A CONVERSATION:

Heinz von Foerster & Moshe Feldenkrais

1977

This is a transcription of a conversation between Heinz von Foerster, Ph.D. and Moshe Feldenkrais, D. Sc. that took place when Dr. von Foerster was invited to address the San Francisco FPTP in the summer of 1977. The training program was in its third year at the time of this conversation. This transcript was originally compiled and edited by Dennis Leri and Lynn Sutherland.

Heinz von Foerster was born in Vienna in 1911. He completed his Ph.D. in Physics and after the Second World War moved to the United States with his family to join the staff of the Department of Electrical Engineering at the University of Illinois in Urbana. Dr. von Foerster is considered one of the founders of the field of cybernetics and systemic thinking. He is a constructivist, cybernetician, mathematician, physicist and philosopher who has had a profound impact on the scientific conception of "objectivity." He collaborated over the years in his research with Margaret Mead, Gregory Bateson, Humberto Maturana, Francisco Varela and Moshe's close friend Noa Eshkol. Ed.

Moshe Feldenkrais: Do I see Prof. Heinz von Foerster? Would you please come in. By the way, here we have a distinguished guest whom we welcome with great pleasure. I have had a close relationship with you for many years. I am a close fan of Wittgenstein. He has something to do with you.

Heinz von Foerster: Do you know him?

MF: No, I am not a personal friend of his. I know him from his books and I know several people who worked with him. Would you mind watching us for a few seconds?[There is an ATM in progress, Eds.] Then we will try to benefit from your wisdom.

Do any of you mind while I take a few seconds to explain to Heinz what we do? I don't want him to be completely out of gear. We are near the end of our training. Roughly speaking we think of the pelvis as .... If you want to improve, you must clear the ground upon which you stand. It means that with the most elementary thing, you need a greater intelligence and understanding than for any complicated thing you can

do. If the basis is improved, then your structure is safe, more pliable, more flexible.

Here we are trying to improve the movement of the head. We give the example that the pelvis has all the strong muscles of the body. It has the gluteal, the quadriceps and the abdominal muscles. Any of the strong muscles are in the pelvis. Certainly you can say that any of the strong movement which carries the body depends upon the pelvis. That means it is the power station. This power station does not know what to do.

The head, which has all the teleceptors .... All the things which connect us to the outside world, the social environment, and to other people must be done by turning the head. Therefore, the way the head moves and works around the vertical, the way we talk, the way we move, and the way we smile is a clear indication of the way we are wired in from childhood to now. Any improvement in that will improve our ability to cope with ourselves and the outside world. Between those two—we liken the thing to a submarine and a periscope. The power station, the pelvis, is the submarine and the periscope, the head, which has a long connecting rod, looks at the world, looks around, and tells the station what to do and where to direct the power.

If that scanning device gives false directions or distorts the thing by its own limitations, then it directs the pelvis to do things which he doesn't know. There is a connecting rod between the two. This means the thorax and the spine. The spinal chord and the musculature will be organized to do futile sorts of things instead of doing the best for the nervous system. So, there we are.

Now we are doing the movement of the head. We have said that the organization of the heads in this room is a little bit better than the average. In fact, you can see....

I say we cannot do anything unless we know what we do. If we know what we do, we can do what we want. Before you can correct an error, you must first know the error. Otherwise, if I find there is something wrong with me which I want to correct, I make another error instead of correcting the original one. Correcting an error is impossible. The compulsion must be eliminated so the error doesn't occur again. It is not a question of eliminating the error. It is a question of learning. Relearning a thing in order to make it errorless. That is our job. By the way, that is a lost cause.

[From the ATM]: Now we haven't broken any arms. All we have done is pay attention to what we are doing. We know what we are doing. The change this produces in the nervous system makes you learn in a way which is the only learning. That means discover, within the things you are familiar with, reactions which you did not know were included. It is like discovering you can describe a circle around a triangle. That is discovery. That is the only way of thinking that in what we do, there is suddenly a new element, new insight, new ability to do. So you can learn by improving a minor insignificant thing in your life. By doing that, our brain works better and organizes itself better.

Do you know why it organizes itself better? In our intentional cortex, there are wired-in inhibitions and overexcitations. There are patterns which become fixed by habits of thought, habits of organization, habits of actions. These elements are not free to make any change or any reorganization. That means the thinking is limited. Our ability to do is limited.

It isn't that we don't have a brain. It is because we have wired in that brain in such a way that it is not free to learn a new thing. That means learning something in the direction of ourselves, and changing the way we act in the outside world.

[And later]: I will show you something extraordinary. Do you remember how much we had to work to get many of you to roll the head? Originally, how many of you understood what it meant to roll the head between the hands?

