CHAPTER 20

Dialogue on the Nature of Causality, Measurement, and Human Communication Theory

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INTRODUCTION

The question of causality and its role in human understanding has occupied scholars in both East and West since before recorded history. In the twentieth century, communication scholars still find themselves puzzled. Many communication theorists distinguish three classes of theory within the field, often designated as causal or laws theory, rules theory, and systems theory. Often the utility of causal theory is called into question, while new and sophisticated advocates, like adherents of what is called the "causal modeling" approach, have grown rapidly. Frequently, advocates of the different approaches truly disagree, but often the word "cause" is used ambiguously so that arguments are more apparent than real.

This chapter will present several meanings for the term "cause" as it has been used both past and present and examine the extent to which

COMMUNICATION THEORY:
EASTERN AND WESTERN PERSPECTIVES

causal theory in any of its meanings may be usefully applied to the study of human communication.

THE DIALOGUE

Continuing Galileo's (1914) dialogues 350 years after they had occurred was an interesting idea to a physicist like Sagredo, but still some things bothered him. First, while he was glad to have been chosen, he wished it had been for some other reason beside the fact that he was the only scientist they could find named Sagredo. And he was, he admitted, a bit disappointed that the other two scientists with appropriate names, Salviati and Simplicio, were both not actually scientists, but social scientists. At least we will not have to wear pantaloons, though, he thought.

The image of himself dressed as a medieval Venetian gentleman was still in his mind the next day when he noticed Salviati was speaking.

Salv: Well, gentlemen, a great deal has happened since our three namesakes met in this place nearly 350 years ago. Have we learned much more than Galileo knew then? Sagredo, since you're from the same field as "the Academician," perhaps you'd be the one to answer first.

Sagr: Well, I suppose the answer is both yes and no. We've certainly resolved the dynamic questions Galileo raised, at least for ordinary notions of ordinary matter. Newton's laws codify virtually everything Galileo originated in terms of dynamics, and the extensions of Einstein cover situations Galileo never anticipated. And our understanding of the strength of materials is far advanced over Galileo's, especially since we understand so much of the atomic structure of matter . . .

Simp: We're certainly much more sophisticated than Galileo was. If he were here now, he'd have a hard time coping.

Sagr: What do you mean, Simplicio?

Simp: Well, of course Galileo was a great man in his time, but he did believe in a simple mechanical model of the world. By modern standards that implies a fairly naive understanding of causality that nobody accepts anymore. And he had no understanding of quantum mechanics, so he wouldn't understand that modern science is based on probabilities instead of certainties. And the social sciences of his time weren't developed at all, so he had no idea that reality is in the eye of the beholder, that "meanings are in people."

Salv: That's a pretty strong indictment of the "father of modern science," Simplicio. But just what do you mean by a "simple mechanical model" of causality?

Simp: A mechanical model is one in which the world is thought of as a machine, of course, whether the behavior of each part is caused by the behavior of some other part. Like a clock.

Sagr: That's a common belief, Simplicio, but if you're accusing Galileo of accepting it . . . or even Newton, for that matter, I'm afraid they're both innocent. Aristotle, perhaps, and certainly Descartes, might accept your "machine model," but not Galileo. At least not in his maturity.

Simp: But everyone knows Galileo and Newton developed mechanical models . . .

Salv: What everyone knows is not necessarily true, Simplicio, and in this case, Sagredo is correct. In his early life, for example, Galileo believed strongly in the need for machinelike causal connections as explanations for motions, but in his later work he had no use for them and argued strongly against them. Causality he correctly attributed to Aristotle. Take, for example, his famous "Law of Falling Bodies." In his youth, Galileo tried to account for the rate at which bodies rose or fell in terms of a hydraulic analogy. He believed, like Aristotle, that bodies had a "proper place" determined by their weight. The "cause" of their motion was the fact that they were "trying" to get back to their proper place. The rate at which they moved was influenced by the physical resistance of the hydraulic medium—sort of like "ether"—through which they moved.

But in his later work, he argues against this same line of "causal" analysis. His law of falling bodies does not explain why bodies fall, or why they fall at a given rate, but simply describes the rate at which any body will fall. This represents a movement away from "qualitative" causal explanations—that is, explanations of processes in terms of their qualities—and toward "quantitative" causal explanations, which consist of statements of invariant quantitative relationships among variables. It really isn't causal explanation that has been discounted by modern scientists, but qualitative causal explanation.

Newton's gravitational law . . . which is the same as Galileo's . . . doesn't give any mechanical explanation either . . . at least not in the sense in which you mean the word mechanical. It doesn't suggest any mechanism at all. It merely says that two bodies will attract each other with a force proportional to the product of their masses and inversely proportional to the square of the distance between them. He never says why this is, just that it is. In this way, he abandons qualitative causes and instead proposes quantitative laws.

Descartes rejected Newton's theory to his grave because of this "flaw."

Simp: But you can't deny that modern scientists reject the simple me-

chanical models of Galileo and Newton. And the notion of "laws" is suspect as well, is it not?

