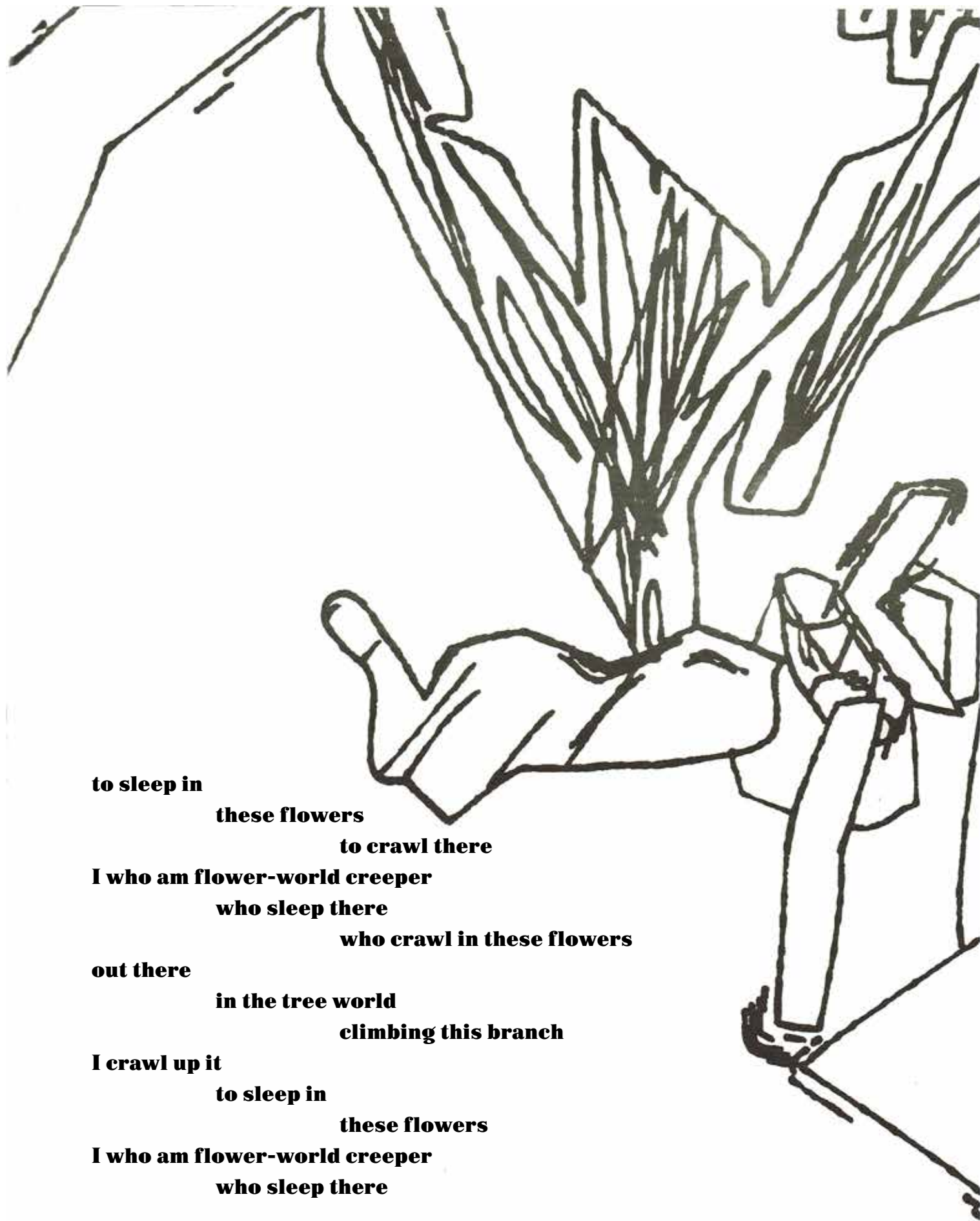   sounding large

ten

to sleep in

        these flowers

            to crawl there

I who am flower-world creeper

        who sleep there

            who crawl in these flowers

out there

        in the tree world

            climbing this branch

I crawl up it

        to sleep in

            these flowers

I who am flower-world creeper

        who sleep there

eleven
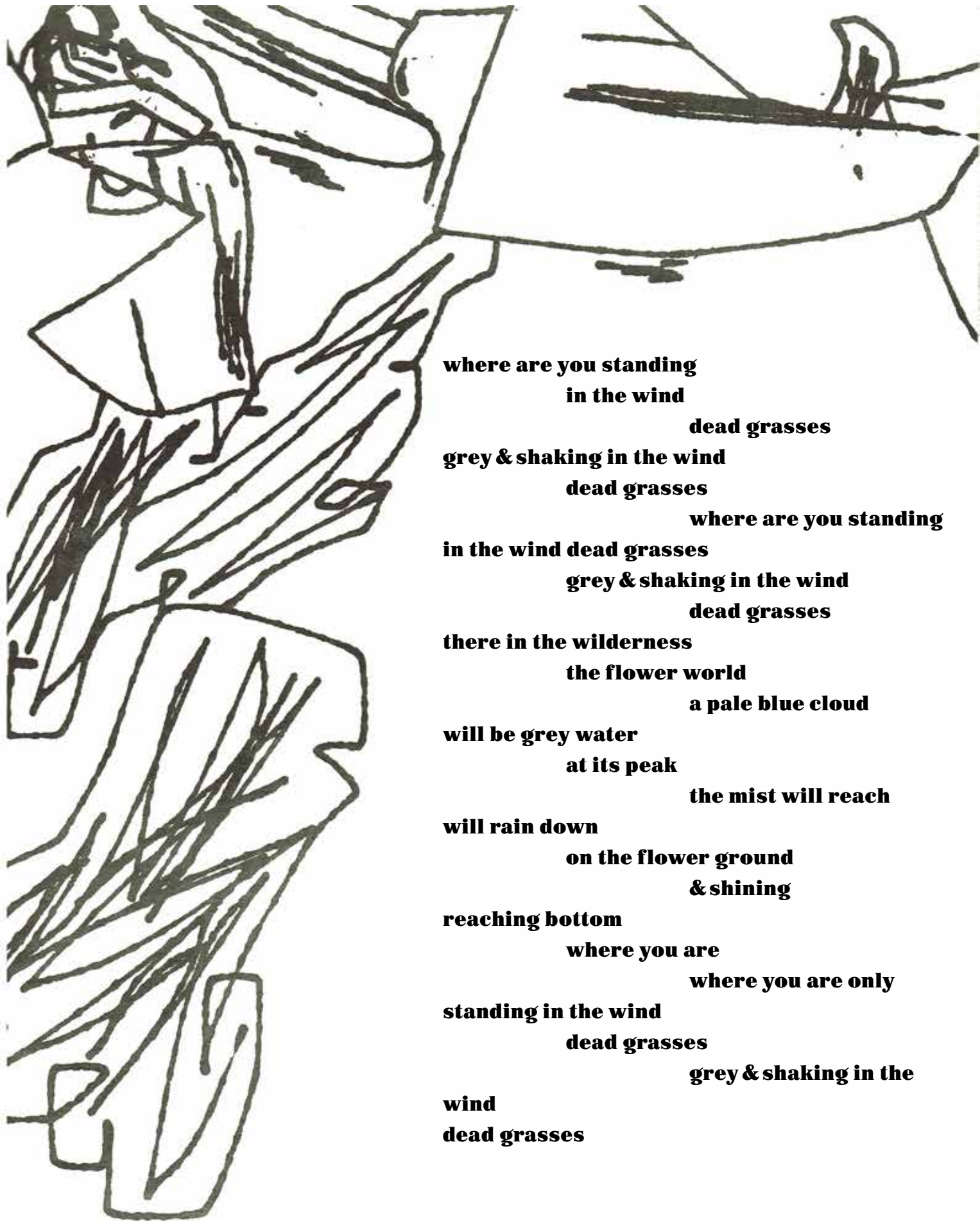
where are you standing
      in the wind
            dead grasses
grey & shaking in the wind
      dead grasses
            where are you standing
in the wind dead grasses
      grey & shaking in the wind
            dead grasses
there in the wilderness
      the flower world
            a pale blue cloud
will be grey water
      at its peak
            the mist will reach
will rain down
      on the flower ground
            & shining
reaching bottom
      where you are
            where you are only
standing in the wind
      dead grasses
            grey & shaking in the
wind
dead grasses

