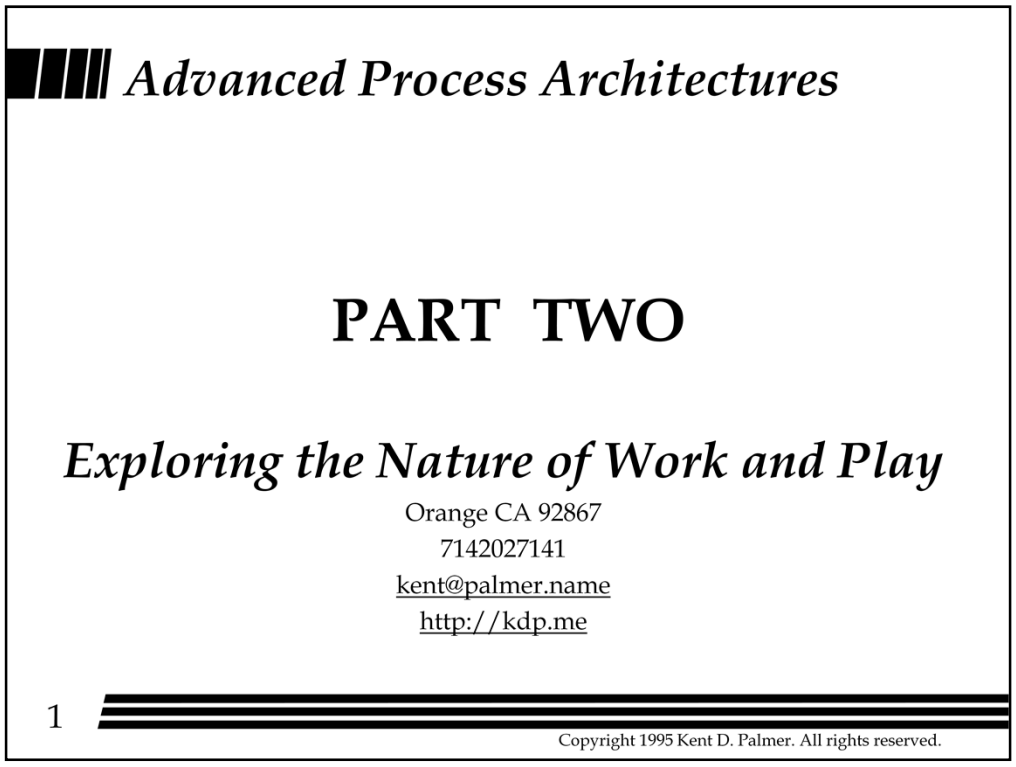
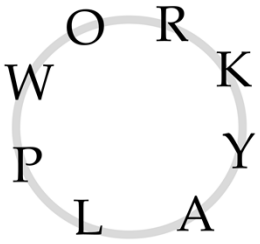


In this section we will explore the nature of work and play. That is to say we will apply the learning and changing of logos and physus to the relation between work and play which are basically the way the dichotomy between the tame and the wild appear within the cultural sphere.

A closer look at the category of work

Work / Play



- In this part we look at the definition of work and how it relates to our understanding of process.

2

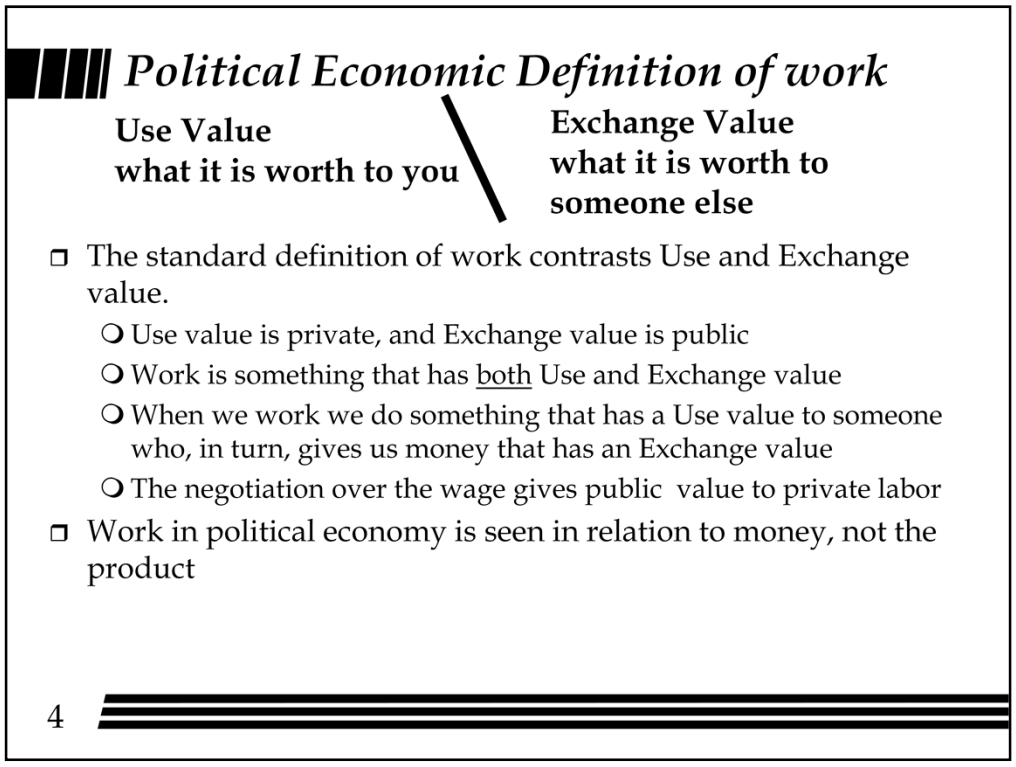
In this part, the nature of work will be explored. We will do this by raising the question of its relation to play. Processes will be seen as a chiasma of work and play. And this will give us a way to approach the biggest problem for defining processes which is the illusive nature of non-routine work. The result is a strikingly different perspective on what process is all about.

What is Work?

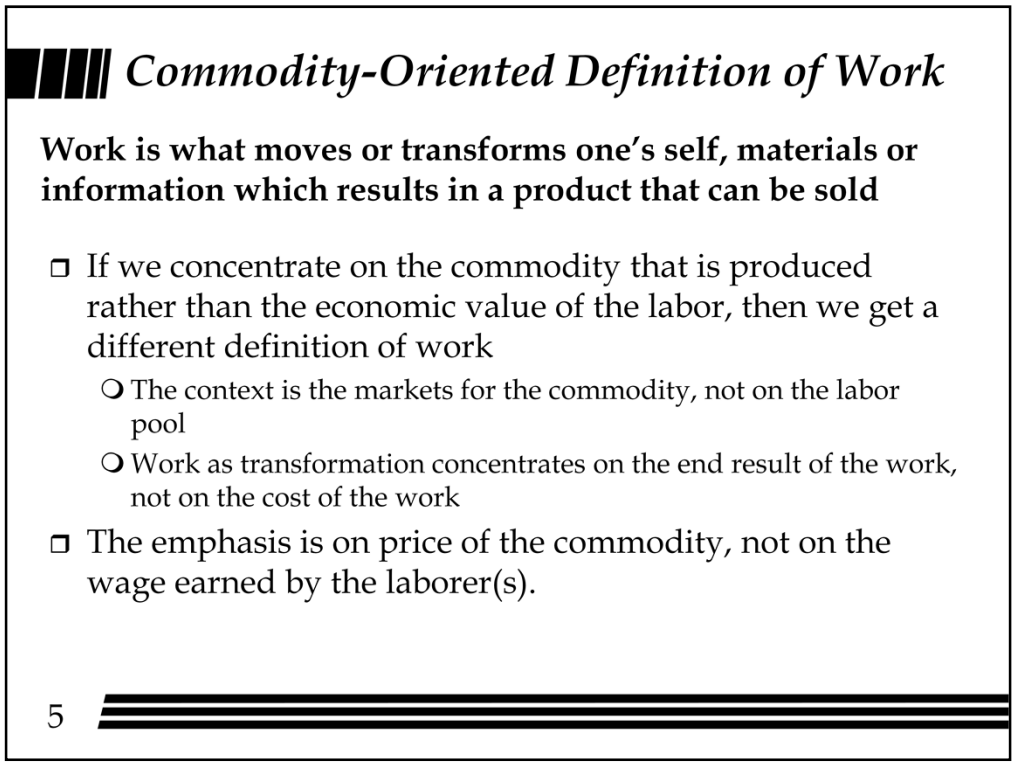
- If we are going to understand "work process," we must explore the nature of work
- There are many other processes in our lifeworld -- how do we identify work as something different from all the others?
- Work is a fundamental epistemic category that organizes our everyday lifeworld
- The major distinction by which **work** is defined is the difference between it and **play**
- We must question play if we want to learn about work!
- Most of our activities in life are classified as either work or play
- It is a fundamental structure of the lifeworld which is socially constituted and culturally determined.

3

We begin by asking ourselves what "work" really is. We work every day, both for pay and for free, under the auspices of organizations. And as individuals, in our garages, there are literally myriad forms of work in which we engage in our lives. So how do we tell that something is work and some other activity is not work? Normally, we do that by applying a distinction between work and play. The activities we categorize as work are contrasted to our play or leisure. Therefore, interestingly, if we want to find out what work is, then we must also question the nature of play. Some things are, of course, neither, like sleeping. Other things can be considered both or either. For the most part, all activities in which we consciously direct our activities are considered one or the other or both. Normally, we feel constrained in work and free when we are playing. However, we can be constrained to play a game and feel like we have been freed when we can get back to work. It all depends on the situation. But generally, the act of classifying our activities as play or work is fairly straightforward even though anomalies exist. And it is clear that we cannot know what work is without looking at play and vice versa.