Sagr: Oh, yes, of course you're right. But it isn't mechanics that is rejected. You yourself use the phrase "quantum mechanics" to describe one of the most modern of physical theories. Mechanics simply refers to the study of the motion of points in space, in its most technical meaning. And modern scientists reject the notion that the universe is like a giant clockwork, with each piece influencing each other part by direct physical contact. But this is sort of a "straw person" argument, since neither Galileo nor Newton really believed that either. The suspicion modern scientists have for "laws" is probably more an indication of modern caution than some epistemological belief. We've seen our laws overturned so many times that many scientists prefer to speak only of hypotheses rather than laws.

Simp: Do you mean to suggest that modern scientists still hope to find universal laws that admit of no exception?

Sagr: Hope, perhaps, is a misleading word. We have a much greater respect for the difficulties, perhaps, than scientists of a century ago (although both Galileo and Newton felt they had seen virtually nothing of what was to be seen, their successors were often less humble!). And few if any of us actually "expect" to make useful statements that admit of no exceptions whatever. But in practice, when a hypothesis is even slightly inaccurate, we say it is wrong and try hard to correct it. If we don't expect to find theories that are perfectly accurate, we are not satisfied with inaccuracy.

Simp: But aren't you ignoring the lesson of quantum theory? Surely you must admit that quantum theory tells us that no event can be established with certainty, but only to a certain level of probability. And, if Heisenberg is to be believed, this probabilistic character is not simply due to our ignorance but is inherently a characteristic of nature itself.

Sagr: Yes, what you say is true, Simplicio. But there are some reservations. Quantum theory does indeed say that there is an inherent probabilistic nature to subatomic processes. The entities which we study in the realm of the subatomic world are small . . . so small they are smaller than any device by which they may be examined. When we attempt to look at these things, we interfere with them, and this is inherent. Moreover, our current understanding leads us to believe many events in this realm are discontinuous, occurring in discrete "packets." Occasionally, nuclei break apart and emit packets of energy. Theory—which is in good agreement with observation—tells us that we cannot, even in principle, tell which of any of trillions of atoms will break apart this way, although we can tell how many of them will have broken in any interval of time. Nor is

this a consequence of our ignorance, according to current theory, but an inherent property of the phenomena themselves.

But misinterpretations of this theory are very commonplace. The most common misinterpretation by far is that the uncertainty principle can be applied to larger phenomena. Quantum theory, and the uncertainty principle which is a part of it, applies to the domain of the subatomic and only to this domain. Attempts to apply it by analogy to larger scale events are inappropriate. It would be quite wrong to say, for example, that the force of attraction between two large bodies—say the sun and the earth—is "probably" equal to the product of their masses divided by the square of the distance between them or that, for N such pairs of bodies, the force of attraction between them is distributed about a mean value proportional to the product of their masses and inversely proportional to the square of the distance between them.

Salv: We should also recall, Sagredo, that modern scientists are indeed humble, accepting nothing as absolute truth not subject to disconformation by later observation. And one of the greatest of modern scientists died believing that the uncertainty principle would someday be shown false.

Simp: You mean Einstein, of course. Well, great man though he was, most scientists think he was tragically mistaken in this belief. And the very mention of Einstein brings up perhaps the strongest of reasons for believing the approach of Galileo and Newton is archaic and useless today.

First, Einstein made it clear that the old absolute view of nature held by Galileo and Newton had no counterpart in reality. In fact, all observations depend on the frame of reference of the observer. Observers taking one viewpoint will experience reality differently from those at another vantage point. And, if I may say so, the work of modern social scientists has made this point even more strongly. We know, in fact, that reality is in the eye of the beholder. As communication researchers often say, meanings are in people. The interactionists, and after them the hermeneuticists and the constructivists have all pointed out that reality is socially constructed. All knowledge is human knowledge, and humans are inherently uncertain. Whether your quantum physicsts are right or wrong about the uncertainty prnciple failing to apply to large scale reality, it is quite certain that it applies to human phenomena. No human actions can be predicted with certainty, but only with probabilities. No mechanical or causal model can ever apply with much accuracy to human beings.

Sagr: I have to admit there is a great deal in what you say, Simplicio. But still it's not completely accurate. In one sense, Galileo and Newton did understand the extent to which observations depend on the observer.

Both knew that the description of events depended on the choice of reference frame and that trajectories that looked like a straight line to one observer might resemble a parabola to another observer moving relative to the first. And both understood that the velocity of, say, a projectile would appear greater to a person approaching the projectile than to one who was standing still or moving away from it. In fact, the changes of reference frame which correct for these differences in reference frame are actually called "Galilean transformations" in physics. There might be a sense in which these kinds of transformations account in part for what social scientists may mean by saying reality is in the eye of the beholder. To a small person, another may appear quite imposing, while to a much taller person the same individual may seem ordinary. As long as we're dealing with objects that are neither very large nor very small, and as long as the objects are not moving at an appreciable fraction of the speed of light, Einstein has nothing to add to either Galileo or Newton. And Einstein's theory doesn't do away with causality or laws of nature at all. Both Newtonian and Einsteinian physics search for laws, and both accept only laws which hold in every reference frame. Of course, in Newton's model, Galilean transformations allow the laws to hold across different observers in different reference frames, while for Einstein, it is Lorentz transformations, but both theories are clearly laws theories.

