Goethe Meets Accounting:
Seeing the Living Company at Work

Conversation with Professor Thomas Johnson
Portland State University, August 20, 1999

Claus Otto Scharmer[1]

C.O. Scharmer: You said you read Henri Bortoft back when we met the first time. What was it that made you excited about his book?[2]

Tom Johnson: I had been reading a lot of Gregory Bateson and a lot of David Bohm. There was so much in Bortoft that appealed to me and that reinforced the things that came from both of them, but especially from Bateson. Bateson referred to Bortoft frequently, and I was mindful of his thinking, enough to appreciate what Bortoft was getting at. It just appealed to me so mindfully, that message as he described it there. I was moving in that direction, with Bateson, with some reading of the poetry of William Blake, and it was all coming together there so nicely.

There was so much that was going on for me at that time. I was getting into Fritjof Capra's work and using his books in my courses. Every quarter I would take the students through *The Turning Point*, and then later *The Web of Life*. I also had them doing a lot of reading in Bateson…. Bortoft's book came along and fit in so nicely with all of that, and with all the thinking and writing I was doing about life system approaches to management. It just couldn't have been any better.

COS: So in the course of the last three years a lot has happened. When we met last time you were pulling together the concepts and your thinking about the new book that Peter [Senge] told me is virtually finished, right?

Tom Johnson: Yes, almost. There have been three completely different iterations of that book. The first time I had chapters up front on the new scientific thinking, and then a whole chapter on Goethe. Then I worked into my discussion of the three companies, Toyota, Scania, and this little consulting firm in Stockholm, how the message applied to what I saw in those companies. I sent it off to an agent in Boston and after a month she said, "Well, I don't think you'll have much luck with this.

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[1] The conversation with Tom Johnson took place as part of a global interview project with 25 eminent thinkers on knowledge and leadership. The project was sponsored by McKinsey & Company and the Society for Organizational Learning (formerly the MIT Center for Organizational Learning). The interviews and the summary paper are accessible as free downloads from www.dialogonleadership.org.

[2] See interview with Henri Bortoft on this site.

Maybe a university press interested in esoteric or new age type of material would publish it." She didn't want to deal with it, basically. I was very depressed about that.

I. A Goethean Approach to Car Manufacturing

I had had some people reading it in Sweden and elsewhere, and I told them about the reaction of this woman, who was a very knowledgeable agent and knew the market. Somebody reminded me of a story I used to tell about how Toyota and Ford grew up after World War II, and the different approaches they took to automaking. They were dealing in the same market, approaching the same kinds of customers, but by the 1970s these two companies were on completely different paths with totally different results. In the original draft of the book I had a chapter which compared my story about Toyota and Ford to Goethe's and Newton's approaches to explaining the color that comes from the prism, which I had gotten out of Bortoft.

COS: How does that go?

Tom Johnson: It's just the idea that one of them, Newton, was looking with a preconceived notion, a model, in a sense, that was quantitative and mathematically definable to explain how the colors appear. You're fractionating the sunlight into colors that are already there. When you get them there's nothing inherent in the nature of what you're looking at that's implicit in the explanation; it's all explained by the equations and wavelength, or whatever the word was Newton used, refractability. It was all reducible to coefficients in an equation—one color, one coefficient, and so forth.

These two companies, Ford and Toyota, coming out of World War II, looked at Henry Ford's River Rouge plant. The plant was built during World War I and ran in the 1920s building the Model Ts. That was the classic model of mass production, and every automaker knew it by heart. It was a useful model if you were going to mass-produce one car, one color, one way.

Following the war, the big question was how to make cars in varieties without building a separate plant for each variety. Ford Motor Company came up with a solution which in effect was based on preconceived notions of what it would take. River Rouge's low costs and reasonably good quality were achieved by building something to massive scale and then running it at the highest possible throughput rate you could. Always keeping it up and running meant your cost would be as low as possible….

The problem was you couldn't produce variety in a continuous flow of line like Henry Ford was running, because to make two different varieties along the same line means you've got to stop and change over somehow, somewhere. If it's color, you've

got to do it in the paint booths. If it’s anything more than color, you’re also going to have to stop somewhere else. If you get into substantial dimensions of variety, you’ve got an impossible problem on your hands: If you’re stopping the line all the time you’re not making cars. Their solution was to decouple the line. Break up the continuous flow that Ford had, and put your paint shop in one place, your stamping plant in another place, do your welding or your riveting somewhere else….
Now when you change over, you’re not disrupting a continuous flow of line. Now you produce output in these separate decoupled plants, and ship the things to a warehouse when they’re done into a final assembly line. A final assembly then would look like it always did with River Rouge. It can flow continuously, more or less, only now you carefully schedule your flow of parts every day, so that when a red car is ready to be made, a red piece will be coming in. Or when a six-cylinder is required, it’s coming. It’s not quite that simple, but theoretically, that’s the way it worked. This was the way they saw to have variety and do it at a reasonable low cost. It wasn’t as low as Henry could have done it, making it all the same way, but as low as anybody could making variety, they assumed…. This economy-of-scale thinking was very much part and parcel to all of Ford, and GM, and other American manufacturing thinking in those years….