See here is a guest who has never been here before. See how he rolls the head. That is why he is Heinz von Foerster. Do you know that others will do almost everything except rolling the head? I will show you what they do.

First of all, they will hold the head, and carry the arms as they always do when shaving. They turn with the pelvis, and hold the head with the hands. It took us weeks to explain what rolling really meant. Rolling means that the point of contact changes place on both hands. Do you think they understood that? Do you know what they do afterwards? They do this: [Moshe mimes some of the patterns]. There are some here who did it for weeks.

Then, we showed them that the difficulty was our normal belief that the hands and the head must move in the same direction all the time. In reading, in scratching ourselves, in putting on our shoes, we normally move our head and hands together. Therefore, out of the seventy or so muscles of the head and shoulders, we know only one pattern. Are you right-handed? Yes, so when I look to the left, my head goes together. There isn't any difficulty, as this is the normal use of self. The difficulty comes when you put that damn hand here and need to put the head to the left. At that point, the head moves to the left and the arm goes to the right.

Put the hand behind—take away the right hand and do it with the left only. Can you see that the head moves in the direction opposite the direction of the arm? That is too much for people to stomach. They cannot do it. The hands begin to....This is the difficulty. They are unable to do that. It is not the habitual thing. They cannot think a thing in their own body. That is what we are trying to do so we can get there in our own body.

Now everyone can do that. We can differentiate between three things: We can:

- A Slide the hands and do nothing with the head.
- B Move the head with the hands.
- C Move the head opposite the direction of the hands.

MF: There isn't any need to tell you how pleased we are to have Heinz von Foerster here. No doubt we will learn something from him. Without further notice, will you please give us your wisdom?

HVF: First of all, let me return the compliment. I was the first to receive your wisdom when I was allowed to lie flat on the mat, hold my head with the right hand, and lift it up with only the movement of my arm alone. My head did not mobilize itself.

The reason I think the experience of these movements is so important.... I will give you in a couple of reports which I am allowed to give

from scientific insights gained over the last couple of years. They all converge to a Feldenkraisian philosophy which you are all extraordinarily familiar with—not only familiar with, but experiencing it and also doing it. This is one of the essential features with which I can give you a brief report. Essentially what I am telling you, you all know. The only thing which may be different is the way I say it. It will only be the form and not the content which may be different. It may be another way of looking at the thing.

Before I go on, making a reinforcement of some of the Feldenkraisian thoughts or experiences you may have had, let me give you one or two reinforcing remarks about the movie you have just seen. [A movie on the brain had been shown.] One thing which I think is significant, which may not be perceived with full significance, is the absence of comments. It is the absence of something which I think is important. It is the absence of references. It is the absence of certain functions which are usually associated with certain structures of the brain. Do you remember, we saw extraordinarily interesting anatomical structures of the brain with many of the identifiable substructures. In almost no case did the speaker say, "Ladies and gentlemen, here is the seat of this and seat of that. Here you see, and here you hear. Here you do that." He had only one lapse into that style of speech. That was when he identified a particular structure as the seat of feelings and emotions. I am not naming that structure, because otherwise you will once again connect it.

The concept of identifying certain structures with certain functions is an old game. I think it was invented by a German phrenologist during the late eighteen hundreds. He identified certain humps and bumps on the skull with certain functions. I recall distinctly that he called these particular lumps and bumps over here references for extraordinary skill in mathematics. Another example is a particular knob on the brain which indicated your propensity to have love for children. I first heard about phrenology in high school. In high school, we had only one girl. When we heard the love of children was sitting here, everyone was trying to feel, on her head, the bump. She did not have any bump at all. We thought there must be something foul about this phrenology concept.

I would like to add one point about this association of function and structure. It is an artifice. It is an invention. It is an interpretation which is not warranted. It is usually made because if you remove a particular structure, then a certain function will not appear. Therefore, if this certain function has not been handled by that individual who has lost a specific structure in the brain, then it is usually associated with this structure that has been lost.

MF: Let me add one little thing. Sometimes when you take off a structure and something disappears, there is something else which appears because that structure was removed.

HVF: Exactly. Because a certain structure has been removed, the whole system is different. The point that you have changed it is that this particular place removed something. One of the most beautiful arguments against this association between structure and function was given by a neurophysiologist who died when he was very young. He pointed out that this was nonsense. It is quite obvious how wrong this is because

I may claim that stereoscopic vision is located in the right eye—that means that we see depth; if someone loses the right eye, he does not see stereoscopic vision.

This is exactly the same argument which is given with the loss of the function. It is different. You have a different brain. It may react in a different way. OK. This was a certain point. Briefly, not giving association of certain functions to certain structures in the brain, I thought, was a significant aspect of the film.