When you talk about human beings, however, I have to admit you may be right. While I hope I won't offend you in saying it, I'm afraid that few of my physical science colleagues hold much faith in the social sciences and have great doubts that you will discover laws of the sort we have found, even granting all their imperfections.

Simp: I'm glad to see that we can agree on some matters at least. I'm willing to accept the idea that causal laws apply to physical processes with the stipulations you suggest: first, that they do not necessarily refer to some oversimplified machinelike cause and effect mechanism but, rather, to invariant relationships like the one between masses, distances, and rates of falling. And I'm even willing to agree that the word "mechanical" in the special sense you choose to impart to it doesn't necessarily imply the naive machinelike model I once thought. And, of course, we have to understand that these lawlike theories don't apply in the same way to quantum phenomena, since the laws only prescribe probability distributions and not specific states for specific individual particles. Furthermore, I also favor your use of the word "hypothesis" as a substitute for "law," since it seems to me to imply the correct amount of humility before nature that a scientist ought to feel.

Even granting all this, it seems we will still agree that such laws will do me no good, since I am a social scientist. The phenomenon I study is

humanity or at least the thoughts and actions of humanity, and I think we can all agree that the notion of causality, no matter how carefully qualified, can't be applied to human matters.

Sagr: I quite agree with you there, Simplicio. Our earlier disagreement about the application of laws to physical phenomena was mainly a result of our different vocabularies and differing perspectives. This discussion has been a great help to us both, since a source of apparent disagreement has been eliminated. But we've not heard yet from Salviati about this. How about it, Salviati, do we all agree?

Salv: I think we've come a long way from our initial confusion. Whenever strangers first meet there is bound to be some initial confusion and disagreement, much of which may be real and some of which may just be the result of different points of view and different uses of language. Our discussion has cleared a good deal of this away, but I'm still not sure that such a short discussion is enough to bring about complete harmony.

In fact, just as we may initially think we disagree when the disagreement is only an illusion brought on by different perspectives and usages of language, we may just as often think we agree when we differ and for the same reasons. Before I conclude that we are of one mind on these issues, I'd like to hear more. Particularly, I'd like to hear why each of you believes that laws—like the law of gravity—can never be applied to human thought and behavior.

Simp: There are good reasons for saying laws of human thinking and behavior do not exist. Foremost among these is free will, the capacity of human beings to make choices. "Particles" can't make choices, but human beings can.

Salv: What you say may or may not be true, Simplicio, for each individual person. But even if it were, wouldn't that bring about exactly the situation we have in quantum mechanics? I mean, of course, that even if the behavior of each individual person (or particle) is indeterminate and unpredicable, still the behavior of the aggregate of all of them or even many of them might be described by laws of the type we have already agreed on. And I'd grant your argument in a flash, Simplicio, even for individuals, if you can only tell me on what grounds you are led to believe that human beings have the power of free choice.

Sagr: Very clever, Salviati! I'm afraid you'll have to go further than that, Simplicio, since Salviati has a point. When you say that human beings make choices freely, you are simply using different words to say their behavior is not governed by laws. And that, of course, is what you are trying to prove in the first place.

Nonetheless, since the earliest days of scientific thought, most scholars have been reluctant to believe human thought and behavior could be

modeled by the same kinds of laws as physical phenomena. Many generations of the best effort of the best scholars have failed to find even one law of human behavior. Even if Simplicio may not be able to prove that this quest is impossible, you should recall that the burden of proof is on the affirmative. If you, Salviati, believe that there are laws of human behavior, it ought to be on your shoulders to show it is so.

Salv: Of course, you're right, Sagredo. It is my responsibility to show that such laws are possible and yours to rejoin my arguments, should I find any. Before I begin, it's well worth pointing out that your own remarks go a long way toward explaining why most scholars don't think there are any causal laws of human thought and behavior.

Sagr: My own remarks?

Salv: Yes. You see, you said first that very few scholars believed in the possibility that such laws would be found. Since so few believe in the existence of the quarry, is it unlikely the chase will be futile?

Sagr: A good point, Salviati, but a long way from a convincing argument that laws of human thought and behavior will ever be found. Just how do you expect to argue your case?

Salv: With the strongest possible argument, my friends. I hope to show not only that there may be laws of human thought and behavior but that they have already been discovered.

Simp: Already discovered?

Salv: Yes. And furthermore, not only have they been discovered but you yourselves accept them as true.

Simp: If you can convince us not only that there may be laws of human thought but that we already hold to some, that will be quite a trick, Salviati. Especially since we have all agreed among ourselves that no two humans perceive these matters in the same way.

Sagr: The key problem seems to me that laws of nature, especially causal laws, are meant to explain observations. But if everyone observes social and psychological events through a different set of attitudes and values and beliefs, then there is no common set of observations to be explained.

Salv: Do either of you believe that anyone is ever exempt from this filtering of experience by values and beliefs?