Toyota looked at Henry Ford’s continuous flow system like Goethe looked at color, and basically said, let’s look at the many particulars in the process. What they concluded was the costs were low because of the continuousness of flow…. They went back to Japan and said, all right, we want to build varieties…. For them it wasn’t feasible to break the line up and have a shop here, and a shop here, and a shop here. They didn’t have the resources to build to big scale and run them fast; they were sitting in ashes after the war, they didn’t have any capital. If they were going to do it, they were going to have to do it once, in one plant. Whatever varieties they made were going to come out of that plant and they were going to have to use as few resources as possible. So the continuous flow was logical to them, and that’s what they perceived when they looked at the line….
By the 1970s, when we first started to become aware of what was going on, changeover rates were down to minute fractions of what we took for granted over here. We had stamping presses that took eight hours to change, and they changed them in 20 or 30 minutes. Eventually, by the early ’80s, they were getting it down in the range of six, eight, ten minutes. Having done that, they were able to build what they called the Mixed Model Line. Now you could have a continuously flowing line, and for a certain period you could see red ones come through, followed by blue ones, and whatever the model mix was required by the customers for that day would flow along. **They had enormous variety at very low cost because they had a system where they were able to build every work station to a scale that consumed resources no greater than what was needed to make one order at a time, to fill one order at a time. A wholly different conception of the world is lying behind this.**

As I see it, they looked within the minute particular, they didn't have a preconceived model. They went out and looked at how people did the work. It was sort of like Goethe. He looked at color and finally saw, ah, it's the shading together of the dark and the light that gives rise to the color. Newton wouldn't have conceived that in a thousand years, never would have perceived it. Then Toyota looked at relationships between the people and the way you orchestrated those relationships. These made possible what was a logical solution, which is you can end up with a facility that requires no more resources at any point than what's needed for one order. You build one order at a time and theoretically you're marching toward a day when every one of those orders can be different from the one before it.

I gave this story as a way of showing how we think. How you think determines how you behave and what results you're going to get. When I talk about the world view of the Fords, and the world view of the Toyotas, it's kind of like the world view of Goethe, and the world view of Newton**. Then it dawned on me one day what this is. This is mechanism-versus-life system, really. That's what Goethe was talking about.** It began to get richer. So in the second version of the book I put the science and Goethe and all of that from the first version towards the back, and I brought the Toyota-Ford story forward.

It also addressed the problem this woman raised, which was, "If you want to sell this book to business people, you can't sit around talking about Goethe, for God's sake. Talk about something they know." So I said, "Okay, Ford-Toyota, they'll know that." I sent that version out to several people and got strong, powerful, good reactions from some people. But there were a couple of industrial engineers whom I had enormous respect for and who knew both companies very well, who said, "You made up this story, didn't you?" And I said, "Well, yeah, it's kind of apocryphal history." And they said, "Well, you've got a lot of problems here. If guys from Ford look at the way you've described what they supposedly did in the '50s, '60s, and '70s, they can just shoot you full of holes. Because in a rough way, yeah, it all comes out this way, but it isn't quite how they got there. They had to fight with the unions and Toyota didn't. That makes a big difference." They convinced me that I was leaving myself open to too much criticism, that the whole book could be shot apart because of the flaws that were in the opening chapter....

The other thing they criticized was that I had stuff strewn all through this book about cost management. Of course, that's where I came from originally. And they said, "It just isn't pulled together anywhere in a good way. You obviously know a lot about it, you contributed a lot to the literature yourself, but for the person who hasn't been there like you have, it's in too many places, too scattered, you've got to pull it together." So I did that. Then I ended up finding I could conclude the book on some notes that I had had up front in the first versions, and finally it all seemed to fit much better. My wife was helping me with the editing a lot, and we were really getting into the problem of making each paragraph flow to the next one, and we were getting the words really worked out this time, paying close attention. It was hard work. I think it is a much richer product than what I had three years ago, and it’s because I learned a lot.

COS: If you look at the book as a whole, what is the underlying question that you are trying to address? What is it that you are trying to find out or bring across in this book?

II. Organizations as Living Systems

Tom Johnson: I think the underlying question of the book is how would you think differently about an organization if you viewed it as a living system rather than the way we have typically viewed it in the last 60 or 70 years. What is that difference, and what does it mean in concrete terms as to how we would approach production, design engineering, and cost management? Those are the three themes through the three companies that I play out. Profitability analysis might be the right term….

Along the way I implicitly bring the reader to the understanding that if you make this transition and you’re viewing your company as a living system, you will move toward working more in harmony with nature’s principles. This will have profound consequences for the ecological environmental crisis that we perceive surrounds us today. Once we get straightened out and manage companies as if they were living organisms, living systems, that will take care of itself.

And I think I’ve got that problem resolved more.

COS: Resolved in what way?

Tom Johnson: In terms of being more concrete and more full now in my explanation of what I mean by following natural system principles. In the book I call it managing by means, as opposed to managing by results. I start the book by describing what I mean by the life system world, the organic world view, which is based on quantum, relativistic, evolutionary science. I’m really not talking about life system just in terms of cells in the earth’s ecosystem, but I’m talking about Brian Swimm and Thomas Berry’s universe story. Which in a way is, I think, substantiated and supported by a lot of writers like Stephen Hawking, Richard Penrose, a young fellow at Penn State named Lee Smolen, a fellow named Green, in Britain, and others.

COS: What is the essence of that story?