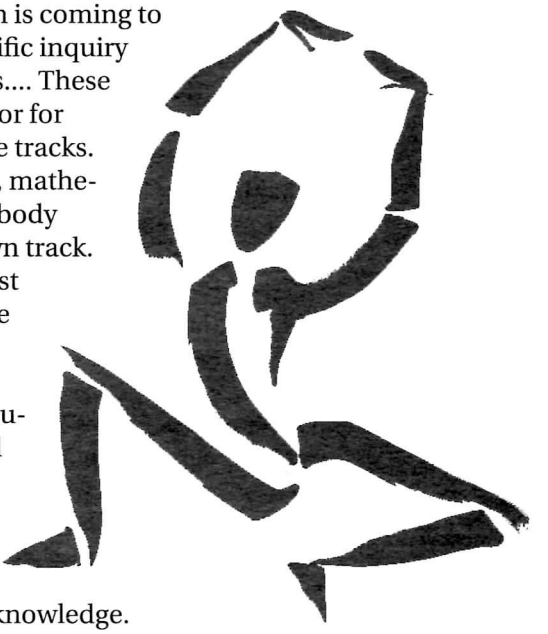
Another item I thought was an interesting point about the film. You can always judge the level of a science if it makes us cognizant of differences. In the first stage of a scientific inquiry, scientists are always elated by things which are the same. First anatomists would say, "Wow, everybody has a single nose. There is one nose. There is one liver and one heart." You find the stage where we recognize that we are all alike. Then you can go a little further. They say, "Well, we are all alike, then we can make this operation and that operation." Apparently things never are that simple.

Eventually, they begin to make references to how different individual brains are. They say the differences in the brains are as different as their physiogomies. Which I thought was a very nice....

MF: Differences of our brains are as different as my hands are different than your hands.

HVF: Exactly. I think the recognition of differences is one of the really nice signs that the anatomy of the brain has reached a level where differences are recognized. These are the two points which I wanted to make. The other things you can see are beautiful.

Let me now switch to the other things. Let me have an admiration speech for Feldenkraisian philosophy. Again, whatever I may say you already know. The only thing which may be new is the way I am stating it. I think a most crucial insight, which is coming to the fore within the last couple years of scientific inquiry by a synthesis of various scientific disciplines.... These may have been galloping for years and years or for decades and decades in their own lonely little tracks. For example, linguistic philosophy, ethology, mathematics, neurophysiology, physics, etc.; everybody was busy riding on his own horse with his own track. In the last couple of years, maybe even the last decade, there have emerged people who have wanted to look over and see what was happening in the other tracks. They wanted to know what the other chaps were doing. Gradually, people were saying, "I could understand this, if I understand that first." Suddenly, a convergence, a synthesis of some scientific thought emerged. By a cooperative effort, more was understood by integration than if you recite the insights from the individuals' knowledge.



More and more, something very interesting has emerged. Very briefly, I would like to put this forth, even if it seems crazy. As my friend

and neurophysiologist, Francisco Varela, has put it, "We are essentially not only seeing with the eyes. We see essentially with our legs." He is still a professor of neurophysiology in Chile and is remarkable. Now I will tell you how this ties into our Feldenkraisian philosophy.

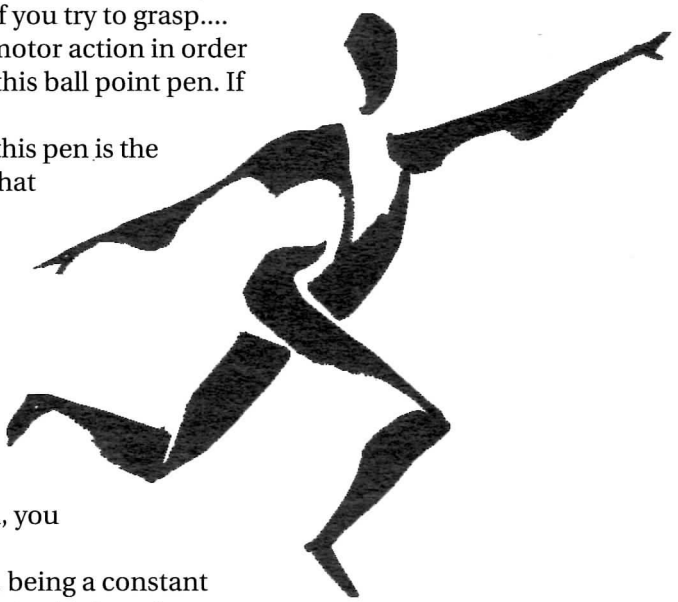
It started when.... If one really looks into the development of the shift of perceptual competence—it is not really going directly into the sensors, but it is going into the motor system. It started with a paper by Henri Poincaré. He was a French mathematician/philosopher. He published, in 1895, a paper in an obscure journal called, *Revue de Métaphysique et de Morale.* In English, it was a journal concerned with ethics or morals. The title of the paper was, "Space and Geometry." It was a very short paper of about two or three pages. In these two or three pages, Poincaré proved, unambiguously, that it would be impossible to perceive depth of space (we may call it three-dimensional perception or depth perception)—perception of space would be impossible if we were to have sensors, eyes, only. If we would have eyes only, we would be principally unable to perceive depth of space.