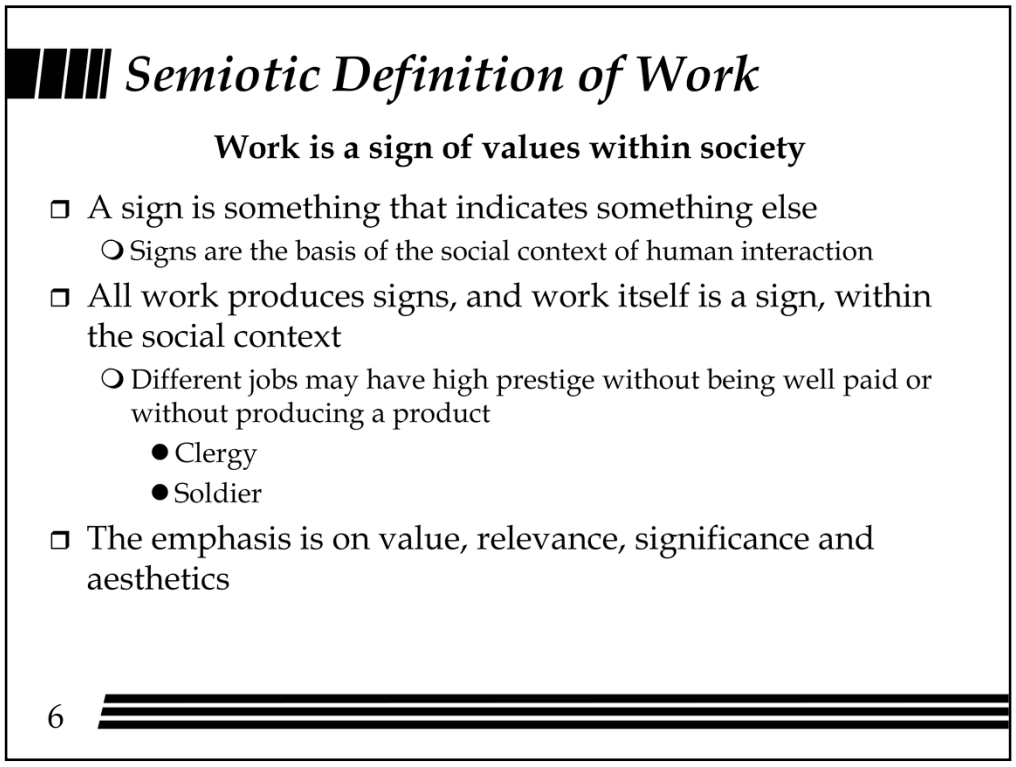


One definition of work emphasized by political-economics is a definition based on what the activity is worth. This is the wage definition of work. Most of us can differentiate *real* work from other activities that are more leisurely or playful by whether someone else will pay you to do them. From this perspective there are two basic values -- what it is worth to you (use value) and what it is worth to others (exchange value). Use value applies to the value of the activity toward immediate ends of the individual, whereas exchange value is the money that one is given for that work that can later be exchanged for something else. In any non-barter system of exchange these two values become radically separated and different. In a barter system what one is given for the work is something that probably has some immediate value in terms of usefulness. So the usefulness of the activity or product one is doing as work can be compared to the usefulness of the thing one has been given for doing it. In a money economy one is, instead, given something that is generally useful for getting other things and in relation to which everything else is equated at some rate of exchange set by supply and demand and other factors. This has the effect of allowing us to value the work separate from the value of the things produced by the work. This differential makes profit seeking and capitalism generally possible. We can not only get higher value by transporting things from afar that are scarce, but also we can make things and sell them for more than the labor, materials and fixed cost.

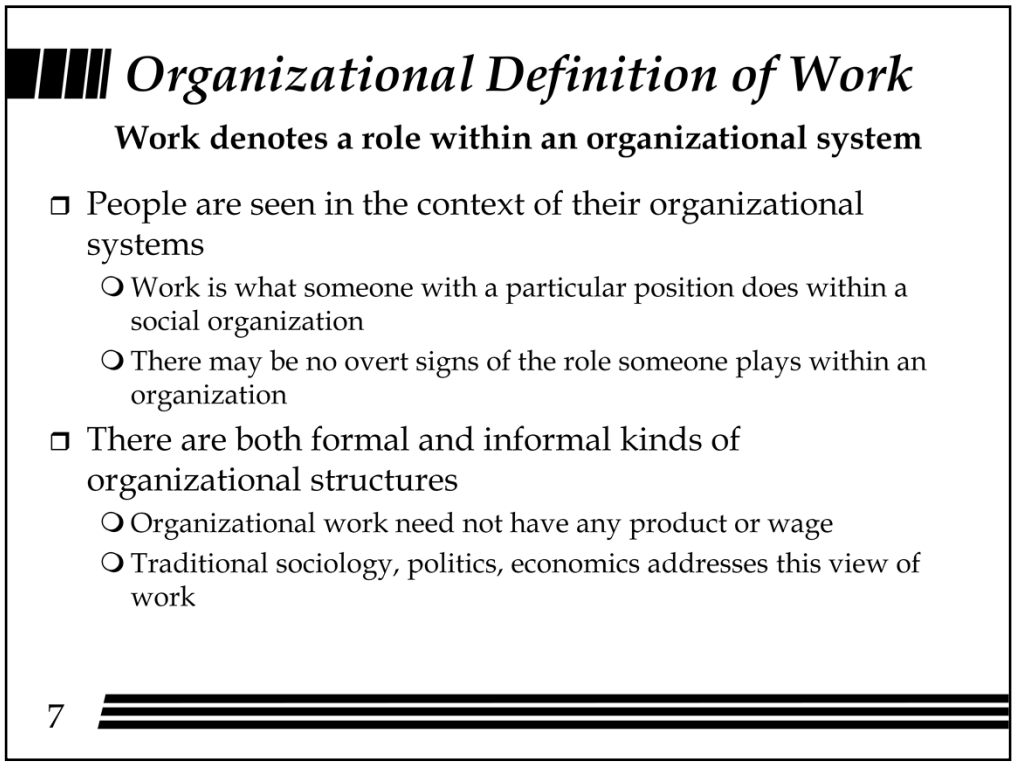


Another completely different way of looking at work is in terms of the transformations made by the activity itself. Work must either be a movement of the body, and change in some matter, or a change in some information. The effects of work on things is usually viewed in terms of the end product that can be sold and its price. Commodities circulate in markets and have various exchange values for money just as labor circulates in the labor market. Money, again, is the basis for the valuation of commodities. So we can see each product in terms of a certain price for which it is sold. There are myriad products -- determined by the wants and needs of human beings. There are myriad kinds of work that go into these products. But the market system allows each kind of work to be equated to a wage and each product to be equated to a price. Exchange between the producers of various products creates our economy.

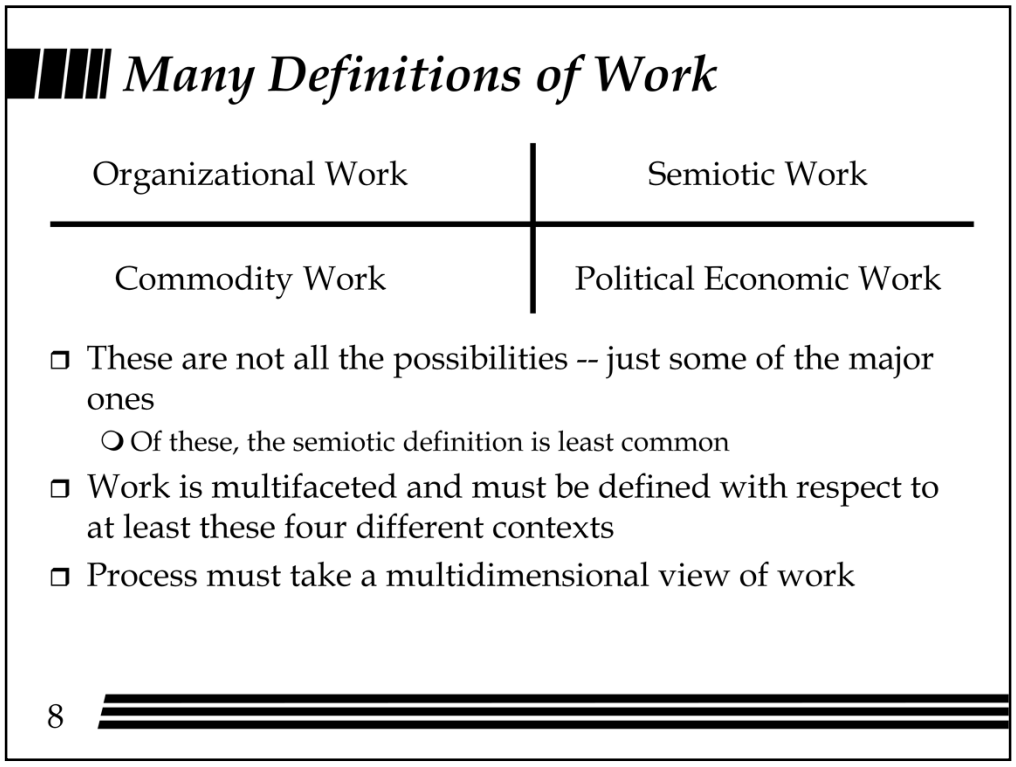
These two viewpoints on work -- wage and price -- or labor and product -- have deep implications for how we view the coercion of work. We must do it to get the money to buy things, and what we do is determined by what products can be sold. So economic pressure flows from two directions to sculpt our work. There is a tight loop between what someone will pay us to do as job and what the customer will pay for the product. This tight loop is generally referred to as **reality** within the capitalist economy.