III. Three Evolutionary Principles

Tom Johnson: That the entire cosmos, the entire universe is an evolving system that emerges from a particularity at the time of the Big Bang 15 billion or whatever years ago. It's been evolving from relative homogeneity into more and more diversity as time goes on, from hydrogen to helium, atoms to galaxies, to stars, to supernovae, to planets, and then to what goes on this earth. That whole story, I'm saying, manifests the working of certain principles. I boil them down to three. Essentially they're the three that Swimm and Berry use, and I find that Lee Smolen uses the same ones…. **We use words like self-organization, interdependence, diversity to describe these three principles**. I said you've got a universe which for 15 billion years has been showing a pattern of development that manifests these three principles at work.

COS: Looking at self-organization—

Tom Johnson: Self-organization is the emanation of material form in a system where everything is related to everything else, and where the emergence of self-organizing forms that are of necessity forced to relate to everything else gives rise to infinitely growing diversity. I think it's very similar to what Bateson was saying 40 or 50 years ago. This view has lots of support for it, not the least of which is empirical support of some of modern quantum and relativistic physicists.

These principles are a pretty sound basis for explaining reality. **If that's the case, then our organizations, our human organizations, should be looked at as nothing less than life systems growing out of the same system, same process, and should emulate the same three principles if they want to act in harmony with nature. The fact that they're probably not operating according to these three principles most of the time explains why they're usually screwed up.**

Having reached that point, I said, what would a human organization look like if it emulated these three principles? I draw a little picture right in the first chapter of a system where you have a continuous flow of energy and matter passing between company and customer at the macro level and then down to the micro-micro particulars where every worker at every moment is always doing something in response to the needs of customer. He can identify at every moment as the work is being done whether the customer need is satisfactorily fulfilled. You can work on a picture that looks like a tree and the cells of a tree, or the cells of a body. You've got continuous flow, continuous self-referencing through feedback. As [Humberto] Maturana and [Francisco] Varela would say, knowing is doing, doing is knowing. I say the information is the work and the work is the information at every point, at every instance. There's nothing controlling this; there's nothing directing it and saying from the standpoint of an equation or a model or a plan, now you do this, now you do that. It's all self-organized from within.

Having set that out in the first chapter, I'm then able to go forward and say, okay, now take a company like Toyota. The reason we see Toyota doing so well and manifesting the strengths and robustness it has over so many years is because it's emulating these principles. Then I discuss what I've seen walking their line for so many years in terms of these three principles, and I relate it back to my little picture. Now I've got it clinched. I can compare design engineering as I've seen it at Scania back to the way nature's process of evolution works here on earth, where we can be more concrete and specific about evolving the pattern of incremental change made by minute steps. I relate what they're doing to that, and I compare it with the alternative approach, which is making blueprints and designs, and imposing them on the system from above.

COS: What is the Scania way of designing? Not using blueprints, but—

Tom Johnson: Their modular design system took them years and years to work out satisfactorily, but they're able to meet every customer on each individual customer's terms. They say, "we can produce a fingerprint truck for each and every customer at much the same costs, probably a lower cost than those makers who in effect are mass producing."

COS: And not using modular design.

Tom Johnson: That's right. They can identify very specifically and precisely, right down to within the modules, the changes that have to be made to meet a new set of requirements. Usually the difference from one customer to the next is not that great. Maybe one is driving in the city and one is driving more on hilly countryside. You've got to have your power configuration, your gear change characteristics, maybe the torsion bending capabilities of the frame. These are the kind of things that have to vary, but they can be very, very precise about exactly what pieces and parts will vary and by how much. Theoretically, their modular design matrix can handle billions of alternatives. From a practical standpoint we're only talking about 50 or 60 thousand trucks a year, but nevertheless, they can really make 50 or 60 thousand all different and do it very, very economically because a change for them means a little bit here, a little bit there, and everything else stays common. That's what the secret of success is, everything else stays common. We can see among their European competitors that Scania could produce the same number of trucks with about half as many different components. They made a science out of fine-tuning and tweaking variety.

COS: Haven't they been acquired by Volvo recently?

Tom Johnson: Yes, just in the last month.

COS: Are they continuing their approach or is that now being —

Tom Johnson: I think they will. I think Volvo is mindful of what Scania does, and they wouldn't want to kill the goose that lays a golden egg. The financial writers in Sweden have been writing about this for years; everybody knows. If you go back as far as you can get the data, Scania's profitability tends to be double or triple on the average what Volvo's is, selling fewer trucks in much greater varieties…. They make profit even in the business down cycles. In the last business cycle they made more than Volvo, and they always made more than Mercedes.

I can't think of another example where you have these two, almost perfectly pure competitors, identical companies in identical markets, and the least profitable one moves in and buys out the other one at an enormous cost…. It's sort of like the cobra buying a mongoose. You bring them into your cage.

IV. Seeing the Parts as Embodiments of the Whole

COS: The big shift you are talking about is a shift between two world views—one which looks at organizations mechanistically, and one which views reality, social systems, and organizations as living systems, right? That probably implies changes in various levels, one of which is how you approach reality.

Tom Johnson: Laws in the mechanistic view of reality are, as you say, "behind the curtain," kind of hidden. In the second case, in the living organism view, the laws are visible only through the minute particulars of the system itself. The whole is manifest in the parts. I think one of the biggest changes is for managers to start to see the whole mirrored in the parts. Bohm referred to the universe as holographic, that the whole can be perceived through observing the parts. Every part manifests the whole uniquely, each differently. By studying the parts you begin to understand the underlying principles. You see the underlying principles by observing the details of physical reality, like Goethe did looking at that color for 20 years. Study it and you begin to see it's got nothing to do with angles of refraction. It's got everything to do with darkness and light. Look at the particulars in an organization, don't go hunting around for strategic mathematical models.