How do we do that [perceive depth]? It is not the eyes alone. It is that we can voluntarily move our body in order to get a change of visual sensation. By the very change of visual sensation, which we register when we move the locality of our body, the notion of depth of space emerges. If we are unable to move, there would be no motor system. If we were not able to control the movement of our motor system, we would not be able to perceive the sensation, or construct a three dimensional space. We all experience this phenomenon. Poincaré presented us with a little philosophical curly-que and said, "My friends you need motion in order to perceive." This was 1895. It was buried within this French Journal. I believe this was the source of the notion that we need motor activity in order to make perception or sensation.

Another branch of that thought, which was independent of Poincaré's observation, was made by Piaget. I think most of you are familiar with Piaget. I want you to pay particular attention to Piaget's studies with small children. He observed that notions of objects, particularly the notion of the constancy of an object, could not be acquired by a child unless the child was allowed to manipulate the object under consideration. By the sensory-motor interaction, i.e., taking a ball and putting it in the mouth, tasting it, tossing it, shaking it—many, many times to the annoyance of the parents—that is the way you learn what the thing is. When you toss it up and out of the crib, you learn what that is. Piaget made oodles of experiments. He experimented with the age and exposure of the child to particular objects. Eventually, a constancy about objects will arise in one's own development.

The notion of object constancy is not as trivial as it first appears. You may immediately move from anything which we may call a constant geometric object—a ball or a cube—to an amoeba. We can recognize this as an amoeba and know that it moves like this. There is nothing constant about an amoeba. However, there is something constant in an amoeba. Otherwise, we would not know to call it an amoeba. What is constant about it? Its volume remains constant. It is made out of protoplasm. Whenever the amoeba moves like this, it sends out a pseudopod, and marches around. We recognize it as an amoeba. You may even begin to recognize it by the number of nuclei.

The notion of object constancy is not a trivial one. Moreover, if you really come to think of it, you will recognize that if you try to grasp.... See the Feldenkraisian notion? You must have a motor action in order to understand, to grasp. Everyone can recognize this ball point pen. If you look at this, you know it is always this way.



Consider the following thing. The way you see this pen is the way you have never seen before. My statement, "that you have never seen that before," is a statement that the projection of this pen onto your retina, in this particular position I am holding it, with this particular color scheme, with this particular silver knob, etc.—all these particular things, sitting on your retina—has never hit your retina before. The probability that it ever did is absolutely so small, it may be eons before it would ever recur. Yet, even though you have never seen it before, if I were to show you this pen, you may think, "Oh, he has one of those pens."

Ladies and gentlemen, this thing here you call, being a constant object, a pen. Yet, you never see it to be the same. Again, in order to extend Poincaré's observation, you would never realize it is the same thing if you were not allowed to handle it, to manipulate it, to work with it, to get a motor reeducation of it.

MF: Do you see me blushing? We have been talking about this for months.

HVF: My point has been that this would be familiar, and I am only changing the context. I would like to draw your attention to something else. For the moment, let us call this an object. If you translated that object into German, then in German it is called *Gegenstand.* If translated into English, the word would mean "stand against." *Gegenstand* is something which stands against you. It is something which objects to your movements. Therefore, you call it an object. You have an "object" whenever your movements are "objected to" being carried out in the manner you wanted to do it. See, this is an "object" because it "objects to" my motion.

If the degrees of freedom of your actions are constrained.... But, a constraint can only be sensed when you move. If it just sits there, you can't sense that it is there and will limit your movements. You move and risk the interaction with whatever is there. Whatever is there objects to your movements by further interaction—computing. I will now use "computing" as an interaction which takes place in the brain. I can justify that term "computation" in a moment. I do not mean numbers. You may compute some type of invariance, some type of constancy. You may name this constant or restraint on freedom by the sameness with which your actions are reduced.

Then you have given a name to something which is invariant in one way or the other. That means you name this or that, in spite of the fact that it may have different size or shapes. It is an invariant in the sense that you become dexterous with it. See either with the right hand or the left hand. Therefore, you can handle it, or grasp it, or manipulate it, or understand it. You know what happens when you do this, or that, or

when you write on a sheet of paper. The ink stops coming out of the pen, you throw it away.