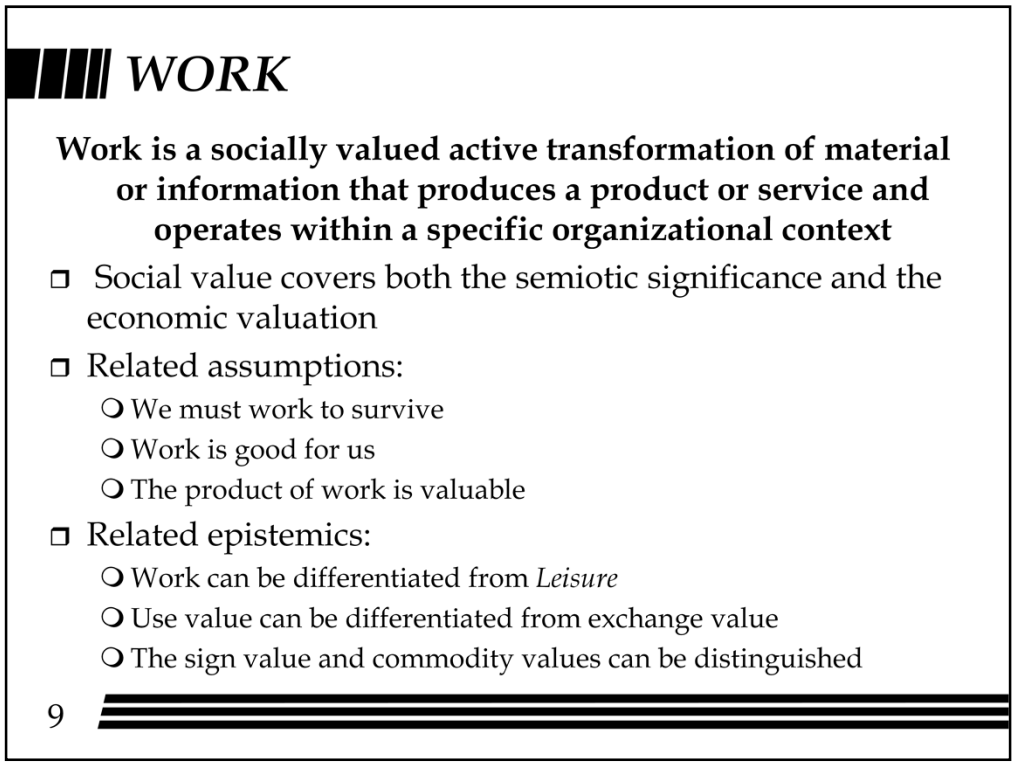
But this **reality** is not the end of the story. There is also the fact that the work itself is a sign within our society which is valued in many other ways besides by the wage and by the outcomes. Our society is full of signs which are given varying values. Thus, for instance, there are certain jobs that are very prestigious that are low paying, like the clergy or soldiers who give their lives but are not paid very well considering the risk. We can see work as a production of signs of value within the society. In fact, a kind of work is itself a sign that has significance in relation to all the other kinds of work within the society. Signs are actions or things that indicate something else. A certain kind of sign is a symbol -- where one thing stands for another. But there are many kinds of signs that merely are signs of something without standing for it. For instance, when we see smoke, we infer fire. The smoke just indicates the possible presence of fire without standing for it. On the other hand, if we see a picture of billowing smoke, that may be a symbol of fire. There is a kind of sociology called symbolic interaction that sees all human interaction as the exchange of signs and symbols. In that case each kind of work would be seen as the production of signs and symbols that are meant to communicate significance, relevance, values, meanings to others. Many kinds of work merely produce signs and symbols of various types -- like broadcasters or advertising agencies. But even traditional work can be seen as a production of signs and symbols as a supplement to the actual material transformations that are occurring. For process this definition becomes more important than it has been in the past. When we look at human processes, it is the semiotic dimension that allows us to capture what is going on in mid-stream before there is any final product.



Yet another definition of work that gains prominence with the advent of process concerns is the organizational dynamics definition. The place of the person within the organization can be as important or more important than what that person actually does. In bureaucracies, for instance, many jobs are positions which mean they really exist only to fill a spot in the organizational chart. What a person does could be irrelevant because their position could be completely the result of politics or some other extraneous factor that does not actually produce any value. The roles of the people within the organization and the rules they operate under within those roles when they work together is crucial to the smooth functioning of the process. Organizations tend to be strongly hierarchical and control oriented. They exert a lot of pressure on how people interact within them. But this pressure is, for the most part, normative -- in other words, it is not seen unless the norms are violated. One way of looking at processes is to see them as a fine tuning of norms so that people know what is expected of them and what will happen if the norms are violated. In many organizations without processes both the norms and the consequences are not stated except at a very high level so that no one really has any idea what will happen if they don't do something until the mistake is made. And many times they are never actually told what should be happening. Everything is left to the discretion of those who are involved to decide as things unfold. Processes provide fine-tuned norms which say who will be effected if certain things are not done, and who is responsible for what kinds of activities within the organization.

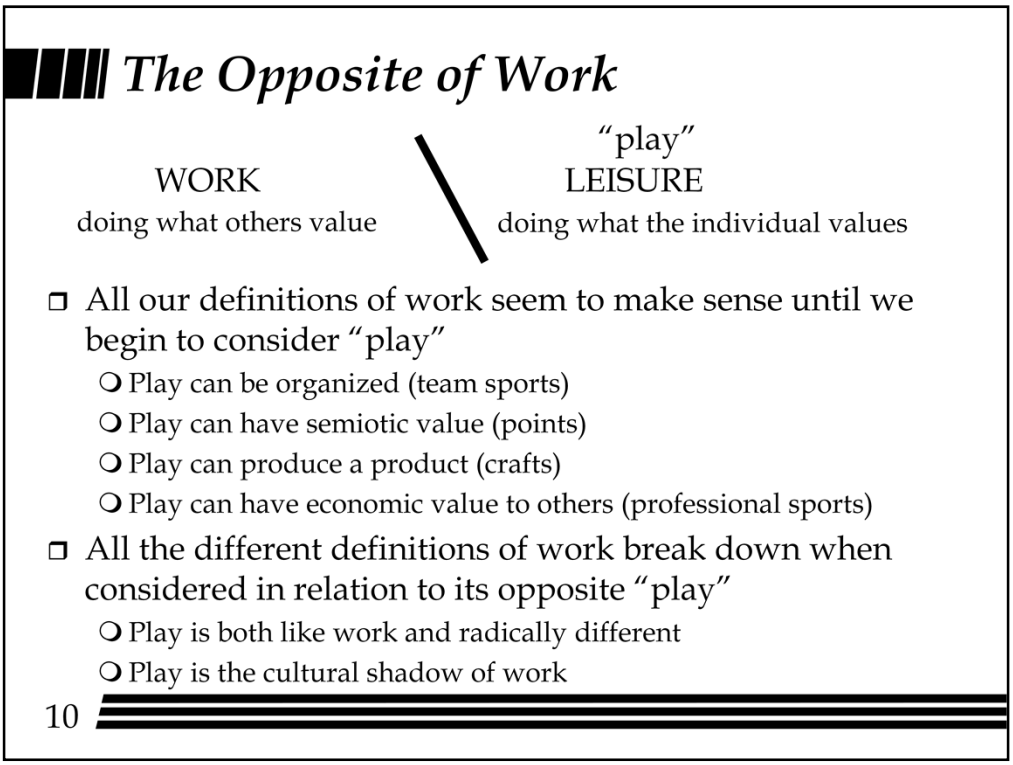


These are just four definitions of work. Two were selected that have been traditional within our society, and two others have been given that are becoming more prominent with the advent of process improvement efforts. Work itself is multifaceted and must at least be defined in relation to these four contexts. So process itself must be multi-faceted to deal with the different dimensions of work. We defined process as the chiasma between learning and change, and work as the differential application of learning and change. But what is being learned about and changing in each case is different. These definitions provide various viewpoints on the context of learning and change. We change what we do constantly in order to maintain our raise our wage. We learn constantly in order to maintain or raise or wage. The changes we make to things and the things we learn are too many to ever be counted as they are a series of ongoing micro-adjustments to our environment. But the flow of them together can be considered a process -- where learning and change are seen non-dually -- frozen like spacetime beyond the places in space (things learned) and the events in time (the changes that are made). This flow can be seen as a flow of money and resources, as a flow of intermediary products, as a flow of signs and symbols of human interaction, and as the dynamics of an organization. We learn with every change and change with each thing we learn, and the process is the chiasmic flows of these learning-changes that can be interpreted in terms of resources spent, things produced, signs and symbols flowing between people, or the running of organizational machinery. All of these views, and others, are important to keep in mind when we try to understand work.



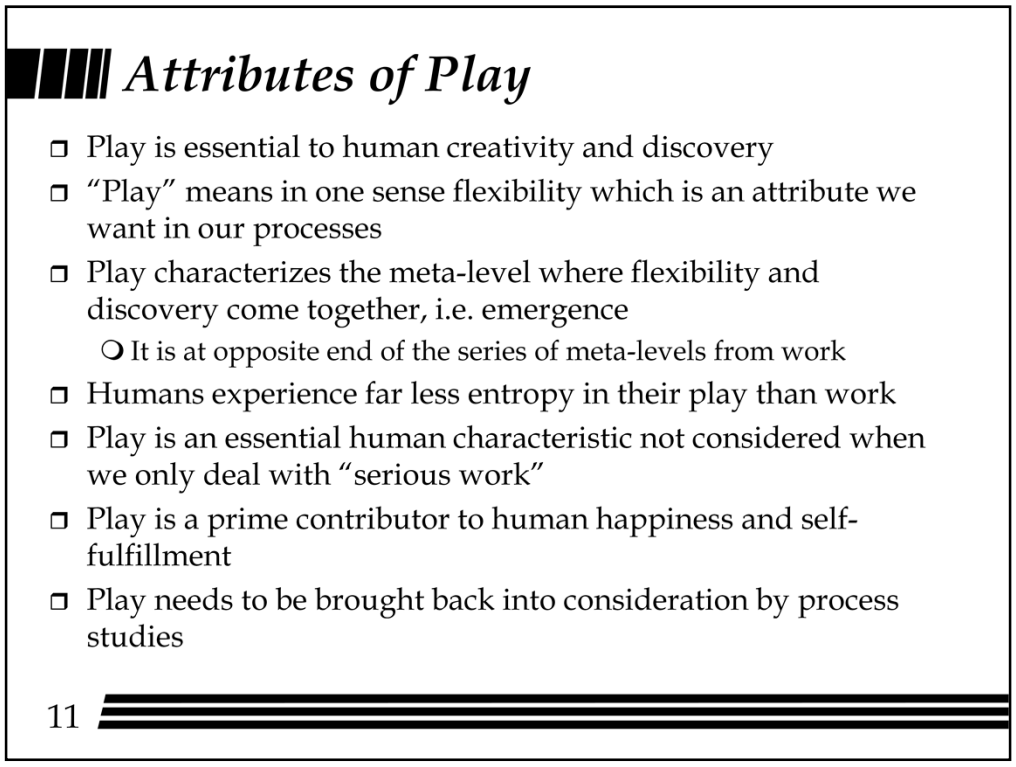
So if we were to define work, we would try to write a definition that covered at least each of these viewpoints. They serve to connect us to our hidden theories, paradigms and epistemes. But if we ever wanted to study work from a scientific viewpoint, then we would have to formulate explicit theories from one or the other of these viewpoints and then attempt to disprove parts of that theory. Those things we could not disprove after a certain amount of testing would stand as pieces of knowledge about work.