COS: Would the particulars be practices? When you try to approach organizational reality in this way, what is it that you really do? What are your own practices that you use in order to get to these particulars?

Tom Johnson: At the most elemental level you're mindful of how **the work of each and every individual in the organization is somehow manifesting the union of company and customer. I think this is the ultimate reality, the reason organizations and business organizations exist**. They're somehow matching the expertise and the talents of people who have services to offer with the needs of customers who have some want to be fulfilled. They're trying to do that in the most expeditious, complete way possible. We should also think of it as being in a way that is most harmonious with nature's requirements.

The starting point for reaching that position is having a system in which you can say, yes, we and every single person here knows that what they're doing is linked expressly to the satisfaction of customer wants and nothing more. There's no empty-handed work, no work that can't be identified with satisfying the customer need. The resources being consumed and the capacity being required to do the work are to the best of our ability no more than what's needed to fulfill one customer order at a time. Now if you can do that, you can produce with all the variety that's needed to meet the market's conditions at the lowest possible cost imaginable. I think those are the two things you've basically got to do. **Those are the two things that Michael Porter says you can't do. He says you can do one or the other. You can be a low cost producer or you can be a differentiator. What I'm saying is in a living system, you're always doing both**. It's not either/or, it's both/and.

And when you look at Toyota from a concrete standpoint, they've achieved this to a great degree. They don't fit his model at all. This is because they've paid attention to the detailed minute particulars of the product's design so that it can be produced according to these requirements. The work of the individuals is very standardized according to how the workers themselves have standardized it, so that they know every moment isn't, in terms of fulfilling customer needs, normal, abnormal. If it's abnormal I can stop and I correct it. I don't waste time passing it onto somebody else and having them correct it. Those little things are the secret. And in the design of the product, are we designing it up from a sense of how each particular meets the needs, and then when a change comes, not having to vary any more than the particular part that impinges on that new requirement?

The third thing is cost probability analysis. One of the biggest flaws we've got in our system is we don't know profit until it's all over. You go to the accountant and he'll say, well, I can tell you for last month, last quarter, last year. And they pull together all these numbers that have got no connection with the processes in the organization at all. Reengineering and activity-based management and all that nonsense is created order designed to take accounting numbers and create the illusion that, aah, now we know where all this comes from. **Instead, what I say in my book is, why can't we pull assessment to order one at a time? And do it in real time, just like we're doing with production as I talk about it in Toyota; or design as they talk about it in Scania. We could have real time assessment of profitability, order by order, as it happens.** This is what I learned from my friend Anders Broms in Stockholm. His company's been doing that for its clients for 20 years and nobody understood it. He was becoming very frustrated, trying to explain in his best English to English-speaking people what he and his colleagues had been doing, and they weren't getting the point.

COS: Which is doing assessment in real time?

Tom Johnson: In a sense, yes, that's what it is. The way I described him in the book was that his concern is cost analysis, but basically it's profitability analysis. For the last ten or twelve years he used the phrase *activity-based costing* to describe his practice, and he was smartly opportunistic to do that. He rode that wave. He's doing something that looks like activity-based costing, but when you get into it, it's got almost no relationship to it at all. Like activity-based costing, he's going in and saying, look, the only way to understand cost in an organization is to get down to the grassroots level of the work being done. Analyze the work, cost the work. **But unlike what usually goes on when people talk about ABC, he's looking at the work, order by order. The intent or the hope is to trace the indirect costs of each order.** That's what activity-based costing is dealing with: how to get the indirect costs onto some object you were trying to cost. So he says, I don't care about costing products, I don't care about costing departments. I cost the orders, order by order by order by order. It's a procedure that resembles activity-based costs.

COS: So how does he deal with the indirect costs when he tries to apply them to the orders? He still has that problem, or not?

V. Three Cost-Driving Purposes: Structure, Newness, Volume

Tom Johnson: He has to identify some unique characteristics of the orders that cause them to consume resources differently, the resources that bring about indirect costs. He has two or three basic classifications. He doesn't call them cost drivers, he calls them cost purposes. He says, "We incur costs because we have structural problems that have to be dealt with. We incur costs because we have newness. We bring new things online that cause work to be done that otherwise wouldn't have to be done. And we have costs that are just due to the fact that we're producing stuff."

COS: We exist.

Tom Johnson: If you want to, call them volume costs, or something like that. Those three categories, sometimes more, enable him to define or classify the different work and the different research consumption patterns going on in the company. Through that he can trace the indirect cost uniquely to each order, depending on how much it consumes the structural resources, newness resources, and basic order volume resources. It's a relatively simple matter to figure out the revenue by order, that's pretty much automatic. And direct costs are never a problem. So when it's all done, he can show you your profitability order by order.

Now, once he's done that, with computers he can code his data and sort his costs by product, by customer, by region, by channel, by any dimension you might come up with. You can't do that with an activity-based costing system, except with horrendous wrenching of the data. It isn't just a matter of sorting when you're in activity-based costing, you've got to go back through and redo the costing. You cost your products, then you want to know your cost by customer. Well, then you've got to go back and find by customer the products each one bought, and then you've got to make a lot of arbitrary assumptions, and retrace costs, many of them, to customers. You end up with a fiction that you call cost by customer, profitability by customer, based on the original product costing. Then with more difficulty you can probably come up with costs and profitabilities by region and by channel.