The computed invariants are in the experience of constant flow and change, which can only be computed with it or its interaction with yourself.... For example, this is what I experienced when I lay here on the floor. That is why I immediately started to participate. That is a way of knowing yourself. If you are doing two things which have been stressed again and again. You are doing something and watching what you do. In some cases, you may do things merely by watching yourself. Watching, itself, is an action. Right now, you engage your whole body into a watching operation. This is an activity which you carry through. Actually, I was fascinated when Feldenkrais said, "Turn your head and see the difference between left and right." There suddenly were two universes. There was the left universe and the right universe. When I suddenly started to lift my head with only my arm lifting the head, suddenly, I had a head which was quite heavy. I never thought that before. When Moshe suggested I should roll my head, I already had my experience of knowing there was something sitting up there much heavier than I was usually aware of. It could be rolled around as if it were resting on a little rod. So my rolling around wasn't a problem at all. From the preliminary exercises, I knew what he meant by rolling the head.

MF: Just a minor thing. Put your chin in the hand. As gently as you can, move the head as if it was a precious thing. To us it is a precious thing. To you, it may not be precious. Move it a little right and left, up and down, just as if it was a precious thing. Then you realize how much HvF can multiply and become a bigger, nicer, better HvF. Then, you can see where parts of the wiring still remain, in spite of our intelligence having transgressed. Just as you improve your reading by the disassociation of words from seeing, which enables you to read ten times as fast. While you are doing that, you can read ten times as fast.

HVF: Thank you very much. I feel fantastic. You move your head with the help of your hands. Let me give you a footnote to what you just said—a clinical observation which I think is a very interesting observation. In World War I, there were many lesions which were caused by projectiles entering the skull in the parietal region. If they penetrated the brain, and in some cases the patient wasn't dying from the injuries, these injuries healed very fast. Small wounds can be taken care of relatively fast. They may even cover the opening with a little metal plate. Patients, with clear cut injuries to the brain, would be dismissed from the hospital after a month or so.

Then I discovered some very interesting cases when patients had injuries to the occipital region. This is a big region over here. These were cases where there were clear entrances and exits to the wound. The projectiles would pass through the brain and leave a clear hole so healing could take place. After the patients went home, after three months, they showed signs of body disorganization. They would have difficulties moving the hands and arms. For example, they could not write easily. In order to write, they might have to lift the right hand onto the table with the help of the left hand. Or, when they walked, they might have to pull the right leg behind themselves.

Of course, these people returned to the hospital and were investigated. No one could find anything wrong with the motor system. All the

reflexes would test out, there wasn't any atrophy of the muscles, etc. No one knew what was going on. One of these patients came in and there was a young medic, who offered him a cigarette. The patient replied, "What?" The medic repeated the request in a louder tone of voice. The patient did not respond to that, but finally responded to the next request. [When offered the cigarette in a different location, the patient was able to see it. Ed.] Perhaps the patient does not see normally. The patient was referred back to the ophthalmology ward. This man had a complete loss of central vision with only a small amount of peripheral vision remaining. It meant he did not see anything which was in the center of his visual field. He only saw things that were in the periphery.

This means he could not see his arm. Therefore, he could not move it. Absence of central vision was not noticed. The question was raised. How could this man, who could not see, actually not know that he could not see? That is a deficiency which we all, permanently, suffer from. We do not see that we do not see. It may be taken as a metaphor.

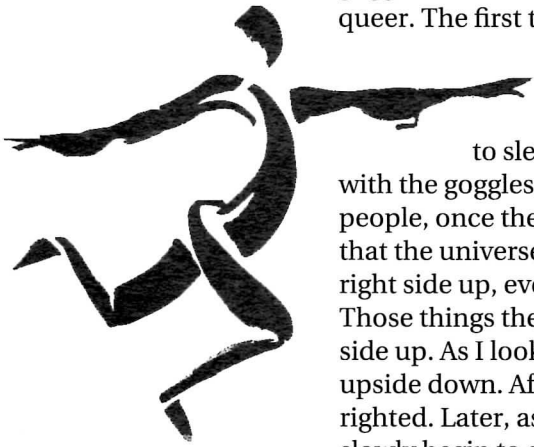
MF: We say it that we do not know what we do not know.

HVF: However, if you know that, you, at least, know a little bit. If you know you don't see you have, at least, made tremendous progress. I will tell you the therapy. At first, the people in Innsbruck did not know what to do with these people. Eventually they came up with a very elegant solution. The elegant solution was to blindfold patients with this central vision loss. Blindfold them for a month. When you are closing your eyes and you don't see anything—of course, immediately you take control of your proprioceptive system. You know exactly which posture you are in when you close your eyes. You know if your arm is up or your eye is down. That means you are re-exercising your internal notion of your body, posture and position. You are ready to receive the signals of the body which are constantly coming in, but you don't usually pay attention to them. Here, you pay attention to them, and you just become aware that you are standing on a board.