twelve

ah brother
        they want us to kill
                this beaver
they want us to kill
        ah brother
                this beaver
this beaver
        ah brother
                they want us to kill
with a bow & arrow
        they want us to kill it
                ah brother
with hair standing up
        this were waiting
                & ran from us
broke down their doors to get in
        now they want us
                to kill it
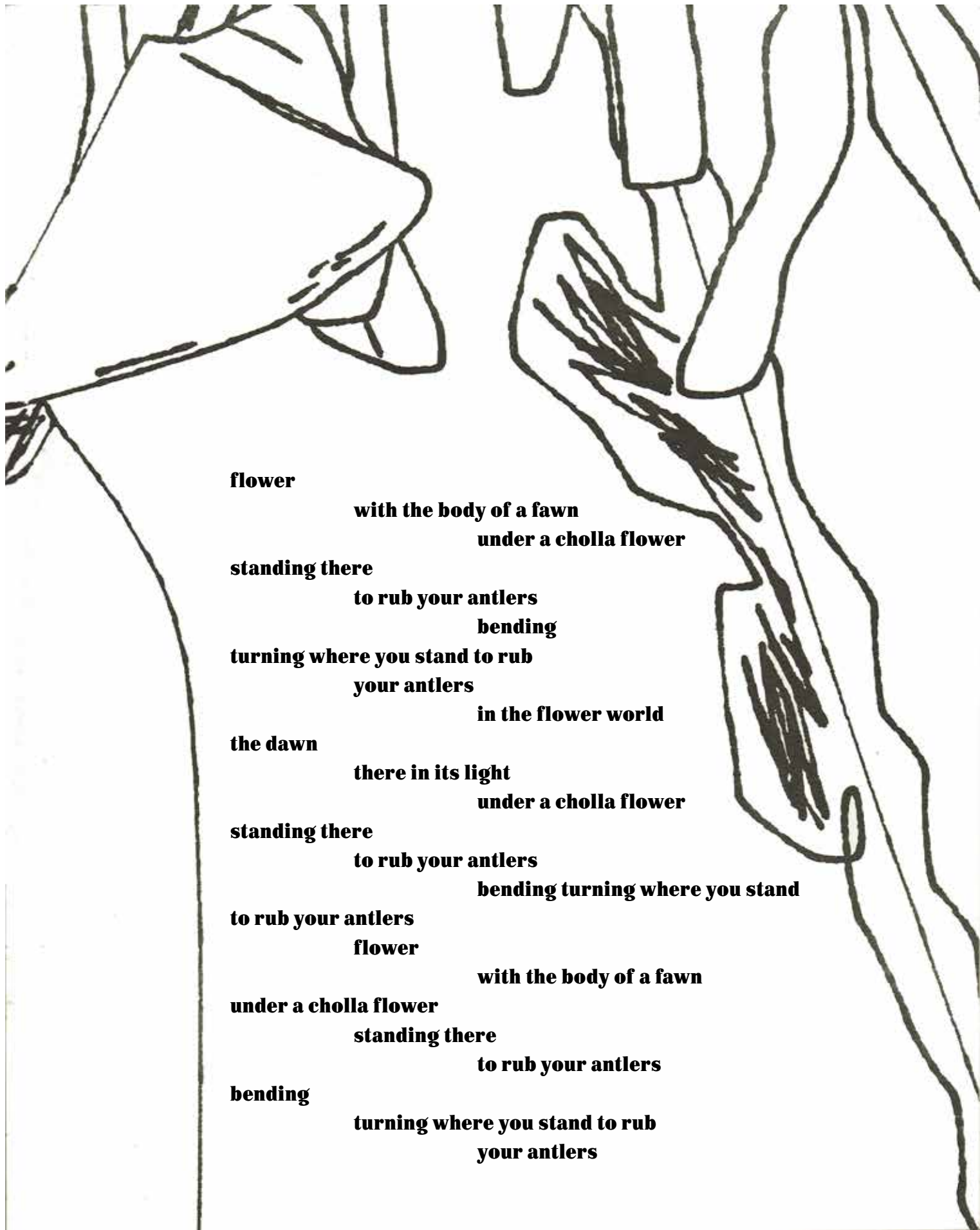ah brother
        with a bow & arrow
                ah brother
they want us to kill it

thirteen

flower
                with the body of a fawn
                        under a cholla flower
standing there
                to rub your antlers
                        bending
turning where you stand to rub
                your antlers
                        in the flower world
the dawn
                there in its light
                        under a cholla flower
standing there
                to rub your antlers
                        bending turning where you stand
to rub your antlers
                flower
                        with the body of a fawn
under a cholla flower
                standing there
                        to rub your antlers
bending
                turning where you stand to rub
                        your antlers

fourteen

Song of a Dead Man

I do not want these flowers
       moving
              but the flowers
want to move
       I do not want these flowers
              moving
but the flowers
       want to move
              I do not want these flowers
moving
       but the flowers
              want to move
out in the flower world
       the dawn
              over a road of flowers
I do not want these flowers
       moving
              but the flowers
want to move
       I do not want these flowers
              moving
but the flowers
       the flowers
              want to move

fifteen

now the cloud
                will break
                                the cloud will break
& now
                the cloud will break
                                the cloud
will break
                & now the cloud
                                will break
the cloud will break
                there in the flower world
                                under the dawn
this pale blue cloud
                will be grey water
                                at its peak
the mist will reach
                will rain down
                                shining
& reaching bottom
                now the cloud
                                will break
the cloud will break
                & now
                                the cloud will break
the cloud
                will break

post-face to the 15 variations (from original printing)