One of the things he finds out and always shows his clients is that you never ever gain much, if anything, by getting rid of losing customers or losing products. Activity-based costing people are very big on that. They say once we give you our costs you'll get a better idea where your costs are. We can show profitability more precisely than with old costing methods, and teach you where your real losers are and where your real winners are. What they don't realize is that if you're a major seller of commodities, an automobile maker like Volvo or Scania, you've got customers who typically buy a lot more than one of your product. A single customer buying multiple products from you may, on average, show up to be a loser. Some of the products they buy might have been sold on a quite profitable basis, some on a losing basis. Anders can show that, whereas no activity-based costing system I know in the world can do that….

VI. Tracking the Neighbors to Profitability

Now he says, I don't want to talk about cutting customers or cutting products or anything, I don't want to talk about cutting costs. I want to talk about telling stories. That's always been his message. He says I want to go in and I want to create stories about the order lines. And I want to talk about what were the conditions. He uses the phrase "neighbors." What were the neighbors to profitability? What were the neighbors to loss?

VII. The Roots of Reinventing Cost Accounting

COS: When was it that all this got started?

Tom Johnson: Anders and this group of people—he's an electrical engineer—thought it through in a different way that accountants never would have dreamed of. I think it all got started about 30 years ago back at Ericsson when Anders had a partner who cofounded this company with him. The partner, Stane, is now retired. He is 15 years older than Anders and was a young master student at KTC, the Royal Institute of Technology, back in the late '50s. He got involved in a class project where doing a project for a company was like a Harvard Business School case. A company comes along, they've got a problem, so one of your master students writes a case. The company president, who was not an accountant, felt that all of the cost numbers were screwed up as to what his different products cost. I think he made aluminum consumer items like pots and pans, or something like that.

COS: So the reality was screwed up or just the numbers?

Tom Johnson: The numbers. He said, "They tell me that these are my margins on these different ranges of product, and I think it's just nonsense. They don't think I know where I'm going." And so he said to Stane, "Take a look at this. I think the problem is in the cost numbers somewhere."

So Stane, not being an accountant, didn't go talk to the accountants, he went down to the shop floor. He looked around and said, "Well, okay, that's where these indirect costs are coming from." He started to look around and he decided it's in the work. You've got to figure out what the work is that's causing the costs. He started to interview people about their work day, and in effect he did what we would now call activity analysis. He found out how people on average spent their time, and in an average day of eight hours, maybe one hour is on the real work of getting the product out the door and the other seven hours is having to confront this system they're in to deal with messes—you know, rework and budgeting and form-filling-out, all the good things that people are rushing around to do. He sorted out the costs according to these things and found out which products were causing which kinds of costs. In effect he came up with drivers to attach these costs to the products, and went back with a new set of data. It turned the company around for this guy. That was the beginning.

Stane went on to Ericsson, and some years later he met Anders, who had joined as a young junior engineer. They got to talking about this problem and he said, "You know, the same situation exists here in Ericsson, only in spades. It's just an order of magnitude worse than it was in this little company I dealt with as a student. We ought to look into it." Working with their fellow engineers, with no accountants involved, they kind of horsebacked some activity-based numbers and gave them to the division that makes the old-fashioned telephone switches for city systems, which was a big money-maker for them in those days. They showed that the way they were running things was based on fiction, and here was a clearer set of numbers. Management paid some attention to it and they embodied this new way of looking at costing into their systems in the early '60s.

Then around 1964 or 1965, along comes IBM. They've got mainframes for the first time, and they were computerizing everybody's data processing. They were taking the old hand-prepared records and putting them on punch cards and tape and computerizing so everything came out on printed computer forms. After they did the payroll system and did the accounts receivable, they usually found their way down into the factory and started to do the cost accounting system. The accountants in the company were working with the IBM guys who didn't understand what the hell Stane was doing anyway. They all took a look at this stuff and said, "Jesus, this has got nothing to do with the categories by which costs are handled in the accounting system. We can't handle this. We're going to computerize the accounting system and it's going to tell us the costs." They kept on doing it the old way in the accounting system all along. Stane had this sort of side system going.

COS: It was a parallel system.

Tom Johnson: Yes, a parallel system, that's my understanding of the story…. Stane and Anders stayed on with Ericsson for several more years and then they drifted away. In the early to mid-'70s they started working together on the outside doing consulting. They decided they would resurrect this practice around 1975 or 1976, and it was with the blessing of some of their old friends within Ericsson…. They grew other clients over the years and developed this practice of profitability analysis where they could show customers tremendous arrays of data.

…. They kind of grew up with the power that the new personal computer gave us after the late '70s and into the early '80s. They were always way out at the front in that, always crunching more data than anybody else. Once they sell a project, they take the entire range of orders for a year, or six months, or something like that. That's a lot of data. They input the characteristics of every single order line—in effect, it's every line on every invoice to every customer. That's an awesome job. But it's the only way they've been able to do it up until now.

I think if we get the message out and people start to appreciate what this is about, it's going to become more of a real-time way of thinking about how to process data so that you can assess to order. That is what I'm saying now in the book. I think that was something new I was able to add to the picture here. I said, for God's sake, imagine the power of this in the context of Toyota and the product context of Scania. If you can take a company that can assess to order, there's almost no reason to have any indirect costs. If you produce to order, you design to order, you assess to order. [The effect is that there is] nobody around here but us guys doing work; you know, it could be mind-boggling.