After a month or so, these people are completely in control of the signals from their proprioceptive system. They can walk around. They have a reliance on their motor system and their proprioceptive apparatus — this system tells them about the tension in their body and where it is in space. Once these people have learned to use their body without visual cues, the blindfolds are removed.

I wanted to give this as a little footnote to your observation. What you are doing here is that you become more and more aware of visual perception. You are not only doing this as a metaphor. You are extending your vision by knowing how to walk, or how to lie down.

I would like to give another experiment because these are all interesting things which fall precisely into your concepts. These are experiments which had been made by a group of experimental psychologists from Innsbruck. The man's name is Kohler. Kohler, himself, is a great skier and a great mountaineer. When he did these experiments he was a very young man of thirty to thirty-five. He convinced some of his graduate students to wear optically distorting goggles and spectacles. These goggles would very badly distort visual perceptions. For example, they would expand sight in the upper direction or sideways, or reverse the visual field one-hundred-eighty degrees, etc.



In the last case, it meant that whatever students were wearing the goggles saw the world from an upside-down perspective. It was very queer. The first time you put these goggles on, you are absolutely lost. They had to be guided through the room, carried down the stairs, etc. They were not supposed to take the goggles off for a month or two. The students had to sleep with the goggles, brush teeth with the goggles, eat with the goggles, etc. The result of the experiment is interesting. These people, once they become a little bit used to wearing the goggles, find that the universe which is within reach of their arms starts to appear right side up, even though the rest of the universe is still upside down. Those things they could reach, such as a chair they sat on, became right side up. As I look at myself, I am right side up. If I look at you, you are upside down. After three or four days, the immediate vicinity becomes righted. Later, as people walk into rooms, they find that the rooms slowly begin to appear right side up.

Slowly, lamps and pictures appear to be right side up. The longer the students wore the goggles, things in their further distance became right side up. That means, within your motor interaction with your correlation with sensation, you get more and more learned correlations between the sensation and the motor actions.

It is the correlation between the motor activity and the sensation that is important. It has nothing to do with if something is actually right side up or not. It is in which way can you correlate your experiences coming through various sensory modalities that you identify the universe around you.

The fascinating thing from this chap was the report where he bicycled to the institute. He could not tell any difference. Even while wearing the goggles, everything appeared right side up. It was November, and the first snow was coming down. The student could not believe it. The snow was going up. He could not believe it. He ran down the stairs and held out his arms. He had the palm upwards and downward. After he felt the snow on his upturned palms, the snow was coming down normally. This means he had to have a sensorimotor experience to correct his perception of the snow. The falling of the snow must be correlated with all the other experiences.

I also wanted to bring this thing about—to loosen one's attachment to purely sensory experiences. Sensory experience needs motor activity for its interpretation. Motor activity needs sensory experience for its interpretation. What you have here, and what I would like to conclude with, is considered in scientific circles an anathema. This is a circular proof or a circular causality.

Sensation interpreted by motor activity and motor activity interpreted by sensation. People call that type of argument omniscient tautology. I call it auotopoeisis. I think it is a creative circle which allows us to compute or perceive that type of universe we, as individuals, want to exist.

Thank you for having me.

MF: You don't know how well you served me. I am very glad to hear, coming from other quarters, the same ideas. Once, when I listened to a tape recording of what I said, I said great minds think alike.

I only want to give some minor details about what we did, and complement what you said.

When you look in a mirror, your left is on the right and your right is on the left. In front of me, the left and the right have changed. We are always used to talking to others—we are used to seeing the right on my personal left as we talk directly to another. So, I look in the mirror and see myself as someone else. I find my right and left have changed. Some people think it is the mirror. I tell them it is all right. Why do you still have your head up and the legs down? Why didn't you invert that also? Or maybe lie down and have a look. In the lying position, the arms should not change because obviously the head and the legs do not change. Obviously, this inconsistency is not in the mirror. It shows us how we are wired in. We are wired in to see right and left. It is like we are a computer with one card, and we can't take it out.

Another thing which is most important is the sensory and motor together. I say that the object, the type of thing you said we learn, the constancy of the shape.... For example, if I look at a box of cigarettes, it does not become smaller if I move it further or nearer. It keeps its shape and I recognize it. That has nothing to do with the eyes and what I see. It has to do with my habitual interpretation of the hand—sensory appreciation of the space, form and size. Obviously, my eyes see an object getting smaller and smaller. Yet, I know that a cigarette lying there with an object I don't know, enables me to adjust the size of the unknown box.