For the last three years (81/82/83) I was witness to Deer Dances at
New Pascua Pueblo in Tuscon, Arizona -- not a spooky other-worldli-
ness, as Castaneda would have it, but the enactment, through reli-
gion & art, of high & brilliant worlds one step outside-the-human.
For these the Yaquis have their own names: huya aniya = enchant-
ed world; or seyawailo = flower world; or, in the language of some
of the younger inheritors, "wilderness" as such. The dance (set
against the parodistic Pascola Clowns as alternative flower world
beings) is tight & classical & contained (always) within the nar-
row space alloted to the dancer. (Constrast, e.g., the Nijinskian
capers of the trumped-up Deer Dancer in Mexico's urban Ballet Folk-
loricao, etc.) It is a wonder to see & to dream back into one's own
language. But the dance, of course, has its language as well, the
words of the accompanying songs; & these, as translation opens them
to us, become the principle means for bringing that flower world
to life. The process, then, is one of singing & stating, re-sing-
ing & re-stating, into a new wilderness "in which," as our old
friend George Oppen has it, "the wild deer/startle, and stare out."

The poems presented haere are from literal translations published in
Carleton Wilder's *The Yaqui Deer Dance* (1963). I have taken the im-
ages as found & have attempted to bring them (again) into song. (The
computer-generated drawings by Harold Cohen act as well as the most
direct analogues I know to a sense of those human/other-than-human
worlds from which the original songs come.) I have no desire other-
wise to argue the poems' veracity (they seem to me no further "off"
than most translations) beyond the question of whether they allow the
image of a flower world to come out in the reading. The presentation,
then, is simply as poems that do the work (or play) of poetry -- in
the belief that the enchanted world is there and here, as a posses-
sion that we hold in common.

JEROME ROTHENBERG

This isn't the place to explain how a computer program can gen-
erate original drawings: please take it as a matter of fact
that during a series of museum exhibitions, between November '82
and October '83, my own program, AARON, generated several thou-
sand. The drawings in this book were selected from among them:
they are details cut from the originals, reproduced here the same
size as they were actually produced on one of my drawing machines.

AARON is the most recent of a line of AARONS, the progenitor of which had kinship, odd though it may seem, to the artists of the petroglyphs of the Californian deserts. I went to those petroflyphs for many of the keys I needed, when I was starting to write programs, fifteen years ago. They seemed to me to embody the clearest account of the raw material of representation-building of any art I knew, and the most compelling evidence we have of the fundamental human-ness of the strategies we use, owing their form directly to the cognitive system itself, for the building of "visual" representations. The earliest AARON is nothing more than a very small subset of these strategies, playing out their own propensities.

I have not lost a sense of debt to my program's early kinsmen. Were they like the Yaqui? AARON's existence reflects the common machinery of human experience, which does not change from culture to culture: perhaps they were no more like the Yaqui than they were like us. But some part of what I found in their drawings I find again in Rothenberg's homage to the people of the flower-world, and that allows me to pay some part of my own debt. A collaboration with a man I love as a person and admire as an artist -- what better occasion for an act of homage?