The Information Factory

In the book I use the phrase "information factory" to describe these great masses of resources we've piled up over the years to do information processing and handling in systems where we don't produce to order or we don't design to order. We produce a schedule, we design a blueprint, and in effect, batch everything and put it in holding tanks and wait and watch and hope and pray, and get involved in planning and budgeting, and after the fact, blaming and shaming….

That's been a big mote in our eye that's caused us not to see reality. **We've been piling cost upon cost upon cost in what I call an information factory that's got nothing to do with the real work that it takes to satisfy customers. We talk today about non-value activity, about waste, about getting lean, and all of these things. But I think most of the guys who talk those ways still don't understand what the problem is, which is we're not pulling work to order….** I call it whitewashing the decks of the Titanic. Produce more, and in an economy like the one we've been in the last six or seven years the consumer saves your ass. But give us something more like the economy of the '70s or the '80s, who knows? Some people think the business cycle's gone. I'm not quite that sanguine, but I think we've been living in kind of a fairyland lately.

COS: What would an organization that embodied these principles look like? For example, would the implication be that there is no separate function, such as manufacturing, marketing, accounting and so forth? Would that be all one at the end of the day, or how would that integrate or overlap?

Tom Johnson: I think you would still have accountants in the traditional sense. Bookkeepers, recordkeepers, and recorders of the past would keep track of results. And of course, we have to comply with the law, if for no other reason than this is the world we live in. You would have somebody to help you keep track of cash flow and make sure that you're not moving into dangerous territory in terms of overcommitting yourself in spending or whatnot. I think that it would still be necessary to have people doing those kind of things.

What you wouldn't have anymore would be people taking information from those systems and bringing it back in in the form of targets to drive work, to drive the behavior of people in the organization. We would no longer bring quantitative targets—whether it's bottom line financial number, a balanced scorecard, whatever—inside the organization to drive the work. The work would be directed by adherence to natural system principles and guided by notions of, is what we're doing normal? Is it abnormal? Are we correcting what's abnormal? Taking care of it on the spot? Are we doing no more than is needed to meet one order at a time ideally? Or if not, do we have good reasons to explain why we must do otherwise? And there will be reasons, but there will be people understanding principles and work and patterns and disciplines developed over long periods of time who will be taking care of operations. **You won't need outside information. It will be just like in your body. There's no central information system directing it like an oil refinery. The information is in the flow, in the metabolic flows in a sense,**

and those flows are the information. It's all coordinated by this massive neuronal system that includes the brain. If you read Maturana and Varela and others, they don't buy into the idea that the brain is a controller.

VIII. Riding the Wave

It's a rich set of interconnections, as Maturana says, to provide for extremely diverse patterns of interactions with the environment and mediate them so you can behave like the surfer on the surfboard, always ready to make the changes necessary to stay alive. Bateson used the tightrope walker metaphor. How does the tightrope walker stay alive—i.e., upright, constantly moving every muscle of the body to keep the balance? It's the same with surfing. **I think we ought to think about companies more that way. We're riding the wave, we're not sitting back in the control booth. You know, [if] you try to run a surfboard with a control booth, you're dead,** it won't work. In that sense, yeah, we're getting rid of the systems, the thinking, the people, the practices surrounding those systems. Ultimately, I think that also includes production control, particularly of the MRP [Material Resource Planning Systems] variety, as well as the traditional standard cost accounting systems that measure variances from the shop floor.

COS: You talk about these evolving patterns of relationships, and you said that in this other way of looking at the world the whole only shows up in the parts. The whole is inherently connected with the parts. It is embodied or manifests in the parts.

Tom Johnson: Yes, it manifests itself in the parts.

IX. "Bodying Forth" in What We See Around Us

COS: So what really is the thing called "the whole"? Is there any relevance of that for management and for living in organizations?

Tom Johnson: Well, I think there's powerful relevance. I draw my basic thinking in that regard from Henri Bortoft, and Bateson as well.

COS: Which is?

Tom Johnson: Bortoft is more explicit. He talks about the counterfeit whole versus the authentic whole. I struggled for a long time trying to figure out what he meant, but I think those differences are very meaningful and get at what you're talking about here. Were they to be understood by business people, they could trigger a profound change in thinking that would lead to quite different actions. It gets back to all the things I've been talking about. **You can see the universe as objects that are there because they embody a pattern that in effect bodies itself forth uniquely every moment. I think there is a generative process at work throughout**

the entire universe which follows certain principles or a pattern that we are aware of in this bodying forth in what we see around us. The parts are everything you see. Anything is mirroring these patterns and principles, mirroring the whole. I'm not sure Bortoft would agree with that interpretation, but I think that's what he's saying and what he's drawing from Goethe. That's nature. If you look at a machine, created by the human mind, the parts don't mirror the whole. The parts—

COS: Are outside of the whole.

Tom Johnson: Yes. They're outside of the whole. The machine, if it works, is obviously well designed by a mind that sees how to make parts interrelate so they'll do a certain function, as long as properly lubricated and given enough fuel or whatever. But by definition the parts stand alone and don't in any way mirror the whole. They are like Newton saw the whole universe: independent particles which react only to external force or impact according to external laws and principles. That's the way we design machines, that's the way we see the whole thing working. But in nature there's no such thing. Nature, absent the human, has got no such thing. In nature everything has bodied forth from the process of this universal pattern manifesting itself again and again and again, trillions and trillions of times.