If I would try to find out about those things I cannot reach with my hands, I would not be able to maintain the constancy of the shape or the form. Now, I find you can never touch the moon or the sun. Therefore, my opinion of the size of the sun depends upon how high the sun is. I believe that if we could take the moon in our hands, we would think it was the same size regardless of how high in the sky it was.

It shows you that if you find the constancy.... Actually, I believe that consciousness, the real object of consciousness—we say states of consciousness, which means that our present consciousness is only one of many other states. The one that we maintain is the one which maintains constancy of shapes and form by those things which we can touch. That is one of the major objects of consciousness. It is maintaining the constancy of shape and form so we can live in this world with a changing, moving body, moving ears, moving eyes, etc. This is one of the modalities of consciousness. That is good enough. We have talked about it for years.

It is only nice to hear that some people have a way of looking at it that is so extraordinary. I told you [the students] about that. While we were talking and teaching it, I told you there are at least another hundred people investigating this from another angle. They have the same sort of insight. When a culture evolves and something is new, it is impossible that human brains are so different from one another (even though the brains are different), that important developments do not occur in ten, hundred, thousand places at this moment.

HVF: I would like to add a few points to your details. The concept of a closure, a sensory motor closure.... That means the interpretation which I just gave, or you just commented upon, where you are really training people to become aware of their own activities and allow closure to take place, is significant. It is more significant than it appears on the surface.

The significance I think it has, or at least some ethologists who are investigating the question of closure think, is the question of regaining

autonomy. Autonomy is regained. That means if you are handling yourself and not being handled by anyone else, if you are generating the universe by your choice through the sensory motor interaction.

MF: You don't have any right to use those words. They are our words. Unless you know what you are doing, you don't have any choice. If you don't have choice, if you can't do the same thing in at least two different ways, you are a machine. If you can't differentiate the movement, if you have an alternative way of doing something, you restore human dignity to what it could be.

Is there anyone who would like to ask a question about something you did not understand up to now? That is not a shame to admit. If you ask Dr. von Foerster things which he doesn't understand, he will admit there are many things he doesn't know. I am also behind him. I have many things I would like to know the answer to. Does anyone have a silly question? Usually, the non-silly questions have already been answered. Clever questions are usually written in the books.

HVF: Exactly. There aren't silly questions. There are only silly answers.

Class: You were mentioning the concept of closure. Is that related to the Gestalt work?

HVF: Indeed, there is a series of concepts which are considered as holistic as opposed to a reductionistic type of philosophy. That means they aim to integrate into a total whole anything. That means, if you were not to do that, a whole set of phenomena which rests on the interaction of the observer would be eliminated. It would be unobservable, unreflectable and inconceivable. In that sense, all these attempts are a gestalt idea which is a holistic concept. There are others which fall into a similar direction. They all have the same spirit. Namely, they attempt to bring about a closure, an integration of sensing, feeling, grasping and understanding of an interactive entity. This entity, by its very interaction, creates a unit which by the analysis of the individual parts would never be conceivable.

It is exactly the trend of our times. Especially when I think of those scientists—I think of those who are sitting in the forefront of scientific activity. This attempt is being made which I consider as one of the major changes of scientific paradigm. In those changes, the observer will now be part of the observation. This is an anathema to the classical scientific approach. That classical approach says that the observation or concepts of the observer shall never enter into his description. It is the very fact that he is an observer, that he is capable of describing the activity, which is the whole concept of objectivity.

MF: As usual, I can only compliment what you say. To me, it is so obvious that I don't understand how many other people do not follow that or stick to the whole idea. As an experiment, made by a scientist, I offer to people that I will organize an experiment with many instruments working. I will leave the room. I will take another scientist, provided he wasn't working on an exact duplicate of what the person was currently working on.... For example, I will take a scientist dealing in radiology and take him into a nuclear physics laboratory. I will ask the man to tell what the experiment was about. No scientist would be able to answer that question. All he could see was needles moving. It is only

the observer, the man who conducts the experiment, who makes sense between the needles and the thing he observes. I said this in 1946.

Do you know Uri? They found the atomic point of hydrogen was determined by many prominent physicists in the world. They found more and more figures after the point to be correct. By the time they determined the third figure, you find that many prominent scientists, first-rate people, did not agree on the figure.

One of them decided that he would repeat all the four experiments by prominent people that don't agree after the third figure. I will see. They put them into rates so you can count them. At that time, there weren't geiger counters for counting. All the counting was done with their eyes. Obviously, you need to blink occasionally. So, you miss oscillations. You write in your book. If you want to get precision to the third or fourth figure, you cannot miss one or two oscillations every ten seconds.