The problem with this approach is that it does not challenge any of our ideas of what work is. In fact, we have not really discovered what work itself is at all. Instead, we have seen what work is in a particular context. We have looked at it in the context of wages, of products, of social exchange, or of organizational dynamics. These are all the external aspects of work in relation to something else. But what work is essentially has not been breached in all these definitions. This is because we have not considered what work isn't. In order to mount an epistemic challenge to work, we must attempt to attack the very category of work itself. We must vary the category of work until we recognize the limits at which it turns into something else. When we follow this essentially phenomenological method advocated by Husserl, we find that the limits of work are best defined when we relate it to play.

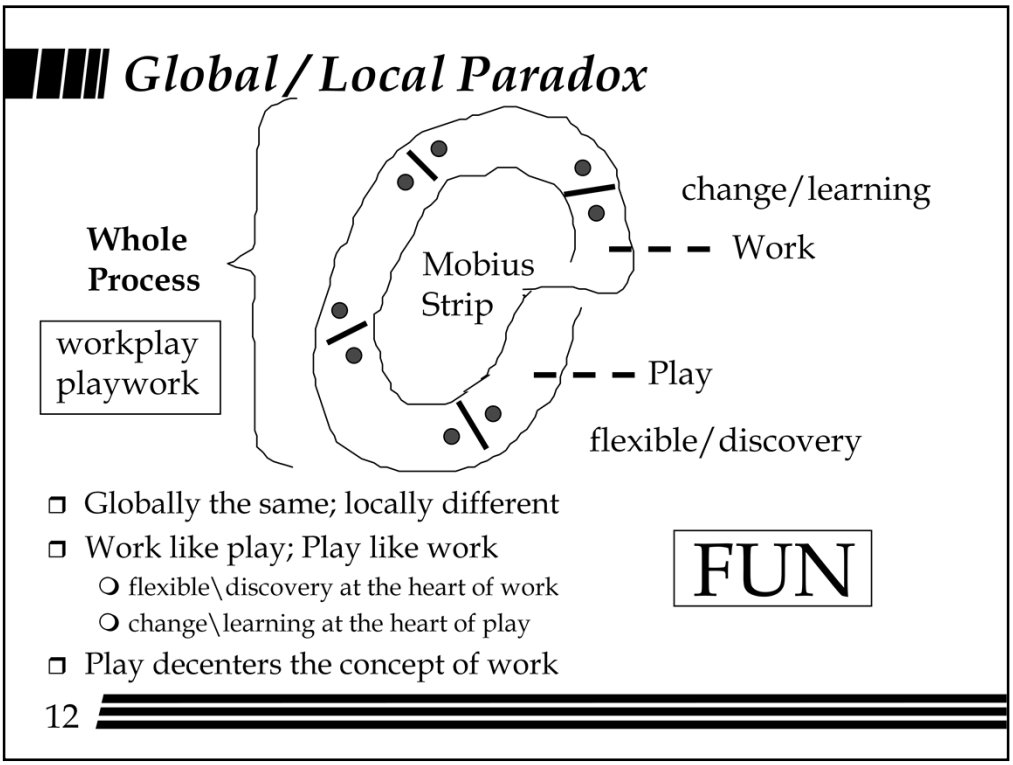


It is natural for us to contrast work to play. But play is not something that we take seriously, so it did not occur to us to include it in our definitions of the extrinsic characteristics of work. We only thought of play when we attempted to ask what it really is beyond all the contexts in which we find work. When we try to turn our activities into something that is not work, then what pops into mind immediately is that if it is not work, then it must be play.

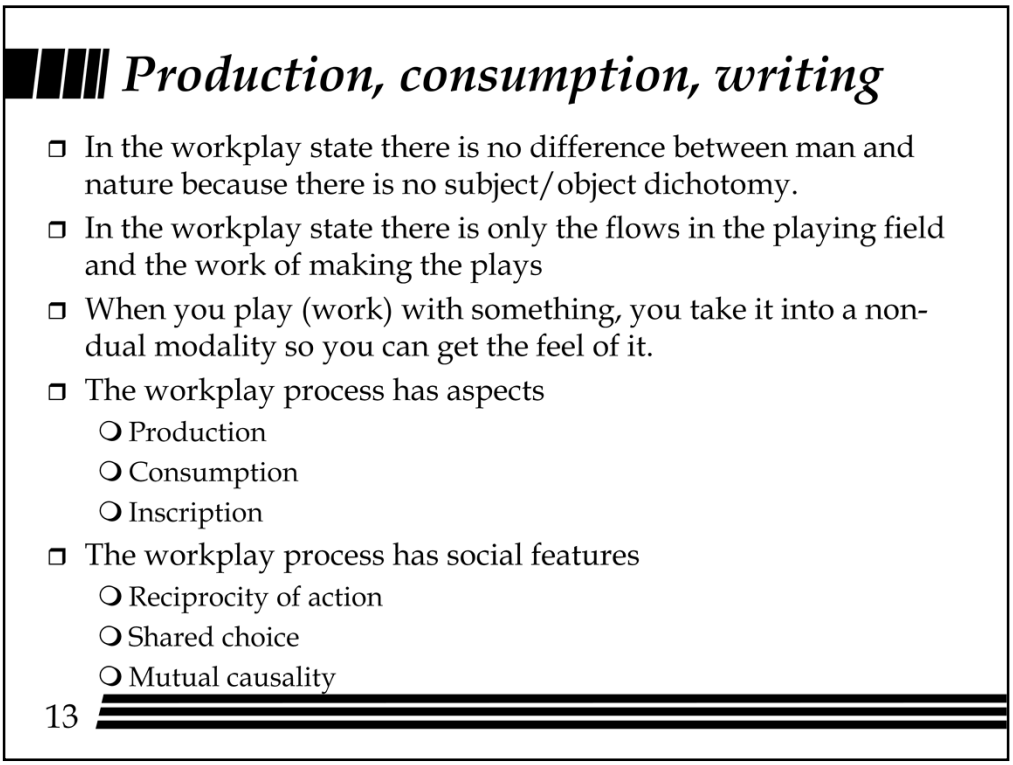
But play is something that is marginalized in our society. It constitutes a separate realm, it seems, where we escape from work. It seems that there could be nothing more different from work than play. However, when we look closely, we see that work and play are hard to tell apart in lots of instances. All of our definitions of work could be applied to play. Play is organized. It produces signs and symbols within the context of games. It can produce products; for instance, crafts. And we can be paid for playing just like for working if we are good enough and are "professional" players. Play functions in the same contexts but is radically marked as different from work. Play is, in fact, something very strange. It is the opposite of work that when we look closely, is difficult to distinguish from work. Culturally play appears to be the shadow or a strange twin of work.



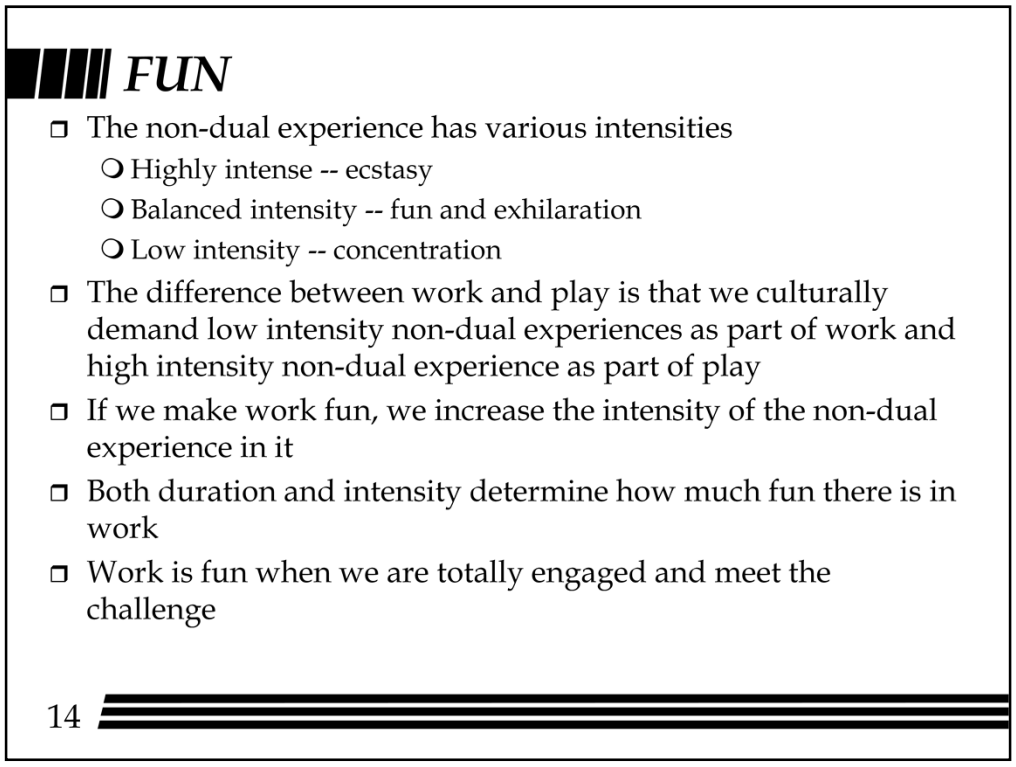
In the last part we talked about whole human process. Here we want to posit that we can only have a whole human process if we consider work and play together. Ultimately the separation between work and play will prevent us from understanding process. This is because process is a chiasma of learning and changing. But we learn and change both in work and play. As humans, we continually move in and out between these two modes of learning and changing. In fact, we play with something before we work on it as a way of learning how to work on it effectively. If we ignore the play aspect we end up ignoring the exploratory nature of work. Playing is exploring -- exploring in a limited and special context that "does not count." By doing that, we find out what will be the most effective approach to the job at hand. When we enter the mode of playfulness, everything changes. It is a completely different way of relating to the world. In fact, we might identify that modality with the chiasma as opposed to the differential application of learning and change. When we play our changes and learnings become fused; whereas when we work, they can be separated. Thus, play is our experience of the flow of processes as non-dual experiences. When we work, we break out of that flow and experience things in a dualistic fashion again. The difference between duality and non-duality is the difference we know so well between play and work.