COS: Couldn't one say that initially we really see both? Don't we also see external objects which are separate from each other and which can relate to each other through external forces? I would say that at least is the way you can look at the world and make some sense of it.

Tom Johnson: You can look at it that way, but Bortoft, or maybe it was Bohm, talked about the difference between separate and separation. You can have things separate but not separated.

COS: Or differentiated and separate.

Tom Johnson: Maybe. Yes, we can look out and we can see things separate from each other, but in reality they are—

COS: Not disconnected.

Tom Johnson: They're not disconnected, they're part of a web that we don't see necessarily, unless we really studied this and thought about it. Even then we don't really literally see it. But there is a web.

COS: The trick is not just to look at the particulars but to look at the particulars in the context of all other particulars.

Tom Johnson: Right. I think that's what Goethe was talking about. I forget his wording—and of course, any words I know of his are translated English words. Bortoft said to me once he doesn't read German, and I was surprised.

COS: That's true. Still, he's one of the best Goethe interpreters.

Tom Johnson: Is that right? As you read Goethe in German, you would know. Goethe made studies with leaves of the delphinium and that kind of thing. I guess he had tens of thousands of these that he had collected over the years in order to see in great detail over the life of a plant under different conditions, what the leaf looked like at each stage of development. He would study hundreds and thousands of the plants at different phases, different years, under different weather conditions, and he got this view of how the pattern emerged. Then he would compare other plants to it. He wasn't studying delphiniums so much as he was studying how this phenomenon emerges, what the pattern is.

X. Implications for Leading Living Systems

COS: If deciphering and tapping into these emerging or evolving patterns as a way of getting at the particulars is of relevance for tomorrow's economies and organizations, what are the implications for practices? How will that affect the way we run and manage and lead organizations?

Tom Johnson: Well, I think in general it means managers and leaders have to be concerned more with how the details are orchestrated.

I have friends at Toyota who grew up in General Motors, worked there 25 years or more, and then came on as managers of the Toyota plant down there in Kentucky ten or twelve years ago when it opened. They've seen both sides. They perceive a shift in their own thinking, and say, "That led to new behavior here and we crossed a bridge that our former colleagues can't even see through the fog yet."

I asked one of my friends, "Okay, what's one of the key examples of this change in thinking?" He said, "Well, the key thing is that when we used to work for General Motors, you worked for the boss. The boss defined everything, dictated everything. The way the work got done and when it got done and how and why it got done was up to him. So you got to know the boss and you got to move in harmony with his more or less rational rhythms. Then one day the boss is gone. He gets promoted, gets fired, gets transferred, whatever, and a new one comes in. We've got to start all over again, and we scramble and we run, because now this guy brings a whole new set of things. They hired some new guy because he's got a new thing he's promised them. So we learned the new thing and we deliver a new set of promises." And he said, "It's awful."

So he came to Toyota. He learned pretty quick the system has changed. There is a system—you can call it the Toyota system if you want to—when a new manager comes in, he spends the time learning a new system. The workers and the subordinate managers who are going to report to you, they're not looking to you as to what should be done or how it's going to be done, or for rewards or punishment, or whatever. Of course, you as a leader are going to create the environment that makes it comfortable for them to do this and make it effective. But what they learn is the system, they don't learn what's in your brain. So when you come and go it doesn't matter to them, they keep going. And they also have control of that system because most of the changes made in it they will make. They design their own work. They said, "You want to know what the biggest change is? That's it in a nutshell." And they said it's like night and day. They said you can't imagine a bigger shift to go through than that. All of these guys when they tell you about it now, they are just thrilled to be inside of this new system. They all love it. It makes their lives better, it makes the workers' lives better, and it makes a better product for a heck of a lot less money, which, of course, is why Toyota has got it there. Everything else, in a way, is kind of subordinate to that, that's the big thing.

COS: I see that there are these three universal principles, but then you also have in each organization, in each company, and so forth, other different more particular principles, which then define—

Tom Johnson: That I'm not sure of yet. I think in nature you don't. As far as the physicists and the astronomers are telling us today, anywhere you look in the universe the same principles work. And in effect, that was Einstein's fundamental assumption, the general theory of relativity, that throughout the universe the same principles apply in every—

COS: Yes, in a universal sense, but I mean principles in terms of individuality. So, for example, you would have one plant which shows certain characteristics, certain particulars that are different from those which are shown by another plant.

Tom Johnson: Well, in Toyota there are differences but they're on a basic bedrock of similarity.

COS: My question is, basically, where do these principles come from? And how would they evolve over time?

Tom Johnson: It suggests a very difficult problem. Toyota evolved this over many, many decades, starting back at least as far as the 1930s. In some cases it's based on what they did in the early automatic loom manufacturing, before automaking became part of the company back in the 1890s. There were ways of thinking about how work should be done that to some extent had roots in Japanese culture, probably more so just in the way Toyota looked at the world. By the 1960s Toyota began to codify and publish material about this. Now, if you ask them what these principles are, they show you a picture of a house that's got a foundation, a couple columns, and a roof on it. The foundation is standardization; everything's based on standardization. The two columns, one of them says do everything as the customer wants it when the customer wants it done. Which you can translate into JIT [just in time]. The other column is when you see something wrong, stop and correct it. Know normal from abnormal, and when you see something wrong, stop and correct it. Then the roof has on it the word *kaizen,* and it says, "And along the way, always be mindful of how you can improve what you're doing." Be in better touch with the customer, give him a better product through processes that are becoming more efficient and more effective.