Simp: Are you suggesting, Salviati, that you've found a way to free yourself from your own biases and can see things as they really are? I don't mean any disrespect, but ordinarily people who believe they have penetrated to the secrets of the universe can benefit from some counseling. All of us are at all times subject to the distorting effects of our past experiences. There is no privileged view of the world.

Sagr: I can't help but agree with Simplicio there, Salviati. No self-

respecting scientist would accept a law, or even a single observation, as true on the word of one person. Science is an objective process, and it requires the agreement of many scientists to accept anything as fact. We believe pretty strongly that the most honest of observers are subject to the distortion of their own backgrounds, beliefs, and attitudes.

Salv: We all agree, then, that all human perception is filtered through the cognitive structures already existing in each individual. And, as you've both agreed, this view is nearly unanimously shared by physical and social scientists alike, is it not?

Simp: I'd say that view is close to the foundations of modern social science, Salviati.

Sagr: It's wisdom to recognize one's limitations, and humans are pretty limited.

Salv: Since we all agree that present perceptions are influenced by past beliefs and attitudes in every person at all times, why don't we just call this a law, then . . . and a causal law at that? In fact, it would seem to be the law on which all rules-type theories are themselves based.

Simp: I have to give you credit for a clever argument, Salviati, but I'm a long way from accepting your conclusion. You can call this "perceptual filtering" a law if you like, but it's quite different, it appears to me, from a physical law, like the law of gravity. For one thing, you law doesn't specify any mechanism by which the filtering takes place . . .

Sagr: That's a dangerous approach, Simplicio, and will soon fail. You'll get trapped in the same mechanistic or machine-like theorizing you argued so strongly against a few moments ago. A law doesn't have to posit any mechanism, and modern scientists don't believe in causality in the way that Aristotle did. The law of gravity just says that two bodies attract each other in a specificable way but not why they do so. We're so familiar with the law that we forget this. But when a small child asks us why things fall we say gravity makes it happen. When he or she asks why or how gravity does this, the greatest of physicists has to change the subject.

But that doesn't mean I accept your view, Salviati. There are still many things wrong with your law, I think. First of all, if it is a law, it's different from the kinds of laws we have in physics. For one thing, it's clearly not the same form as a physical law. It doesn't say how perception is affected by past beliefs and attitudes. I don't mean "by what mechanism," but "in what way." Maybe past experiences influence current perceptions randomly, maybe systematically, but we can't say from the current form of you law. Your law, I'm afraid, is vague enough to be true.

Salv: As I've stated it so far, you are both correct. The law is vague and different in form from physical laws. But I think we also agree on ways

the law can be made more precise. Would you say, Simplicio, that social scientists are prone to see new data as more or less favorable to their own view due to this filtering?

Simp: More favorable. But it's not that simple, Salviati. The influence isn't always positive. People don't always misperceive to see what they wish to see. Sometimes the opposite is true. Sentries and guards, for example, often see the enemy when it's not there.

Sagr: That's right, Salviati. In general, scientists often misinterpret results to favor their own theories but not always. Michelson, for example, was quite disappointed that his experiment failed to show the "either drift" he expected, and this led him to ignore the much more profound implications of the constancy of the speed of light which his own experiment showed.

Salv: You're both right. But I don't think it would be accurate to say selective perception biases you to see what you want to see but, rather, what you expect to see, good or bad. Selective perception is like an inertial mechanism. And it is a principle, as many other physical laws are principles. This particular law is an inertial law like Newton's first law. It says that the mind tends to remain the same, to resist "acceleration." It tends to maintain itself as it is. The first law, then, may be stated with precision: *in the absence of outside "forces," cognitive structure tends to remain as it is.*

Sagr: I'll grant you that, in the way you now state it, your "first law" has the same form as does Newton's. And, so that the argument may continue, I'm willing to overlook those of a religious persuasion who might believe human cognitive structure can be miraculously changed in a dramatic way by the intervention of supernatural forces. But even so, Salviati, the notion of selective perception implies more than just this. It implies as well that some change is to be expected when the cognitive structure is not isolated from outside forces. To account for this, you'll need at least one or two more laws. If Newton had left us only the first law, none of us would remember his name today.

Salv: Of course, you're correct, Sagredo. A theory made up of only one law is of little use, but a second law won't be difficult to find if we follow again the example of Newton. We already know that the first law—both Newton's and the one I have proposed—is a principle or stipulation rather than an observation. And so is the second. For Newton, the second law states that the acceleration of any body may be accounted for in terms of two new variables, one of which retards the acceleration of the body and another of which increases it. The former we call "inertial mass" and the latter "force." Neither of these variables has a real existence but are really only logical constructions to help us think clearly about what we

experience. As you said earlier, they may as well be called rules as laws. And we may agree to the same rules in our cognitive science by simply stipulating that each attitude or belief indeed has some calculable "resistance to acceleration." We need not at first stipulate any mechanism for this resistance but simply observe that some cognitive elements are easier to change than others. Those that resist change most strongly we will consider high in mass, while those that change easily will be assigned a lower mass.