HAROLD COHEN
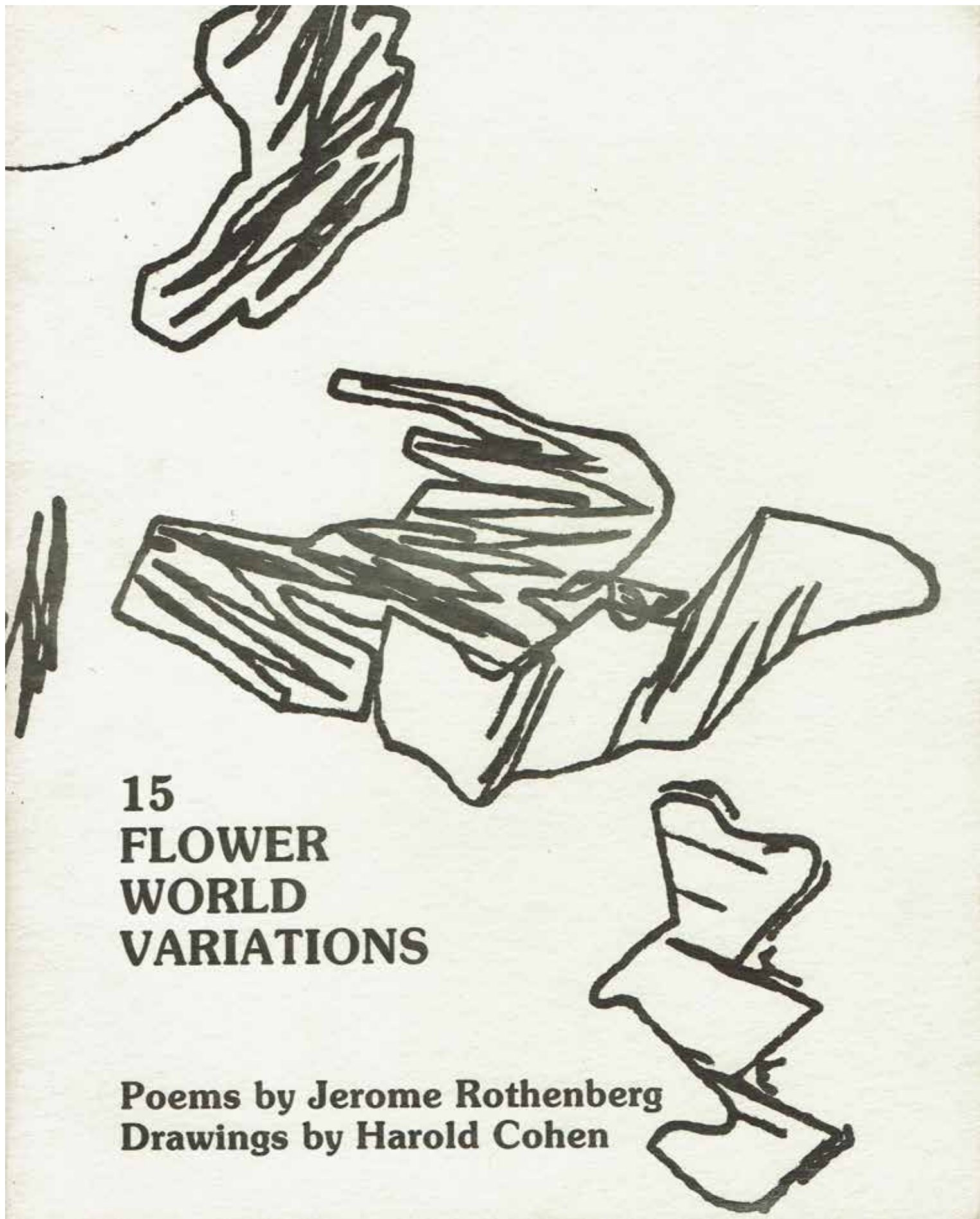
15
FLOWER
WORLD
VARIATIONS

Poems by Jerome Rothenberg
Drawings by Harold Cohen

the material of symbols

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Karin and Sherry are seven year-old twin sisters. They are both in the habit of carrying large bags of colored pens and pencils with them wherever they go, and at every possible opportunity they sit down on the floor and start to make drawings. Those illustrated her (1,2) are entirely typical of their work. Their output is certainly well above average in quantity, but the drawings themselves are in no major respect atypical of the sort of drawings which most Western children might make at some period of their development.

On the same afternoon that these drawings were made, I pro- posed a game to them: I would cover sheets of paper with dots, and they would make their drawings by joining up the dots (3»~)- They both took to the game with obvious enjoy- ment, but also with an unexpected attention to the struc- tural constraints imposed upon their performance by these new rules, which they promptly investigated. One of them wanted to know whether it was permitted to leave some of the dots unused. The other asked whether she was allowed to use the dots as eyes, if she was drawing a face, and in due course she contrived to use the dots also as Christmas tree decorations, snowflakes, sunbeams, and a number of other unspecified objects which she said were falling from the sky (3). In both cases — and I do not believe that this is part of their normal procedure — each drawing was fol- lowed by a long verbal account of the subject matter. After an hour or so the game ended, and they returned to their habitual mode.
There are a number of formal differences in the drawings which re- sult from the two modes which might be dealt with at some length. Their normal practice, for example, is to use the plane of the paper to represent some sort of coherent spatial unity, corresponding very roughly to what we might call a "view". In some of the dotted draw-

ings this practice gives way to a more elemental approach, in which the plane of the paper is used in a manner largely neutral with respect to the images, and the images are disposed upon it without regard to any concept of "natural" ordering in the real world. (By the way, these results are quite consistent with the results of a more extensive set of similar experiments with a drawing class at UC San Diego.

The students there were up to forty years older than Karin and Sherry, and their habitual modes involved different conventions to those of the children; but they were cer- tainly no less conventional.)

But the more immediately noticeable differences between the two modes relate less to the formal aspects of the drawings than to the level of imagination and inventiveness wich Sherry and Karin exercise in making them. When Karin decides to sign her name in a manner appropriate to the game (4), she is making a witty comment about the nature of drawing at a level of insightfulness we might not expect from a seven year-old. If we compare the bird in one of her dot-drawings (5) with the drawing of a duck made just half an hour earlier, we are struck by the fact that she is evi- dently capable of rather acute observation, although it required the setting up of unfamiliar, and presumably chal- lenging, circumstances to allow her to exercise that capability.

What becomes clear, in fact, is that there is a significant difference between an image of a bird, and an image of an image of a bird. The earlier drawing is less a duck than it is a toy duck, less the result of observing what the real world is like than it is the result of learning what drawings — of the world — are supposed to look like. It is conventional in the precise sense that its conventions are the common property of that sub-culture we call children, where their stability is maintained both by the children's desire to conform and by the adult desire that they should.

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I incline strongly to the view that we all spend our lives -- not merely our childhood -- trying to effect an accept- able and workable compromise between the internal demands for the satisfaction of our individual psychic needs, and the demands made upon us by the culture within which we live, for the sake of the stability, if not necessarily the ultimate well-being, of the culture itself. This is not to say that the things we do, like drawings, singing, talking,

fig   6

do not grow from the most fundamental patterns of the mind but that the cultural rules imposed for their exercise may lead to behavioral pat-

terns quite at variance with these deeper ones.

Most children are able to build their early images without difficulty with marks which result directly from simple physical movements, just as the African sculptor has no difficulty satisfying his representation- al needs with conceptually simple forms requiring simple manufactur- ing skills (6). The notion of representation which held sway in Eu- rope for nearly five hundred years, on the other hand, requires the student to spend a minimum of three years persuading his eye to see what it is supposed to see, and disciplining his hand to move as itis supposed to move. These movements are arbitrary with respect to the individual, since they have to be determined by events in the world — the random play of light and shade on objects -- which have nothing to do with the way his shoulder and wrist are articulated. The reconciliation which the artist in this tradition is obliged to make is a striking example of the sort of compromise I am referring to.

We do not pay for our membership of the culture on a one- day-on, one-day-off basis. All our behavior is acculturat- ed to some degree, and any attempt to isolate a discreet behavioral mode which we might think of as "natural" would be fruitless. Yet we might still find in the under- lying structures of behavior aspects which are evidently not fashioned by the constraints of any particular culture, and this would be as close as we might come to a notion of
"naturalness". It will be the tracking down of these as- pects with which I will be concerned, knowing very well that their separation from other aspects is a theoretical one.

Much of our mental activity seems to involve complex schema of entities standing for other entities, and we would prob- ably agree that the ex- ternalizing and manipulation of im- ages, as such, grows directly from basic mind functions. But that area of symbol-manipulation which is directed towards communication between individuals and between groups must obviously involve highly acculturated perfor- mance. For a symbol- ic structure to stand any reasonable chance of being unambiguously un- derstood, its maker must both have clear knowledge of the expectations which the reader will bring to its reading, and be prepared to accept the constraints imposed by those expectations. Communica- tion is pos- sible within a culture only because of existing agreements as to what entity is to stand for what entity, and how it is to be presented to be recognized as doing so. At an even more basic level, this implies also that all the involved parties know about the same entities: which may be true, more or less, within the same culture, but is unlikely to be true from one culture to another.