Then they give you further slides that say, now fundamentally we look at four conditions in a priority order. The first one is safety in meeting the terms of our house…. From a practical standpoint, most of the time that translates into a concern for ergonomic conditions. So, at least in Kentucky, this has manifested in the form of a real concern with the stress and strain of every particular job you do in every station on the work line. They have a four-scale ranking system for ranking the ergonomic difficulty of the work. They cycle the workers every two hours…. The guy in charge of safety in Kentucky Toyota said, "Our goal is to have the worker, at the end of a two-hour stint on the line, come away feeling like they've been in a health club." He said, "You know you've worked out, but you feel good."

COS: Cool.

Tom Johnson: So safety is the first principle. The second one is quality in terms of customer satisfaction….
The third thing is productivity, which basically is what boils down to number of people per vehicle, but they think of it in terms of cycle time. They've got a way of thinking about it which isn't an accounting-based measure of productivity, but it boils down to efficiency in the end.

Then the last thing is cost. What you perceive is, and what they tell you is, "We spend almost no time thinking about cost." Now there have been some exceptions to that in recent years, but basically they say, "We don't think much about cost, and we don't think much about productivity. Because we know from historical experience, if you take care of those first two, safety and quality, productivity and cost will take care of themselves." They have such a track record on that it's unbelievable.

About five years ago they became aware that Americans were starting to catch up in ways that Toyota, because of the nature of their system, wasn't paying attention to. Let me explain one example of how they got to it, which is very Toyota-ish. They had to answer the mandate from headquarters to get serious about finding out what some of the cost differences are between say, the Toyota Camry and the Dodge Intrepid. They tore them down and put them on the floor, a big space half the size of a football field. They told everybody in the plant, “For the next month or two this stuff is going to be there. And when you’ve got any spare time, when you’re on your lunch break or when coming from work, going home, pass through here, study these vehicles, and give us your thoughts.” Just talking to all the workers, eight-thousand workers in the plant, they said, “You know the cars better than anybody else.” It was right down to nuts and bolts. All this stuff was on the floor. And they had a big curtain rod. I wasn’t even let in at the first time I visited; later they let me in. But it was a big secret what was going on. And everybody was passing through all the time, looking.

They came up with interesting things. For example, they found that welded underneath the frame of the Camry were four big lug bolts, heavy bolts. They looked at them and they said, “We know the exact place on the line where we weld these damn things onto the frame, but we don’t know why we’re doing it.” So finally it got back up to Japan, question the design engineers. The young design engineers didn’t know, and finally some old guy said, “Oh, for God’s sake, when we started making the Camry and selling it in the United States they all went over on ship. Those bolts were there to hold the thing on the deck of a ship to keep it from shifting.”…

They had another one with the rear view mirror. By the time you got to the mid-’90s, there wasn’t an American car made that didn’t slap the mirror on with an adhesive, that was it. Toyota was still putting them in with four bolts because it would last a hundred years. It never got loose and it was there. The adhesive thing, sometimes they fell off. They took it up to the top design in Japan and went around on that one for quite a while, because the old-timers didn’t want to give up on that one. But then they were convinced and so they changed it. The list of stuff just in one year that they took out of the Camry was awesome. Now they’re doing some new things, but they learned, boy, they learned. When the time comes they won’t repeat it.

COS: That’s a wonderful example.

Tom Johnson: Cost was finally something they paid attention to, at least in one dimension there for awhile.

COS: Okay, so I’m mindful of the time. Thank you so much for the really great conversation.

XI. Reflection

Tom Johnson’s recent work is organized around the following underlying question: How would we think differently about an organization if we viewed it as a living system rather than as a machine.? Living systems evolve according to the same universal principles that have guided the evolution of the cosmos over the past 15 billion years. The evolution of the cosmos embodies three fundamental principles: self-organization, interdependence, diversity. This change implies a fundamental shift of mind. A shift of mind from a mechanistic, "Newtonian" type of thinking to another perspective that conceives of reality as a living system. Following Bortoft, Goethe, and Bohm, Johnson suggests that the whole is manifested in (and between) the parts. Says Johnson: "I think one of the biggest changes is for managers to start to see the whole mirrored in the parts." As a consequence, leaders will have to pay more attention the detail: "Leaders have to be concerned more with how the details are orchestrated" such that "the work of each and every individual in the organization is somehow manifesting the union of company and customer."

XII. Bio

H. Thomas Johnson holds the Retzlaff Chair in Quality Management in the School of Business Administration at Portland State University in Portland, Oregon. He has practiced, taught, and written extensively in the fields of economic/business history, management accounting, and quality management and has served on the editorial boards of *Accounting Review, Business History Review*, the *International Journal of Strategic Cost Management*, the *Journal of Cost Management*, and the *Quality Management Journal*. His book *Relevance Lost: The Rise and Fall of Management Accounting* (Harvard Business School Press) was cited by the *Harvard Business Review* in 1997 as one of the fourteen most influential management books to appear in the first seventy-five years of the *HBR*'s history. His controversial and internationally acclaimed sequel to that book, *Relevance Regained: From Top-Down Control to Bottom-Up Empowerment* (Free Press), has been translated into four languages. At the time of the interview, Professor Johnson and co-author Anders Bröms were completing the manuscript for *Profit Beyond Measure: Extraordinary Results Through Attention to Work and People* (Free Press, 2000).