In the same way, if two occurrences should change the same attitude or belief by different amounts, we will say that the one occurrence was proportionately more forceful than the other. Again it is not necessary to postulate a mechanism underlying the forces. Our second law, then, might simply say that *the acceleration (change in the rate of change) of any cognitive element is directly proportional to the force impressed on it and inversely proportional to its own inertial mass.*

Simp: I've listened with some interest to your remarks up until now, Salvaiti, but this strikes me as the emptiest of philosophical speculation. If I was opposed to the idea that there might be laws of human thought, I'm even more strongly opposed to the idea that they might resemble Newton's laws in any except the emptiest logical sense. And in fact your usage of these laws is empty, since they are not inductions based on honest observations but, rather, stipulations and word games. A physical object has mass because there is some observable matter there. You can feel it and weigh it. It's objective! An attitude or belief or any other cognitive element is subjective. You can't see it or touch it or sense it in any direct way. It's existence has to be inferred, not observed.

Sagr: I'm still extremely skeptical about Salviati's argument, Simplicio, but not for the reasons you mention. In some ways, Salviati is right. Mass isn't objective as you say. Newton thought it could be observed directly, but we now know that's not true. Mass is no longer considered the "quantity of matter" in a body but, rather, is simply defined as its resistance to acceleration relative to some arbitrary standard mass. Masses and forces are inferred by physicists, not observed as you think.

And it is true that both of Newton's first two laws might be considered stipulations or definitions. Many physicists and philosophers do so consider them. But even these two laws alone have no meaning and gain us nothing in explaining either physical or cognitive matters. First of all, some sort of measurement system has to be devised if the laws are to be worth anything. As you say, modern laws are quantitative, and, although your laws may take on a quantitative form, there must still be some way in which these quantities are to be anchored in experience. And second, it seems to me that the third law is what makes the first two useful. New-

ton's third law relates the two unknown terms force and mass to something we can measure directly—distance. Without these, the other concepts, force and mass, and the laws in which they occur, are quite empty.

Simp: Even though I might be willing to grant the philosophical subtleties philosophers attach to Newton's laws, the idea that they might be applied to human cognition is too far out to consider. Virtually every scholar in the social sciences knows that physical and social experiences are different and that these differences lie in the immaterial, subjective, and uncertain character of human variables. It will take a powerful argument to convince me otherwise, I'm afraid.

Salv: I have no hope that any arguments I could propose in a single conversation could be energetic enough to convince you, Simplicio. But I do hope to show that there is enough plausibility to what I say to warrant my own continued investigations into the matter. And it seems to me as well that some of the principles about which we've already agreed here today provide the basis for a third law, one which makes the other two useful.

Simp: I'd be amazed if we already agreed on a third law when we don't seem to have agreed on the first two yet, but nonetheless, please go on.

Salv: When we first began our conversation, we appeared to disagree about the meanings of certain important words and their application to physical theory. The word "cause," for example, was used differently by each of us, as was the word "mechanical." This led us to disagree about whether or not contemporary physical theory could be called causal. And we initially disagreed about the extent to which the work of Einstein and the new quantum theory had overthrown the works of Galileo and Einstein, but after some conversation we were able to come to agreements about how we would use these words among ourselves. And this, in turn, led us to a closer agreement about the nature of causal and mechanical theory and its use in the physical science. Wouldn't you agree?

Simp: If you plan to suggest that the third law will hold that our views grow similar through communication, I'd have to disagree. It's true that sometimes communication brings people's views together but not always true. Our own conversation is a case in point. While we're closer to agreement about the things you mention, we're farther apart than ever in our beliefs about the application of mechanical or causal theory to human cognition. At first I thought we were closer than we are now and would even have been willing to grant you that there was a sense in which causal theory could be applied to human communication. But once I learned that you had in mind an application of the very laws of Newton to these matters, I grew further from your position than ever! You can see, then, that communication sometimes brings convergence of views among the

communicating parties, but sometimes the opposite occurs. And a causal law cannot admit of exception, if I am correct.

Sagr: I'm not sure I agree with you completely, Simplicio. By no means do I agree with Salviati yet about the possibility of applying physical laws to human thoughts, but I do think we've grown closer due to the discussion. At first, we didn't have any idea of just how greatly we differed. In some respects we were closer than we thought, and a little discussion made that clear. And in other areas, we were further apart than we thought. But learning how far apart we were certainly seems to me at least to be a step toward agreement, even if not agreement itself. And perhaps you did not grow further from Salviati's position, but simply realized that it was further from your own than you had at first thought.

But that doesn't mean I'm ready to buy Salviati's argument. And, in fact, we may be somewhat premature in considering Salviati's third law, since he hasn't actually proposed it yet!

Salv: You're both right and wrong, at least insofar as you've guessed what I will propose as a third law. I will, in fact, propose that the third law state that *communication brings the thoughts of contending parties closer together and that this is always the case.* But it is not such a simple law as this.