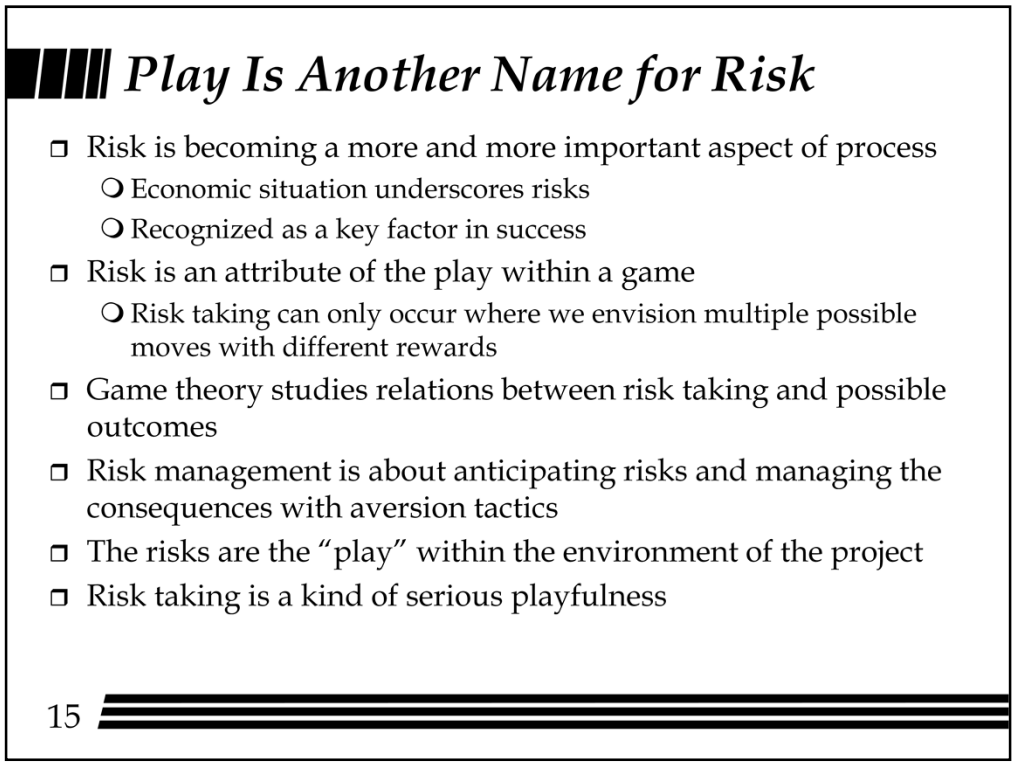
However, we must be careful here. Our culture has given various meanings (semiotic values) to work and play. We do not want to associate these meanings with our chiasmic position that sees the flux from inside rather than from outside. Therefore, we will coin the term workplay, or playwork, for the chiasma. We will leave the terms work and play to their normal meanings. Our model will be the mobius strip in which the sides or edges are locally different but globally the same. Globally there is the chiasma workplay which, in any particular case, will be seen as either work or play but the distinction cannot withstand analysis because globally they are really the same thing. But the key difference between being within the chiasma of process as opposed to any local culturally defined work or play activity is exactly like being in play rather than work. In this we follow John S. Hans in his book The Play of the World. We cannot accept play as a marginalized activity, but instead we see it as running throughout all activities as the expression of non-duality. Work occurs when we separate the subject and object supplements from play and create duality. Thus, workplay, or playwork, as the non-dual has the essential nature of what we call play as a modality by which we relate to the world. All dualistic work or play has the nature of work which splits the subject from the object and takes us out of the flow of non-duality into a dualistic way of relating to the world. This is a radical reformulation of our categories, but it explains a lot about how the world works. Basically, if you are in a non-dual mode of relating to the world, then you are in the midst of flow as you are when you play a game where disbelief has been suspended. When that "trance" breaks, you are working again because you have separated yourself and objects from the field of the flow of process.



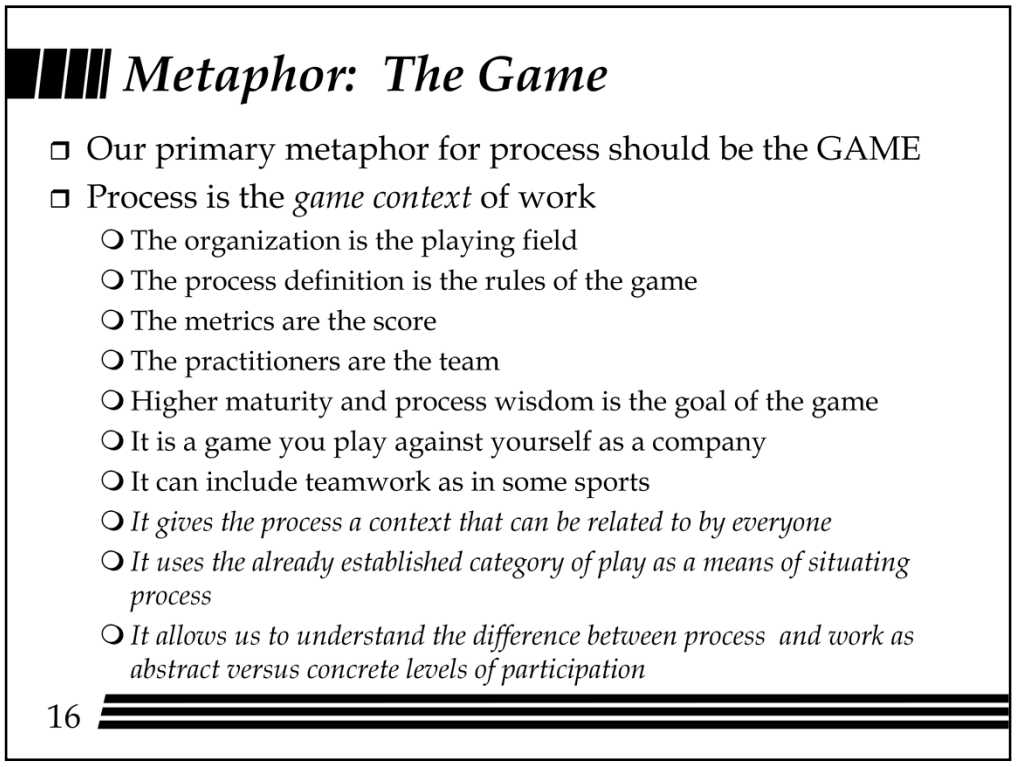
The workplay non-dual state is something that we are constantly using as a way to relate to the world whether we are "working" or "playing." However, more of this state is used and allowed in leisure activities than serious work activities as normally defined. We can think of this state as a "trance" in which we lose ourselves to various degrees when we begin concentrating on things or fall into conversations with people. In this state, the world becomes narrowed to the thing we are concentrating on and we lose ourselves in the action of exploration that we are engaging in with the things in the workplay field. While we are engaged in the field, we are attuned to the flows of the actions, and we no longer distinguish ourselves from the objects in that field. When we snap out of that "trance," we have a special kind of knowledge about the things we have engaged within that non-dual modality. The state can be described as the complete overlapping sameness of production, consumption and inscription. The state is essentially social in that it allows reciprocity of action, shared choice, and mutual causality to appear within a team that enters that state together. Outside of that modality production, consumption and inscription seem to become separated and differentiated within our activities. Outside that "non-dual trance" we are each individual actors who make separate choices, and who each are responsible for the effects of our actions. This is not an esoteric experience, but something we all do all the time in both work and play situations. We do it more in play situations and less in work situations, but our whole experience is fraught by the moving between the non-dual and the dual ways of relating to the world. Think of the many times through the day when you lose track of the time because you are immersed in what you are doing -- when you do not think about yourself, but only what you are working on. At those points you are entranced by what you are doing and lost in its flow as a non-dual experience.