These would seem not to be very promising conditions for the exercise of imagination, inventiveness, and all those other virtues we associate with the making of art, or, indeed, for our understanding of art pro- duced by any cul- ture other than our own. But I think we have to con- clude that art never has been devoted primarily to the cultural function of communication, and indeed it may never have been thought that it did before our own time. The more his- toric view within our own culture pictures the artist in communion with variously-conceived extra-human sources of inspiration and wisdom,, explicitly acknowledging the fact that if he speaks on behalf of the community, he does not speak with its voice or in terms which will necessarily be understood.

Art history deals with the problem of tracking and identi- fying the transformations which continuously modify the significance of symbols within the changing cultural con- tinuum. But there are other problems of a more fundamental kind which fall outside the scope of orthodox iconology. Any art theory which begins with a view of the artist as serving primarily the cultural need to formulate and transmit explicit meanings inevitably ends up viewing the whole system as a sort of noisy telephone network, in which the receiver strives constantly to recon- struct the original message. Yet the cultural mismatch between artist and viewer must then be a major source of noise in the system, and we account for the discrepancies between what the ar- tist "has in mind" and what the viewer thinks he under- stands, by the notion of "inter- pretation". We do not neces- sarily have any evidence beyond our own "interpretations", however, as to what, if anything, the artist had in mind in the first place.

This emphasis upon the specifically cultural use of symbols has left us without any account of the underlying struc- tures of image-generating behavior more convincing than the Divine Muse, and some contemporary variant of that theme usually passes for explanation. I am always a lit- tle shocked to recall that it is only about fifty years since Paul Klee declared that it is a sin against the Creative Spirit for the artist to work when not inspired. After nearly thirty years spent in making art, in the company of other artists, I am prepared to declare that the artist has no hot-line to the infinite, and no uniquely delineated mind functions. What he does, he does with the same general-purpose equip- ment that everybody has, and if his use of it is in any respect unusual, that very fact points to the need for a model of image-generating be- havior which concentrates specifically upon behavioral mechanisms rather than upon products.

In particular, I believe we will need to adopt a view of the artist as

indulging in the generation of what I will call image-rich material as a self-satisfying procedure primarily, and only secondarily involved in the manipula- tion of culturally stabilized symbols: performing that secondary function, moreover, in a manner more in keeping with the es- sentially self-seeking character of the primary one.

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You will see that I am back to the fundamental dichotomy between the internal psychic, and the external cultural determinants to an individ- ual's behavior. The two are not available for examination in isolation of each other, for the rather obvious reason that human beings live in cul- tures. As far as image-generating behavior is concerned, however, it seems reasonable to speculate that image-rich material arises from the innately human domain, for the reason that the cultural determi- nants which act upon the individual tend, by definition, towards conven- tionalizing; towards the rigid binding of symbol to stabilized meaning. To reflect broader experience more accurately, we have to look, not for symbols which are unambiguously understood within their own culture — however powerfully they may function there — but for material which can flow between cultures, and which is constantly re-used to mesh with new and diverse meanings as it does so. What we think of as our culture is no more than a moment in time, a cross-section of a continuum. All but an infinitesimally small part of all the symbols and symbol-potent ma- terial which reaches us comes to us from other points in time and from other more or less remote cultural states.

In some cases, what we find ourselves responding to comes from cultures so remote that we simply have to acknowledge that we cannot possibly know what its original significance was. I am thinking particularly of the petroglyphs which are to be found throughout Nevada and California (7). We know nothing to speak of concerning the people who made them or what they made them for, or even how long ago they were made. We cannot seriously pretend even to misunder- stand their original significance, and what speculation exists is based upon evidence quite extrinsic to the marks themselves. Yet the generations of anthropologists who have added their speculations to an increasing but unrevealing literature bear witness to the power of the glyphs: the power, not to communicate explicit meanings within the cul- ture within which they arose, but to trigger and direct our own innate propensities for attaching signifi- cance to events.
To account for the pressure which these marks are capable of exerting over so total a cultural void, would we not have to assume that their power derives from the essential- ly human determinants to their mak- ing? that it reflects patterns of behavior so deep-rooted in the human organism as to be considered as constant for all human beings re- gard-

less of their particular patterns of acculturation?

The question would be entirely speculative, not to say gratuitous, if we could proceed only by the analysis of exist- ing examples, for the reason that what is present for analysis is the object, not the behav- ior which generated it. Any plausible conclusion would be exactly as good as any other plausible conclusion in the absence of any possi- ble verification.

I will not claim that my own work offers definitive verifi- cation of any conclusion, but I will claim it as an at- tempt, at least, to deal with behavior rather than with objects. Analysis of a range of objects, from the Califor- nian petroglyphs at one extreme to my own drawing at the other, has served mainly to suggest a sort of minimum con- figuration of deep-level behavioral mechanisms, which have then been used as the basis of a computer program capable of generating and dealing with graphic material.

In other words, the choice of mechanisms was largely intui- tive and arbitrary. I suspected that I would be on reason- ably safe ground if I limited myself, at the outset at least, to what I assumed to be percep- tual primitives, and I selected three: the ability to differentiate be- tween figure and ground, to differentiate between open forms and closed forms, and to differentiate between insideness and outside- ness.

Since the choice was arbitrary, I did not think it needed further jus- tification at that stage of a questionable un- dertaking. Yet I thought that actually justification could be found: both in the fact that young children evidently differentiate between closed forms like circles and trian- gles, and open forms like crosses, well before they are able to differentiate between circles and triangles: and also because of the persistence, throughout the long human history of mark-making, of mo- tifs like mazes. It seemed to me that much of what we grace with the name "primitive" actually demonstrates a sophisticated awareness of the nature of the perceptual open/closed duality, for the fas- cination of the maze — the image, I mean, rather than the
physical maze — must surely rest on the difficulty of knowing at a single glance whether it is open or closed.

The point of the strategy — the building of a computer program — was not to see whether the presence of these behavioral primitives would add a sense of authenticity to the output. It was to see whether the program could gen- erate image-rich material In a controlled context where it would be clear that the effect was not the result of some- thing else. That would certainly not have been the case if I had tried to limit my-

self to any particular set of behavioral primitives, and I have taken some care to see that I do not influence the running of the program. As it has been designed, it operates without any human assistance or intervention. There is no way to interfere with it while it is running, and no convenient way to change its parame- ters before the start of any drawing.