For one thing, both of you have correctly noted that our convergence on a common viewpoint has been more rapid on some issues than for others. Most notably, we agreed fairly quickly about the meanings of the word "mechanics" and on the sense in which Galileo and Newton's theories were mechanical. But our convergence has been much slower when we consider the extent to which these matters may apply as well to human thought. Is this so?

Sagr: That seems right.

Salv: And I hope you will not take offense, Simplicio, if I suggest that it was your opinion about the meaning of the word mechanical which changed the most rapidly and by the greatest amount?

Simp: I'm sure you're right, Salviati, but that should be no surprise. As a social scientist I have little reason to think often of the word mechanical, and I've read little about it. Sagredo, on the other hand, is a physicist, and so he no doubt has read a great deal in this area. It's quite reasonable for me to defer to his greater knowledge on matters about which he has studied a lifetime and I hardly at all. And, for that matter, you too seem to have read a great deal about these historical matters, and so I'm not surprised that you should know the technical definition of mechanics better than I.

On the other hand, I've spent my whole life studying human communication and, particularly, the means by which one person persuades an-

other—or resists persuasion from another, for that matter—and so you are not so likely to change my opinions about that so easily.

Salv: Exactly. And I'm pleased to note that the explanation you offer for the ease with which some of your beliefs may be changed in contrast to the difficulty of changing others is a causal one. But regardless of whether your explanation is causal, or even whether it is correct, nonetheless it is quite clear that some of your beliefs are easier to change than others, as are mine. If you were to tell me, for example, that your name was not really Simplicio, I would believe you at once, since the evidence I have for this amounts only to what you've told me once. But if you told me you were not actually here, the evidence you'd need to present would be enormous, since nearly everything I believe about the physical world would need to be changed before I could accept that.

Sagr: Of course, it's obvious where you're going, Salviati. You'll suggest that *the rate of convergence of beliefs and attitudes is the inverse of their inertial masses.* And I have to admit that the notion is a powerful one, especially since we've already established that inertial mass need not make any reference to physical matter but only to resistance to accelerations. Even though that view is interesting, it still leaves holes in your argument. You correctly noted that mass and force are reciprocals, defined in terms of each other. The only thing that saves the whole of Newton's theory from being an empty logical exercise is that he can establish functional relations between these two terms, force and mass, on the one hand, and the observable—or better still, measurable—variable, distance. You haven't shown any such possibility yet.

Simp: At least you'll spare us the absurdity of saying the force of attraction between different beliefs is inversely proportional to the distance between them, then!

Salv: I admit I'm not quite ready to apply Newton's third law to human communication . . . at least not so easily as that. But I do note that you say this position has little attraction for you since it is so far from your own. And of course you are right, Sagredo, in arguing that some measurable notion of distance is required if we are to progress any further. But why do you suspect this will be impossible? Don't you both make use of this concept in your discussion? Didn't you say, Simplicio, that my views are "too far out" to be considered? And didn't we discuss the extent to which our views were far apart or close, or growing closer or growing farther from each other? Don't we use the notion of distance quite explicitly in discussing human beliefs?

Simp: Of course we do but only in the vaguest analogy to physical distances. Physical distances are objective. You can see them, and you can measure them. This is certainly not so far distances among beliefs or

positions one might hold in an argument. This is poetry, not science. And, if you'll permit me to use the analogy one more time, this argument is taking us all further from common sense every moment!

Sagr: I'm afraid I have to agree with Simplicio, Salviati. It's one thing to formulate laws that have the same form as physical laws but quite another to apply them to experience and expect them to hold. There must be a way to measure your concepts, to expose them to experience, otherwise I'm afraid there is no science involved. Science deals with observations, ultimately.

Salv: Well put, Sagredo. Without observations we have no science. But wouldn't you agree with Einstein when he says, "It is quite wrong, on principle, to base our theory on observable magnitudes alone. On the contrary, it is theory which determines what we can observe"?

Sagr: Well, not being Einstein it's hard to know exactly what he meant, but, in a sense, that is true. Quantum theory, for example, leads us to develop devices which enable us to look for things we would not have been able to see otherwise. And it's also true that the subject matter of modern high-energy physics is completely undetectable to the unaided human senses. But I'm not sure that this is the issue we face in our present discussion. The question before us is whether psychological distance can be measured.

Simp: It should be painfully obvious that psychological distance is merely a mental abstraction, not something tangible such as physical distance which can be touched. Physicists can easily lay a ruler or metric stick between the two objects whose distance apart they are measuring and arrive at a ratio in terms of the number of times the ruler physically fits into the space. Whether it's meters or yards, by means of a straightforward transformation, the distance is the same.

Sagr: Oh, but you do us a disservice by suggesting that all physical measures are readily observable and easier to measure than social phenomena. Your criteria certainly do not apply to the measurement of the distance to the nearest galaxy or of subatomic distances which are not directly observable. The measurement of temperature is another important physical property which has not been completely understood after 300 years of work. Temperature scales would not completely pass the criteria for interval scales, since no two methods of measuring temperature agree across the whole range of values. And what about time? Do you believe that time has a "physical" existence?

Simp: Time?