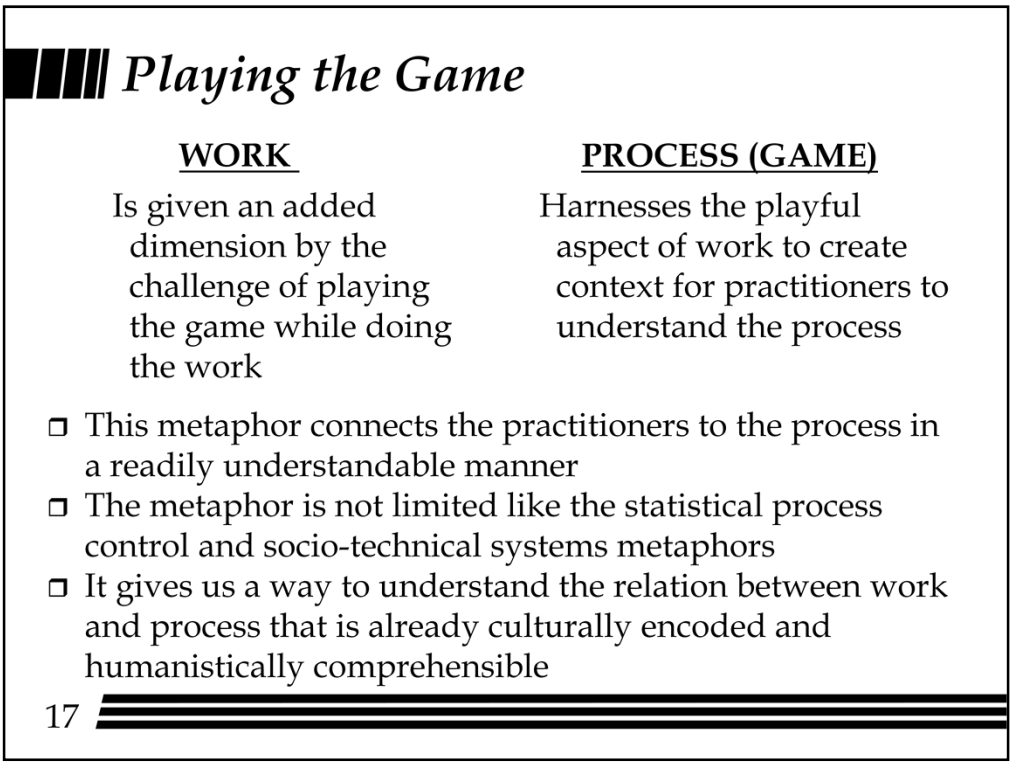
Our redefinition of work and play in which we locate many of the attributes of play in the non-dual workplay and many of the attributes of work in work and play as dual and separate activities causes us to rethink those times when we enter into the non-dual mode. We note that the non-dual mode has various intensities. When we are at work and enter that mode, then we generally keep those intensities low. When we play and enter those intensities, we can more often experience the higher intensities without feeling out of place. Fun is the optimal mean intensity of the non-dual mode. If we are having fun, then we know viscerally that we are actually engaged in playing at work and having a good time. This probably means that there was a challenge that arose, and we became totally engaged and met the challenge. To meet that challenge probably it was necessary to enter the non-dual mode to play out different scenarios and to get the feel of the situation by testing different approaches. All this activity where learning cannot be distinguished from changes at any level of our hierarchy of meta-levels would count as workplay rather than "work" or "play."



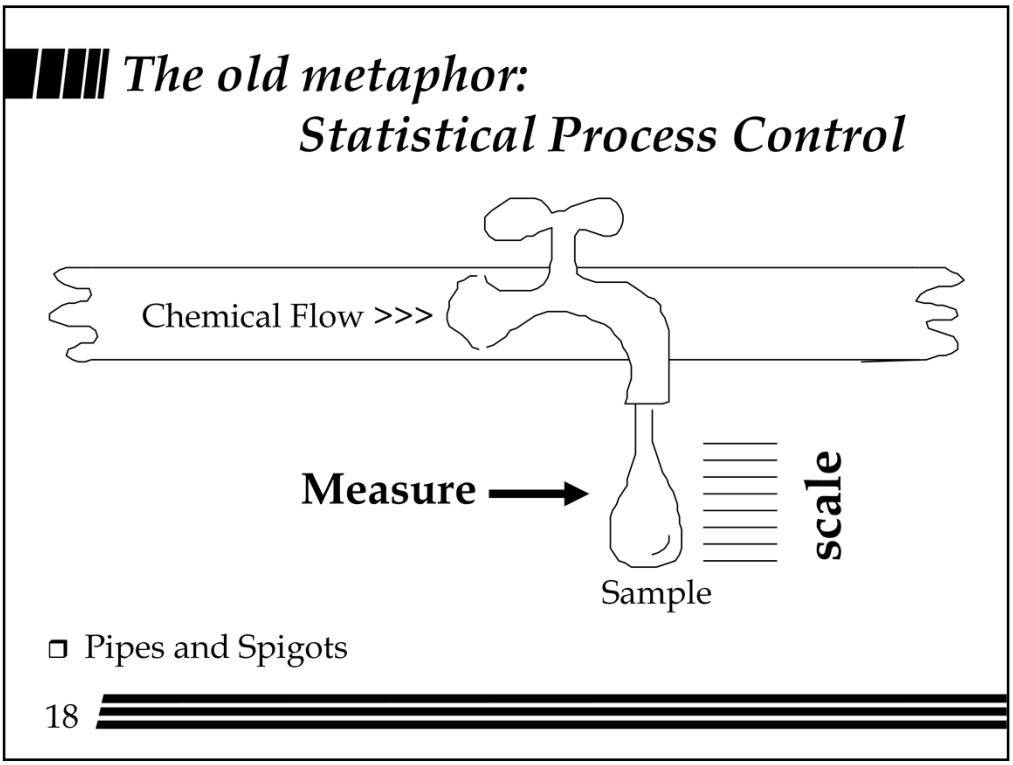
This brings us to the point that play in the work environment also appears in the guise of risk. Risk assessment and aversion is seen as an important aspect of processes. But this is because risk is the recognition of the variability of the work situations as they play themselves out. Risk analysis is an intellectual way of dealing with this variability. However, risk assessment like planning, takes place in the dual modality where we are separated from the situations we are looking at in terms of risk and our plans. In the non-dual mode, we are continually reacting to situations as they occur without plans and risk assessments. This intuitive and spontaneous behavior in which we change our objectives, strategies, and tactics in the midst of play because of the situation we discover on the ground as we are playing out the possibilities has to be balanced with the cognitive approach that occurs in the dual mode when we are being analytic rather than synthetic. Thus plans must be made and risk aversion analysis must be done, but that must not distract us from the realization that in the midst of action as we are immersed in its flow, all these dualistic cognitive maps may have little relevance. Most of our knowledge is what Michael Polyani calls tacit (The Tacit Dimension). In the non-dual mode we are swimming in tacit knowledge embedded in our experiences. In that flow we use other means of knowing what to do that cannot be captured in plans or in risk assessments. In that mode we are reacting to the entire field of what needs to be done as a synthetic experience. This experience of flow is the process. When we separate enaction from description, we are operating in a dualistic mode toward this process. We need to balance the needs of these two modalities against each other. If we consider the process people following written proscriptions, only then we have lost sight of the essential nature of the workplay that underlies both work and play.



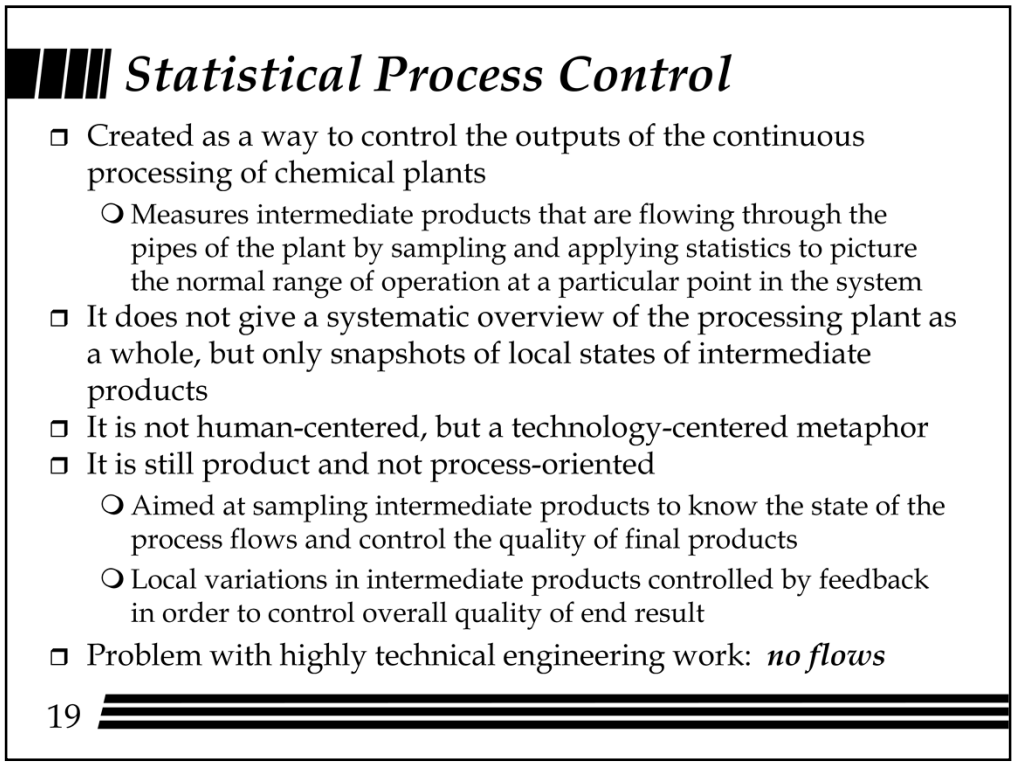
A game is such an abstraction from the play process. A game is separated and defined as a cognitive act in the dual modality. That then acts like a container for the non-dual play that gets lost in the action of the game. This complementarity between the dual and non-dual modes needs to be stressed. When we write the rules of a game, we are attempting to build a model that would facilitate play. Then we enter the non-dual state with those rules in mind and play the game within those rules. Thus, the game is clarified for all the players and different qualities we value, like fairness is instilled into our play. Similarly, when we write a process description, it should be like laying down the rules of a game. Our goal should be to clarify the work and to emphasize certain attributes that will make it work better. Then when we enter the work process, we keep the rules of the work in mind as we work things through. The process description should be an invisible framework that bounds and clarifies the work situation as things are worked out within that situation. For this the game is a perfect metaphor. Our process descriptions should be like game descriptions, and we should think of our process work as playing a game. The game has the perfect fusion of rules (game description) and action within the non-dual flowing state of engagement in action. And just as children do, we can say to each other in the midst of the action -- here we must change the rules -- without disturbing the trance of the game. In the workplay non-dual state, the intellect is not disconnected from experience. You can, in exceptional circumstances, change the rules for good reason as a maneuver to keep the play going -- and as long as there is a consensus, things can continue without breaking the trance to analyze or plan or to consult the process manual.