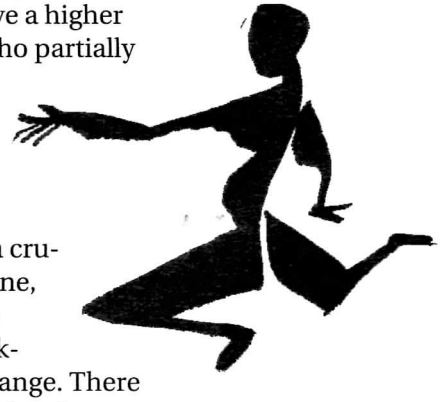
He trained himself to look at the experiments like this. Actually, I too, have learned to do it. [Moshe mimes and makes funny counting sounds.] I look like this so I never look closer. This way I can count all those scintillations on this. Then, he redid it again. Eventually, he found that the third figures and the fourth figures were correct.

At that point, Uri decided there must be a mixture of hydrogen when the fourth figure, with this correction, did not work. There must be a mixture of the two. This is how they found hydrogen. So, without observers we would not have an atomic bomb. Hiroshima would still be there. That is extraordinary.

HVF: In Vienna when we allowed the ladies to make the scintillation observations, they came up with much more consistent data than the gentlemen. The gentlemen were always imagining they were seeing an observation. The ladies were much more specific. I must leave Moshe.

MF: Thanks for coming. It was a very great honor. I hope we can meet again.

Can you see that some of things we have learned, he touched upon? We had it much more profoundly. It is not that you had actually learned. I told you that you were now capable of seeing things in a way which many other people, who by general consent have a higher academic standard than you, cannot match. Even those who partially understood.... It is superior to any other thinking you can find around yourself. It is the type of thinking that Pribram said, within twenty-five years, every university will teach it. All those things which we call "being wired in," what we thought, or what our parents thought.



How many times have I told you that this generation is a crucial one. The next generation, or maybe at the end of this one, what we thought, or what our parents thought, or what the majority of people outside think, will be considered as backward as the Middle Ages. There will be an extraordinary change. There will be a crossing of so many disciplines. There will be people who can see the world and not a collection of silly freaks. From that point of view, the religious people are more intelligent than scientists. They don't know something, so they say there was someone who made it. That is that! God is there and you don't know him. They don't say they know him. They never caught him by his beard. He has done it, he

knows what he knows. He knows the past and the future. They do not argue with him.

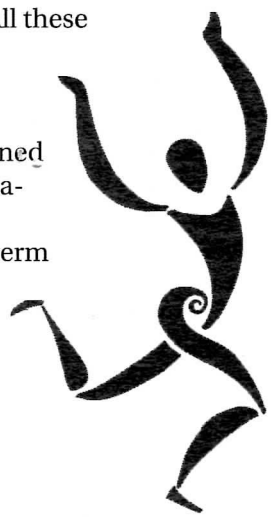
On the other hand, if you were to take a physicist who considers the world—he may say this is all atoms and electrons. Which is correct. All the world is motion. If you stop his world, he has two blinkers on his eyes. When you ask him, "Who are you, who observes the world of science and atoms?" He will tell you that this question has nothing to do with physics. If you ask him if his physics deals with architecture, he will answer that only the architecture of the atoms has to do with physics, all the other architecture has nothing to do with physics. Unless he is a human being, on top of being a physicist, he won't know anything about world architecture. Otherwise, his physics starts with atoms and finishes with atoms. It starts that he doesn't see anything else around him. Law isn't of any importance. Archeology isn't of any importance. The human observer doesn't have any importance. It is the phenomena that has importance. Is that a way?

What sort of world is that? Anything which exists for the rest of humanity isn't any concern of his study at all. He looks at the phenomena and wants to know the world through that. Surely that is asking you to know yourself by your tail. If you know the tail, then you know the person. Is that the idea?

From this point of view, the scientist has less ground to stand on than any religious stance. At least the religious person admits he doesn't know a thing. He may believe in it. That is okay.

But, when someone claims to introduce science and method while eliminating seventy-five to ninety-five percent of the world, except the structure holding atoms together—he missed the world. Some of the great physicists have seen this long ago. They tried to teach the other students that this is not the only way of looking at life.

You can see the same thing in other sciences. Usually, they all have separate facilities, separate cliques. Everyone believes separately. This is modern schizophrenia. It is dividing a human being into several compartments, with each one being watertight to the other. I believe a new era is coming about. Right now, there are so many physicists who are studying gymnastics. Margaret Mead had the idea of saying that. There are biologists who do physics. There are physicists who are interested in different states of consciousness. All these things mean you are becoming human again.



I think this is the beginning of a new era. It means people will learn as they used to learn in Cambridge and Oxford. Centuries ago, they learned natural science. This contained astronomy, literature and philosophy. What was the name of it? There was divinity. I don't remember the exact term they used. It contained all the physical and mathematical sciences of the world. It was the study of the science of nature.

Thank you very much.