Salv: Of course! Time is the most precisely measured variable in all of science, yet it has no physical existence and no one can lay down a unit of time next to another interval of time.

Sagr: Well, then Salviati, since I can't think of any reason in principle (short of religious matters) why your intangibles should be any less measurable than my intangibles and, since Simplicio can't provide substantial empricial evidence against the measurement of distances among beliefs and attitudes, possibly you might suggest some ways in which such measures might be carried out?

Salv: Since we are all well aware of the extent to which our choice of reference frame determines our experience, I might suggest that our conception of psychological and cultural experiences may seem as different as it does from our experience of the physical precisely because we have adopted different measurement rules for the two domains. My first suggestion, then, would be to adopt the identical rule for measurement that has proven so successful for science in the past. We might take any two objects or beliefs arbitrarily and assign some numerical value to the distance between them. Individuals might then be asked to estimate the distances between any other pair of beliefs or objects as a ratio to this standard distance.

Simp: That's nothing more than an analogy to the measurements of physical scientists. There's no reason to suspect it will work, respondents won't be able to do it, no advantage will be gained from it, and our field will be embarrassed by the pretense that we are scientific. You can't be scientific simply by imitating scientists.

Sagr: I assume you mean that there is some evidence this method fails? Those who have used it are disappointed?

Simp: No, the users are enthusiastic, but then, they are users and naturally favor their own method. But the method does take somewhat longer—possibly 10% longer—than our more common ordinal scaling methods. Some people claim it yields an extra digit or two of precision, but these claims are probably exaggerated. But mostly, there's just no advantage to be gained from it.

Sagr: Assuming the claims are not too seriously exaggerated, very few physical scientists would reject the chance at one or two digits of extra precision for only a 10% increase in cost, particularly since your present five-point scales are not sufficient to establish even one digit with certainty! As a scientist, the observational evidence is paramount with me, and I can't judge the virtues of these claims without reading the data carefully. But for the sake of continuing the argument, Salviati, suppose I grant the scales are at least as precise as the older methods used by social scientists. What does this have to do with causal theory?

Salv: Since the measurement method is part of the frame of reference, any important change in measurement brings about a change in what we observe. And this, of course, changes the form of the laws we find. Had

Galileo chosen to use the time-honored measurement system of the social sciences, he would not have been able to arrive at the law of falling bodies in its quadratic form.

Simp: But he didn't have to use ordinal scales. We do, since the phenomena we study are themselves only ordinal in character.

Sagr: No, that's not correct. Or at least, at best, we really don't know whether it's correct or not. You see, the fact is that very few social scientists have ever applied the same measurement system Galileo himself used. And those who have appear quite enthusiastic about it. But those who use the categorical system guarantee that their observations will always contain large uncertainties. They're built into the scales.

Simp: Then you believe that human thought processes can be modeled by the laws of Newton?

Sagr: I don't believe anything that hasn't been shown by data, and that hasn't been shown to my satisfaction. The point is rather that I am convinced that your efforts with categorical scales do not prove such experiences may not be modeled by physical methods, possibly even by the very equations of Galileo and Newton nor could they. The fact is, no one knows whether attitudes, beliefs, and values can be modeled by the exact methods of physical science, because so few efforts to do so have yet been made. I, like most other scientists, believed that human variables had stubbornly resisted attempt after attempt to encompass them within the methods of physical science, but our conversation leads me to believe this is not true. Rather, it seems, the methods of physical science have only seldom been attempted, because social scientists believe in advance that they will not work. If the notion of selective perception is indeed a law, then this is certainly an instance of it.

Simp: How then do we get to the third law?

Salv: The first step in such a program is the development of a reference frame within which any such law might take on a simple enough form to be recognized by our limited capacities. This step includes the specification of scales of measurement of sufficient precision and richness to describe our experiences in some detail, and it also includes the stipulation of principles such as the first two laws we have proposed today. In this regard we should note that neither Aristotle nor his successors thought even physical motion capable of measurement of the type we have described and so cut themselves off from the possibility of determining laws of the type described by Galileo and Newton, as have many social scientists today. Moreover, neither did Aristotle stipulate laws of the first two kinds we have described, which have the effect of making accelerations the experiences which require explanation. Without stipulations such as these, laws of a Galilean or Newtonian type are impossible, since they

depend on the logical form of this system as well as on the experiences themselves. For surely, as we have all agreed, the experiences are viewed only within such stipulations, and changes in the form of these assumptions bring about changes in the nature of our observations. In fact, the contemporary practices and assumptions of many of our colleagues in the social sciences have the character of a self-fulfilling prophecy, since they render the discovery of causal laws impossible.

Simp: Sometimes what you say is sensible and, at other times, seems the emptiest of sophistry, Salviati. But will you just provide us these logical arguments rather than the third law?

Salv: In the proper spirit of scientific humility it is only fair to say that a complete understanding of cognitive processes awaits future generations of scientists. But the notion that the attitudes, beliefs, values, and other cognitive elements of peoples and cultures converge toward the mean of the values of the communicating parties is quite consistent with the principles we have established here and fits experiences so far collected to tolerances at once worse than the best of physical theory and as well or better than the best of theory developed specifically within the human disciplines.