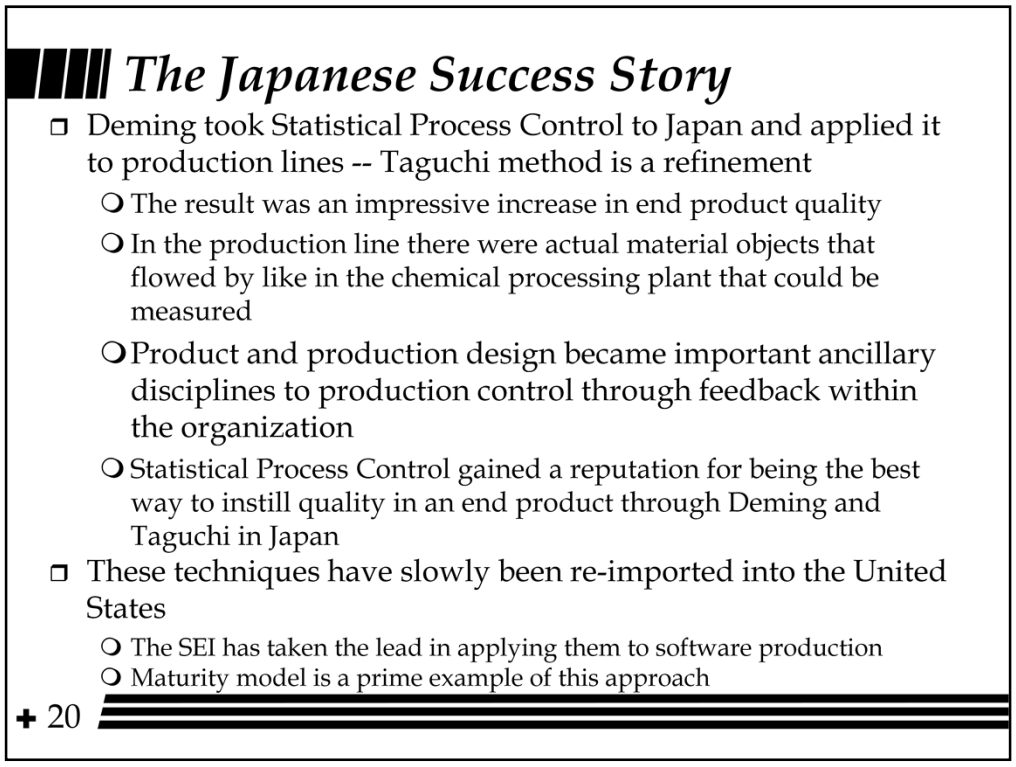
If we follow this metaphor, then we can see how it would be possible to think of all of the process activities in terms of the Game. This is a distinction that people would understand. It says that when we do our work, we are simultaneously playing the process game. The game has rules like any other game, and we apply those rules as we work. We recognize that work has a dual and non-dual mode. We are constantly going in and out of the non-dual mode as we need to explore and play with the complex situations within which we work. The game metaphor allow us to alternate between these modes without experiencing cognitive dissonance. Whereas the normal view of process that separates description from enaction and sees a process as a means of refined control militates against all activities that occur in the non-dual state. When we view process as a game, then we all know that it is necessary to create the rules of the game in a dualistic state. But those rules are framed with the play in mind. When we begin to enter the workplay non-dual state, then we keep the rules in mind but realize that they can be altered if there is consensus as to the alteration. If not, then we must go out and analyze the situation. When we are not in the dual modality, then having a process expressed as a game allows us to clearly distinguish between the process and the other aspects of the business. The process interpenetrates the business actions but must be continually distinguished. Talking about it as a game will help distinguish it and put it in the right perspective. The process is always dropped when things get serious. This is natural because it has no actual monetary value (a problem with our economic system which cannot relate to intangibles). So by using the game metaphor, we would at least clearly know when we are playing the process game and when we are foregoing it due to expediencies. One of the reasons it is foregone is that in a crisis we tend to enter non-dual modes quite often, and our current processes do not lend themselves to that way of relating to the world that rules out process descriptions and any enactment.



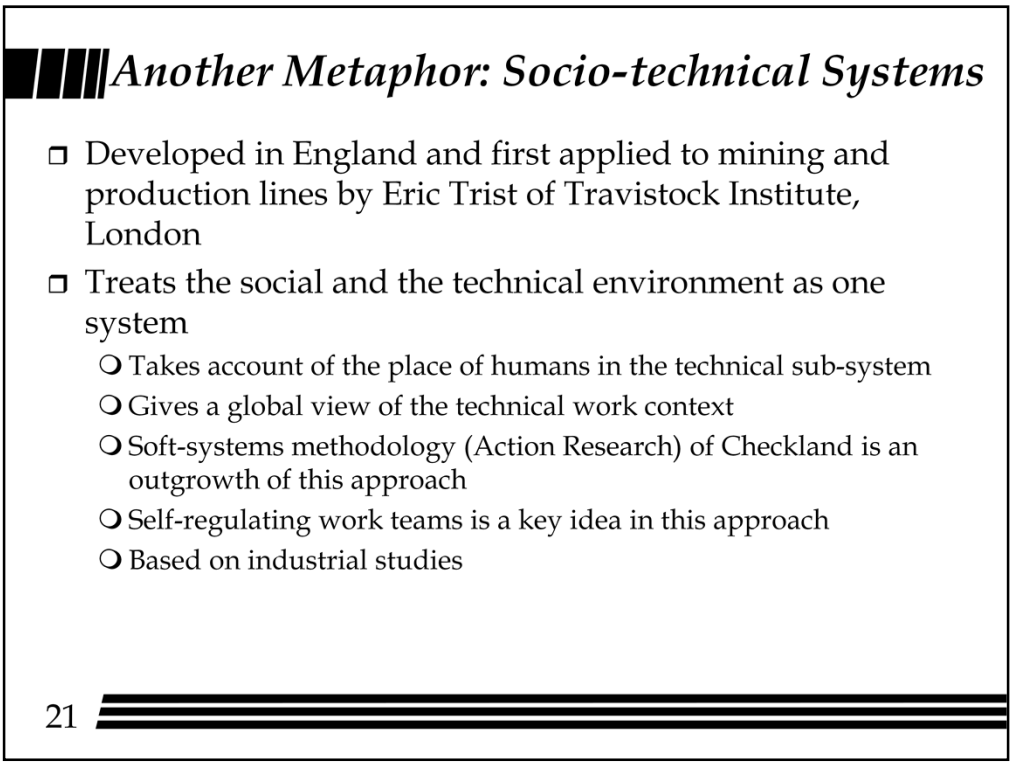
Let us contrast the *Gaming* metaphor to other well known process metaphors. The most well known is Statistical Process Control (SPC) championed by Deming and Taguchi in Japan and reimported into the United States. This is a process that started in the control of chemical processing plants and spread to be used in other industries, particularly in the control of quality on assembly lines. A sample of the flow is taken and measured. Then feedback is used to change conditions up stream in order to narrow in on acceptable parameters down stream. The key to the application of this technique is the ability to have pipes and spigots so that the flows are visible and can be sampled. Without that channeling of intermediary products, this technique cannot be applied. This is why process description must precede process measurement in our maturity growth. We need to establish the flows. Unfortunately, the flows are much harder to establish in many kinds of engineering work. In fact, this becomes the crux of the problem in applying Statistical Process Control to highly technical work. It is difficult to isolate the flows.



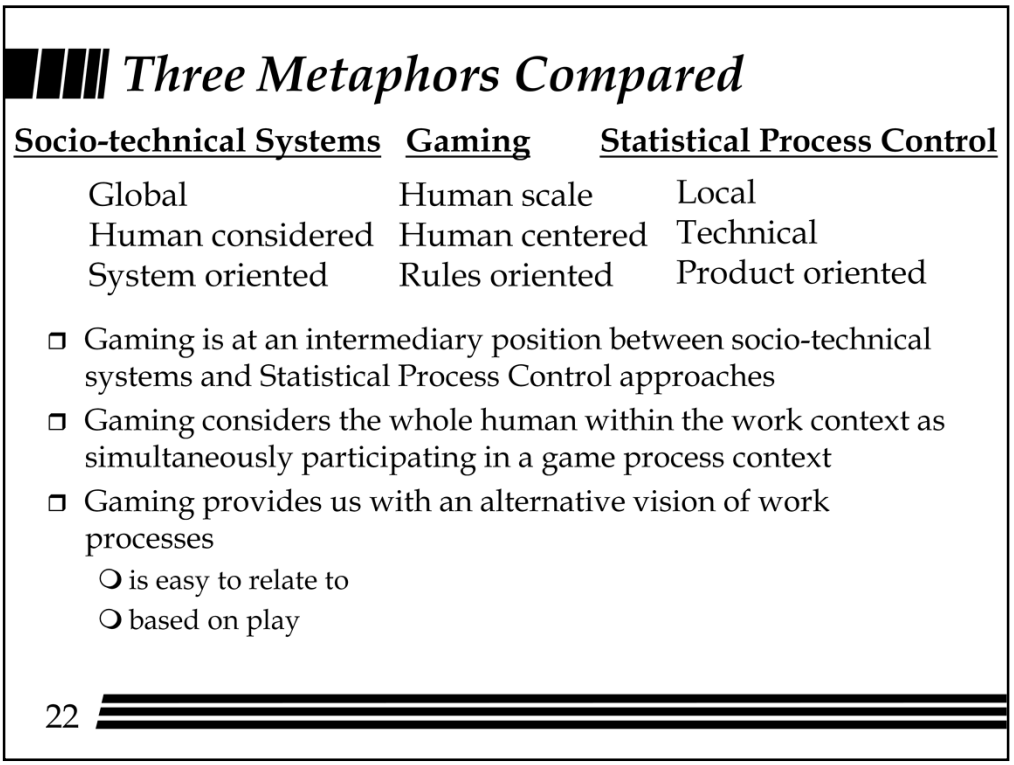
Another crucial point with regard to Statistical Process Control is that it is a local feedback loop that we are working with, not the whole system. So improvement by this approach is piecemeal and fragmented, and no representation of the whole is ever necessary. A lot of small engineered improvements to local flows is suppose to have a global effect over time of improvement. This would probably work in a chemical plant or assembly line where things stand still when you move on the the next point of optimization. But when what you are optimizing is like "jelly nailed to a tree," it is difficult come back and find things as you left them after any appreciable amount of time. So how do you optimize flows in something that is constantly shifting like the sands of the desert? Are we to freeze our processes so we can get accurate measures? This seems to be the approach the SEI would foster. And what will organizations already reified by bureaucracies be like when everyone is maintaining process "mechanisms" built for the purposes of auditing and measurement and no other function. This, it seems, will be an industrial disaster which is sure to stultify growth, adaptability and flexibility that we need now more rather than less.