Much more important, it has no data at its disposal: no lexicon of pre- viously-described forms which it could pull out, run through a variety of transformations, and assemble into a picture. As a matter of fact, it has no transforma- tions available to it, either.

An argument could be made, of course, that the whole program consti- tutes a process description of its output, although it would then have to be seen as the description common to an endless array of different drawings, since the program never produces the same drawing twice. But the sig- nificance of the lack of data is a more complex one. There is no difficulty about writing a computer program which generates drawings endlessly, depending at least upon what "different" is understood to mean. Here the question was whether the degree and kind of different- ness would correspond to the variety we might expect from a human im- age-maker. Would the individual drawings, generated in the absence of any knowledge of the world and its objects, nevertheless function as though they were made by a human image-maker, in the sense that they might appear to be mak- ing reference to the world and its objects?

The answer seems to be affirmative, at least to the degree that most people evidently have some difficulty in believ- ing that the drawings (8-10) were not made by a human ar- tist: an artist, moreover, with a distinct sense of humor and a marked tendency towards narrative.
As the prime mover of these drawings — I still have some difficulty re- garding myself as their maker in any conven- tional sense — I find my- self in a curious position involv- ing a not-too-serious parody on the notion of divine in- spiration. It takes about two weeks after seeing one of the drawings for the first time for me to lose my awareness of it as machine output. I can hardly regard it as my own, because I have no recollection of having participated phy- sically in its making, and it seems to have come to me from another time and place. We might see this as a comment on the persistence of myths, perhaps. But if romance dies hard, the facts are left to be accounted for. If we find elements in these drawings reminiscent of African masks and comets, figures sug- gestive of turtles and submarines (10), it is a fact that the elements and figures which evoke those objects were made by the program. It is also a fact that the program knows nothing of African masks, comets, turtles or submarines.

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Explaining how these effects come about in the absence of any specific intentionality is difficult, primarily because they cannot be identified with the action of individual parts of the program. There is, I mean, nothing like a sub- marine subroutine. In form, the program is a pro-duction
system; and, like other such systems, this one accomplishes two things. It describes the conditions which may arise in the world of the program — in this case the developing drawing — and it lists the acceptable re-sponses to partic- ular combinations of these conditions.
The left part of a production tests for the patterns, the particular combinations of conditions which characterize the state of the world at any moment. The right part of a production changes the state of the world, since all the acceptable responses act upon the world directly or in- directly. The new combinations of conditions will then be trapped by other productions; and the process continues, in this event-driven fashion, from the initial empty state until one of several world states elicits the response that the drawing is done.

The left part of a production is able to recognize that a form is closed rather than open, just as the right part is able to produce a closed form, or effect closure upon an open one. A complete production might recognize that part of the field of the drawing is occupied by a closed form with another closed form inside it; and that it is sur- rounded by similar closed forms, all of which have been shaded in one way or an-other (11). And it might respond — for example — by shading the figure, leaving the inner one as a hole in the middle.

But references to closure, to space-filling, and to repeti- tion occur throughout the production system in both the left and the right parts. They constitute, not a set of rules so much as a set of protocols, the complex intertwin- ing of which gives the entire program its particular iden- tity. They are best considered as characterizing the program's world rather than as controlling how the program is to behave within that world; as characterizing — if I risk anthropomorphizing a little too far — what the pro- gram understands its world to be like.

Space-filling and repetition are two of several protocols which have been added to the program since the outset, most of them simply extending upon the initial ones. I mean that shading is a way of underlining the closedness of a closed figure, and the program now knows a number of ways in which that can be done (12). A recent extension to the figure- ground protocol requires the program to respect the terri- torial integrity of previously drawn figures. This one results in some of the more un-predictable and evocative configurations; though it is never easy, even

watching the drawings being done, to keep track of what is causing what.

Adding a single new protocol to a program is more like adding a whole new conceptual complex to a human's world model than it is like adding a new behavioral rule, and it should not be surprising that the complexity of the draw- ings increases rapidly for each added protocol. This seems to suggest that the program structure is appropriate to the requirement of variety which I noted earlier, since it seems unlikely that human output increases in variety only at the cost of extremely large rule-sets.

I have not yet had sufficient time working with a reason- ably well-developed program to reach detailed conclusions on the nature of that variety, and on how the enmeshing of the different protocols produces it. But it does seem clear that it is the enmeshing, not the individual protocols, which is responsible. Note, for example, that although one drawing may exhibit more sophisticated space filling — shading — abilities than another, it will not have the same evocative force as a "simpler" drawing which exercises both open and closed protocols (cf 10,12). In fact, I think there is evidence to suggest that in the presence of closed forms, open forms take on a distinctly differentiat- ed function, providing a kind of semantic connective tissue for the semantically dominant — more obviously object-like
— closed forms. It is certainly the case that the spatial relatedness of the figures significantly affects their individual reading.

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There is one further aspect to the program, having to do with task-oriented behavior rather than with perceptual behavior, which I should touch on briefly. It controls the way in which the program goes about the actual production, and the physical articulation, of the simulated freehand line from which the drawings are built.

I quickly came to the general conclusion, when I first became involved in computing, that human drawings are po- tentially interesting to human beings at least in large part because they have been made by other human beings; and that for a machine to inspire a similar kind of inter- est in its products it would have to make its drawings in the same sort of way that humans produce theirs. Of course, every- thing I have been talking about has been an effort to elu- cidate what that "same sort of way" might be, but I am thinking now specifically about the lowest-level business of driving a pencil from one place to another.

What seemed certain to me, and still does, is that freehand drawing involves an elaborate feedback mechanism, a con- tinuous matching of

current state against desired end state and a continuous correction of deviation, essentially like the mechanisms we use to thread a needle, or drink a glass of water, or drive a car. Most of the time the feedback is required -- and the artist can claim no exemptions in this regard — by the unpredictability of the equipment we use, whether that unpredictability is caused by arthritis or worn bearings, lack of muscular coordination or sloppy steering. We do not optimize in freehand drawing, and it never seemed to me that the dynamic qualities of drawing would be captured by spline interpolations. Indeed, it never seemed to me that those qualities would be reproduci- ble by trying to mimic appearance at all.

Imagine the problem of driving your car off a main road, where you are facing in one direction, into a narrow drive- way at an arbitrary angle to it. Unless you would proceed by planning your whole course in advance and then closing your eyes and stepping on the gas, you will probably be doing very much what the program does. Given the task of getting from one place, facing in one direction, to another place and facing in another direction, it never knows how to accomplish the entire task, but "imagines" a series of temporary destinations, each of which will bring it a lit- tle closer to approaching its goal from the specified direction (13)' A degree of randomizing is provided as an analogue for arthritic joints, and as it never had any pre- cisely defined path to follow anyway it corrects for accu- mulating discrepancies only when they become big enough to jeopardize its chances of ever reaching its final destination.