As to whether the final form of this law will be, indeed, an inverse squares law, we have perhaps some choice. While it may at first seem as if the laws must be discovered, a closer look shows that we may, to an extent, choose the mathematical form of the law which is most convenient in a mathematical sense. It is then necessary to discover the set of transformations which must be applied to the data as measured which will make our observations conform to this form. Perhaps one may be found in which the inverse squares law may be made to apply to communication quite exactly.

Simp: Then you will admit, Salviati, that, as yet, your third law does not fit perfectly to observations, and is thus false?

Salv: Insofar as the fit to data is not perfect, then the law is false. But so, then, are all laws, both physical and human, since no experiment can be performed without error, and no theory conforms to experience exactly. Yet we do not reject such a theory unless a superior theory is kown to us, and in no case is it wise to abandon a theory known to be false in favor of an alternative theory that fits to experience even more poorly.

Simp: Your suggestion that the theory you describe fits experience to better tolerances than other specifically social type theories strikes me as the greatest of arrogance, Salviati, not at all in the spirit of humility that we consider indispensible to science. To be sure, such researchers as have been reported usually reveal relatively high degrees of explained variance, but at least some alternative models may do as well.

Salv: To be sure, Simplicio, humility is a great virtue, but the greatest requirement of the scientist is, above all, honesty. To be sure, the simple models and limited experiments that have been presented in behalf of this type of theory leave great room for humility, since they pale by comparison to the great achievements of Sagredo's colleagues. And no one could doubt that the achievements of social scientists, using totally new methods and facing great limitations, warrant the greatest of praise.

But, in fact, the measurements we've discussed today without exception produce more variance than the categorical scales more typically used by our colleagues. Some erroneously consider this a drawback, but greater variance indicates that the experience measured has been divided up into more and smaller pieces. When an experiment is able to account for a given percentage of a large amount of variance, he or she has provided a better and more precise fit to experience than when the same percentage of a small amount of variance has been explained. I believe that a fair reading of the evidence will show that the very simple hypothesis I proposed as the first steps toward a third law—that is, that the beliefs, attitudes, and values of communicating parties converge toward the mean of their beliefs, attitudes, and values—fits experience at least as well as any other model of communication yet proposed.

Simp: I still don't understand why we should adopt your model. Thinking of human beings as law-governed particles in a mechanical system seems demeaning, even if we understand mechanics in the way we have learned to speak of it today.

And the costs of adopting a causal model such as this are enormous! The equations which would be used to model attitudes as points moving through space are difficult, and very few in our field can grasp them. The kinds of words used by such theorists, such as "tensors" and "Riemann spaces" and "harmonic oscillators," do not enlighten us but, rather, cover over what everyone understands in terminology so turgid that no one can understand. How can this be clarifying?

Sagr: While I have grave doubts that Salviati will accomplish his goals in any short time, if at all, Simplicio, there is no doubt but that there would be great advantages if it could be accomplished. May I remind you that, in my own field, the very same terms have been not only clarifying but essential to our understanding. There is no doubt at all but that they are learned and understood at the cost of great pain and effort, but a proper understanding of physical processes has proven impossible without them.

Salv: Not the least of the advantages to be gained is the unification of the sciences. Perhaps the greatest contribution a scientist can hope to make is to show that experiences once thought to be so diverse and

separated as to require completely different methods and theories can actually be embraced by a single theory.

Simp: You speak of the gains, but what of the losses? Is the product of a hundred years of social science to be discarded on the basis of these flimsy prospects? Can an entire branch of human knowledge be foreclosed because you hold to a very tentative hope to unit human processes within the confines of theory meant to refer only to particles?

Salv: No one would be so foolish as to suggest such a plan, least of all myself. This model does not deny all other forms of knowledge. Science is a wonderful and powerful system of knowledge but certainly not the only form of knowledge. Those who pursue this quest do not ask all others to abandon their own search but only for the opportunity to continue this work. For indeed, no matter how pleasant and useful this discussion, only experiment will determine the outcome.

PART III

COMMUNICATION THEORY: EAST–WEST SYNTHESIS

The concluding section presents three papers which compare and contrast certain aspects of the Eastern and Western perspectives toward communication and attempt to transcend the differences with some kind of synthesis.

Joseph Woelfel (Chapter 21, this volume) finds a common origin for both Eastern and Western ways of thinking or "models" of the world, which eventually influenced each region's perspective toward communication. Although his focus is on the development of the Western model, his course in a sense takes the form of a circle in which the Western scientific perspective has returned—substantially refined and improved—to a point which shares much in common with pre-Socratic and Eastern-influenced perspectives toward the world.

The crucial distinction is whether the world is mentally constructed in terms of continual processes or discrete catagories. The former choice leads to a position in which the word concepts of ordinary language are grossly inadequate to capture the true nature of the world—a philosophical position found throughout our Eastern perspectives on communication—but to a position in which dynamic change is not only possible but the focus of attention. The latter choice leads to the development of a logical description of the world in ordinary language terms, but to a static