It never knows in advance what will constitute a complete path, and it never fails to complete its path. This part of the program is non-trivial, and certainly not optimal, involving as it does a complex series of decisions for every one of the small line segments which go into the building of a line. But I believe the simulation is a good one, and I have found it possible, moreover, to modify the character of the line — the artist's "handwriting" — by the manipulation of such thoroughly practical factors as the rate at which sampling is done, the suddenness with which correction is applied, and the frequency with which the program sets up new "imagined" destinations along its path.

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It seems to me that most of the things one might say about image-building might be said equally about image-reading. The reason for this, I think, is that the element common to both — the propensity for attaching significance to events, for endowing entities with identities — is also an overwhelmingly important one. It is not the unique property of artists, obviously.

This is not to say that the identity which the viewer at- taches to a complex of marks is exclusively a function of the viewer's propensity, or even that any complex of marks would serve equally well to trigger that propensity. The natural world is full of complex forms, and if we sometimes play with them -- clouds, for example — we are well aware that their "meanings" are our own invention. Marks which we recognize as being man-made, on the other hand, -- and in particular those man-made marks which we see as arising from an intent on the part of the maker to communicate -- these we treat in a special way, not merely assign- ing sig- nificance to them but insisting that that significance has been carried by the marks themselves.

I believe that in searching images for evidence of their origins the mind is surprisingly literalistic. If a machine program is able to pro- duce image-rich material, it does so by virtue of persuading the viewer that the maker was a human being living in a human world, and that his intent was to communicate something about that world. The assump- tion of intentionality precedes the "reconstruction" of intent.

In this case the simulated perceptual mechanisms give evi- dence of the underlying humanness of the drawing's manufac- ture and the drawer's world — though perhaps any other set of reasonably low-level mechanisms would have served equally well — and the constant complex decision-mak- ing which actually takes place, and which is clearly evident in the articulation of the line, confirms the viewer's belief in the artist's intentionality.
This conclusion is not adequate to account for the more highly partic- ularized readings which seem to attach to the drawings — notably the humor and the sense of narrative —
and I do not know at this stage how they are to be accounted for.
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It became evident from the questions and the private dis- cussions which followed this paper that my use of the label "protocol" had done more to confuse than to elucidate the conceptual unit to which I had applied it. Reviewing that usage, it becomes apparent that my understanding of what the program is doing — what roles the different elements in its structure play — has shifted with time, and I have been careless enough to carry over to a slowly emerging construct a term inappropriate to it, but unfortunately still more or less appropriate to something else. The un- derlying confusion has been my own, of course, and I am glad to have been presented with this opportunity to try to resolve it.

Given the choice between rewriting the paper and extending it with a

post-scripted commentary, I have chosen the lat- ter course. This gives
me the chance also to deal in a more measured fashion with one particu-
lar question which is evi- dently quite troubling to a good many people.

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I suggest above that what I call a protocol is best regar- ded as char-
acterizing what the program understands its world to be like, not as a
rule which controls how it is to behave in that world. A rule is ex-
pressed within the pro- gram by a production. A protocol is not fully
expressed by a production. I would not want to change any of this — ex-
cept the use of the word "protocol" itself — but the problem is that
nothing has been said about the structure, or what we might call the
dynamics, of the characteriza- tion. In the absence of any overview
clearly differentiated from the rule-oriented schema to which the char-
acterization must obviously relate, the mere assertion that a protocol
is not simply a rule is hardly sufficient to expunge the sense that it
is.

So be it: let me return "protocol" to the rule-oriented domain whence
it came. In its place, and hopefully more fully expressive of the con-
ceptual complex it is meant to carry, I will use the term "epimorph".

An epimorph characterizes what the program understands its world to be
like, and the machine draws in a human, or quasi-human, fashion because
its set of epimorphs are closely modeled on human epimorphs. We might
go as far as to say that it exercises a subset of human epimorphs. In
dealing with the dynamics of the characterization process, then — and
thus in attempting to elucidate what an epi- morph is — it may prove
more revealing to consider an example of human, rather than machine,
performance. Here is one taken from the drawing class mentioned earlier.

A brief background account is in order.

Two weeks into a deliberately dislocative class — people bring such
rigidly formulated notions about drawing to a beginning class! — one
struggling student volunteered the view that drawing was, as far as he
could tell, "just a question of getting from one point to another". Al-
ways hap- py to take what is offered, I proposed that in that case they
might get into the business of drawing more freely if they didn't have
to worry about the points. Each of them could provide an array of dots
for someone else, who would then only have to figure out how to get from
one to
another.

In practice, it required fairly rigorous measures to ensure that these
dot arrays did not carry any representational weight of their own to
constrain subsequent performance. Eventually we had two sets of draw-

ings, thirty-four in all, pinned up for examination, and before any discussion began I asked the students whether they could write down the rules which they had followed in joining up the dots. They all wrote down the same three rules! — 1. see if you can see an image in the dots, and if so draw a line around it: 2. if you can't see an image, draw closed figures anyway: and, 3. if you can't do 1 or 2, fake it. "Faking it", on questioning, turned out to mean using open structures like short straight lines, zigzags, and so on, as space filling.

Examination of the drawings themselves showed that there were several other rules of a more surprising kind opera- ting. Consider that any dot in an array might potentially become the junction of an indeterminate number of lines joining it to any number of other dots. Of the simpler cases, the order-two case denotes a dot on a continuous line, the or- der-one case marks the end of a line, and the null case is a dot which has not been joined up to anything. Karin's "eyes" would be an example of the null case.

Since the drawings all contained between a hundred and two hundred dots, we might guess that there would be considera- ble variety in the numbers of lines joining at these junc- tions: in fact, we found only three cases of order-four, and only two cases of order-more-than-four, junctions, in the entire set of thirty-four drawings. Over 99.5 t> of the dots had three lines or less attached to them! (A similar situa- tion will be observed in the drawings of both Karin and Sherry, figures 3 and 4.)

The students were certainly unaware, until it was pointed out to them, that their behavior had been constrained in this way, and were even a little resentful of the sugges- tion that they had done anything ac- cording to rules of any sort. Yet, curiously enough, there were a few cases where "extra" dots had occurred when two lines had been allowed

to cross, and in all these cases the students concerned reported a strong sense of having done something wrong, broken some powerful though unstated rule. The class as a whole evidently recognized an un- stated interdiction against crossing lines also, and unanimously agreed that these "extra" dots should not be counted as order-four junctions.

Consistent though this behavioral pattern was, it only required atten- tion to be focused upon it for It to change. The discussion which fol- lowed the making of these drawings evidently identified "junctionality" as an issue, and although nothing was said about what might constitute ac- ceptable behavior in relation to this issue, the drawings which followed in subsequent weeks all contained a much richer distribution

of order-more-than-four junctions; we discovered also that their use involved increasingly com- plex, but hardly less consistent, rule-sets than we had found at the beginning.

We need not go into detail here on the precise nature of these new rules. The point is that they could all be described by a production-like par- adigm involving as- sessment of the current state of the drawing — in relation to junctionality among other things ~ on the left side, and some action resulting in a change of state — through the manipula- tion of junctionality among other things — on the right side. The notion of junctionality itself would not be adequately expressed by any one of these produc- tions, however, and it clearly exists on a "higher" hei- rar- chical level than that of the individual productions. It has become one of the issues which the student believes to be significant in rela- tion to the domain of drawing, and thus characterizes what he believes that domain to be like. It is in this sense isomorphic with those oth- er issues of territoriality, openness/closedness, containment and re- petition, which I said characterized what the program understood its world to be like. It will be clear from this account that of these, at least openness/closedness is also an active epimorph for the human: but I am sure that more extensive evidence will be found in a wide variety of ma- terial, and in domains not limited to drawing activity.

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One of the questions I was asked — not for the first time, by any means — was: am I proposing that the machine pro- gram constitutes a model of human creative behavior? Is it a sort of automated surrogate Harold Cohen?
A full answer would go far beyond my present scope — and, indeed, my present abilities -- and would involve all those other troubling phil- osophical questions which the existence of the computer inevitably raises. A short answer would be that human beings live in a real world, and their internal representations of that world include reference to its objects: the current state of the program knows nothing of the real world or of its objects. Human beings learn from experience: the program begins each new drawing without any memory of previous drawings, and with its production system unmodified by having made them. In these and in other respects the machine's performance is not merely less than, but is unlike, human performance. It should be stressed, however, that these are limitations in the current state of this program, and are not to be regarded as intrinsic to programs in general.

Most searching questions about the nature of the machine turn out to be questions about the nature of people, and this one is no exception. Before we could venture a more complete answer we would need to con-

sider what we really mean by creative behavior, for if that is to be judged exclusively in terms of the manifest results of its exer- cise — we know so-and-so is creative because he makes a great many original images — then clearly the machine is extremely creative. It's drawings are probably as good, as original, as any I ever made myself, and I am hopelessly outclassed by it in terms of productivity.

But once we have stripped off these layers of the artist's activity which have to do with marketable objects, with the desire for approval, for fame or for notoriety, with propa- ganda for this religious be- lief or that economic system: once, in short, we have stripped off the artist's public and cultural functions, how will we characterize the remaining private, essentially self-serving, functions? What does the artist make images for?

My own view can be stated briefly and without oversim- plifying too far. I believe that the artist is engaged, as everybody else is, in building internal representations of his world, and that his behavior is remark- able in only two major respects. The first — and this seems to me to be a feature common to art-making, science-doing, philosophy, mathematics, and most other higher intellectual pursuits — is that the formulating and continuous reformulating of mental models is carried on as a fore- ground, and as a highly structured, activity: not as a background ac- tivity. The second is that he exhibits a high level of preoccupa- tion with the structure of representation as such.

In neither of these respects does he require special mental equipment, and indeed I would assume that the cultural value of his activity, the extraordinary regard in which images are held, rests upon the fundamen- tal normality of the mental functions exercised. I mean that the basic structure of all internal model building is the assignment of associa- tive reference: what we might call the "standing-for-ness" principle. We would not be going too far to regard art as an endless explorative game built around the presumably universally human fact that things can stand for other things.

The playing out of this game produces images, normally embodied in ob- jects, which may be valued by the culture for any of a number of rea- sons. For the artist, it is the play- ing out of the game, and thus the making of the object — rather than the object itself — which is important. If object-making is the means to an end, the end is not the object — art objects are interesting to the degree that they stand for something outside themselves — but the con- tinuous development of new moves in the game. Externaliza- tion is a part of the artist's method- ology in the building of internal representations of his world: a world which includes representations as a central feature.

We are now in a position to generate a slightly more com- plete answer to the original question, and I think we will find that the view which the question proposed — that the program is an artificial artist capable of creative behavior — is both more than and less than adequate. The program does not develop new game-states: it plays the legal moves in the current game. It says "Let me tell you about my world", but rich though that world may be, the telling does not result in any further enrichment. We thus have no reason to say that the machine has any in- terest in the one feature I have chosen to regard as fundamental to human art-making — the continuous development of the in- ternal repre- sentation of the world.

To this degree, it is clearly an inadequate model of human performance: which is not to say that no program could ever provide an adequate one. On the other hand, it does not merely model the playing of legal moves in the game, it actually plays them. To this degree the program is not a model of human performance at all. It carries out a real, and rather extensive, part of the art-making procedure, and its output is in ev- ery important respect interchangeable — both culturally and privately — with output which might result from more orthodox art-making proce- dures. MY world changes as a result of the program telling about it, and in the long term the program changes also. I assume from this that I will go on working on the one program indefinitely, without ever feeling the need to abandon it and start on a completely new one.

Some caution is in order. I have reached this point in many conversa- tions to be told "Oh, you mean that the computer is just a tool." The answer to this is that the advent of the electronic computer requires a total rethinking of what tools might be, for if the thermostat and the speed governor are exactly equivalent to biological feedback systems, com- puter programs are potentially exactly equivalent to intel- lectu- al feedback systems. We have a long way to go before we fully comprehend the shift in significance of "tools" capable of the independent exercise of reason.

I have said several times that the limitations attaching to this pro- gram should not be regarded as fundamental limita- tions in programs. I do not know what will change, for example, or how they will change, when this program does have some knowledge of the world, and can make decisions about the drawing in terms of that knowledge: or when it can use its memory of past drawings as a determinant in building new ones.

Prediction is a hazardous game, and I will limit myself here to only one. I do not believe that any program will ever produce art unless it was written by an artist — as the words have been defined by this discus- sion — and its running serves a vital role for that individual in the

changing patterns of his internal model building. The Sci-Fi fantasy of putting an artist's "genius" on tape and flooding the world with his work after his death, or of becoming a great composer in the twentieth century by wri- ting a program to generate Bach: these merely reflect the confusion of art with its objects.

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