The interesting thing is that Deming could not get American industry interested in Statistical Process Control. But the Japanese picked them up and used them very successfully, and now they are being reimported into the United States. Process improvement might be seen as the royal road to applying SPC to technical work. We are told that levels four and five will be fleshed out when more companies get there, and we see what they are like. This seems like the statement, "I'll know it when I see it," which tends not to inspire confidence that there is any endpoint in sight. But there is a question as to whether the direction we are going is correct. Are we like lemmings, all following each other off a cliff, just because that is the way the herd is heading? Should we not think more carefully where we are going and why? Shouldn't we apply some critique and perhaps the views from different disciplines to see if this route makes sense? When we do that kind of critical analysis, we find that there are some major conceptual problems with the application with STS to high tech work that does not appear when it is applied to assembly line skilled manual work. It is to those problems that we will address ourselves next.

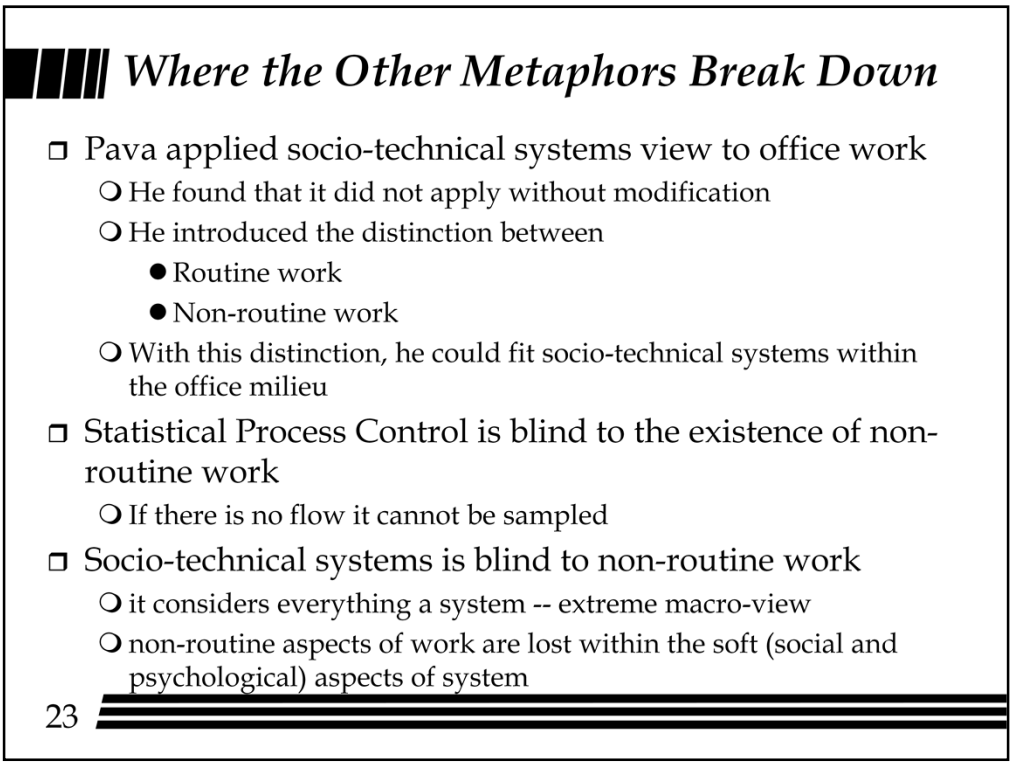


Another completely different metaphor that comes to us from England is Socio-technical Systems (STS). It was developed by Eric Trist of the Travistock Institute in his studies of miners. Subsequently it was applied to many factory settings similar to those that SPC was applied to in Japan. A similar development in Japan was the Quality Circles movement and TQM. Yet, STS was unique in that it went beyond the Scientific Management paradigm by including social and psychological factors as part of the "system" of the workplace being studied. An out growth of it was Checkland's Soft-Systems Methodology and Action Research which uses systems analysis techniques to study human-involved systems rigorously. The major concept to come out of the socio-technical movement was the idea of the self-regulated work teams which was better received in Socialist countries than here in the United States. Also, Socio-technical Systems saw itself as a science and so it did many studies of industrial environments which worked at being disinterested observations of conditions. In England industrial psychology and sociology in the form of Socio-technical Systems had a greater role to play in industry and the creation of organizational policies. These methods are still used in England, but have seen little migration across the Atlantic into American industry.

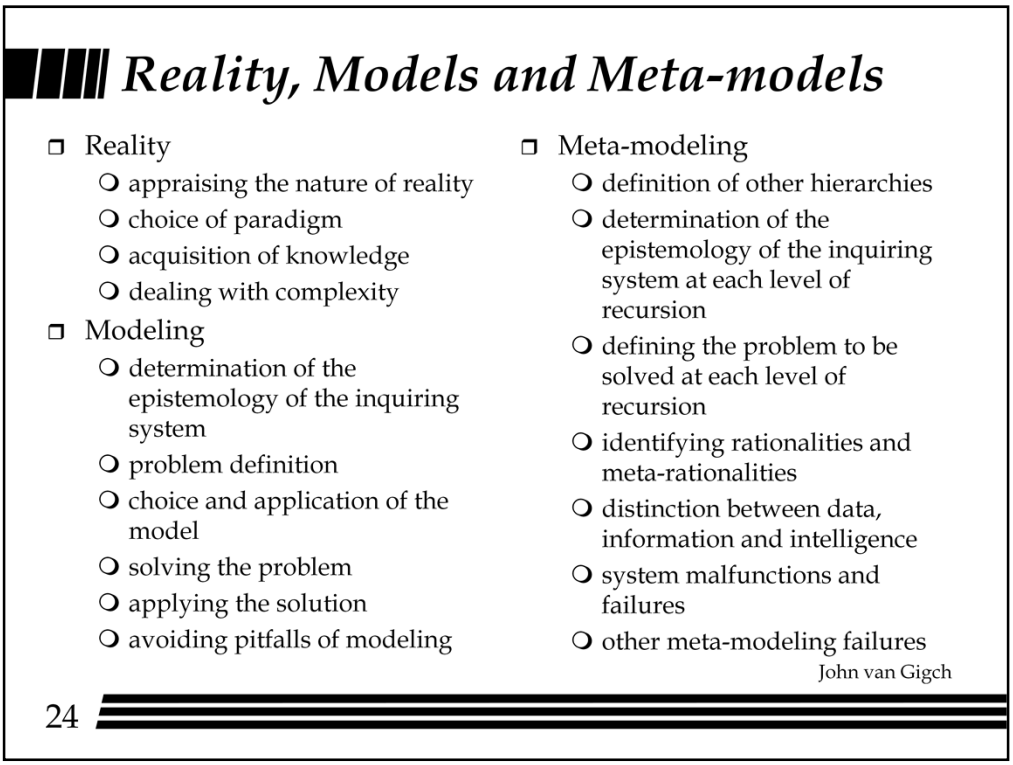


These two previous methods which are both modern adaptations of Scientific Management from very different viewpoints can be seen to be very different from the gaming metaphor. SPC concentrates on the local, technical and is product oriented. STS is global, human oriented, and system oriented. When we compare gaming as a metaphor to these, we see that gaming is neither local nor global, but is at the human scale. Like STS, gaming is human centered instead of technical like SPC. Gaming is oriented not to the system or the product, but to the rules governing behavior locally by those participating in the game. Gaming is the only metaphor that considers the whole human and introduces process directly into work via the game metaphor. Gaming provides us with an alternative vision of work which is easy to us to relate to because we have always played games and because it gives a context to something we do naturally anyway which is playing.

It is important to see that gaming is based on rules. Rules may be in sets that do not form a complete system and may cover exceptions. If we describe the process in terms of rules, then we can apply these rules as they are needed rather than having a global picture of the system in place and rather than knowing the feedback loops of the system. It has been found through the attempt to market Jay Forrester's systems dynamics that people find it hard to understand feedback loops even when aided by simulations. People also do not relate well to global flow diagrams of an entire process. What people can relate to well are heuristic rules. In fact, when we take expert knowledge from "informants" when building an expert system, it is normally in terms of such sets of rules. Thus, it makes sense that our expertise about the flows of processes in our work would also appear in the form of rules and exceptions. And when we change the rules in play in order to meet a challenge, it would be by changing the known set of operative rules that apply to the process.



An interesting development of Socio-technical Systems was done by Pava who applied it to office work. He found that to apply it, he had to change it by introducing the distinction between routine and non-routine work. Once he had identified and isolated non-routine work, he found he could apply STS to office systems in a fairly straightforward manner. What we notice is that Pava's innovation is very important because both SPC and traditional STS are blind to non-routine work. Why? Because it is exactly this kind of work that has been eliminated from the assembly line situation. But it has not been eliminated from office work or engineering work. And in fact, it cannot be completely eliminated from any work. But it can be severly reduced as it has traditionally been in assembly lines. SPC does not see it because there is no flow associated with non-routine work. STS cannot see it because it considers everything a system, and so the non-routine work gets lumped in with everything else. In other words, if we chunk the system right, we can hide the non-routine work within the elements of the system. But when the system we are analyzing has high degrees of non-routine work, then it is impossible to describe the system in such a way that these anomalous categories do not stick out in ways that muddy our analysis if we do not recognize them.



Using the ideas of John P. van Gigch in System Design Modeling and Meta-modeling (NY, Plenum, 1991) we can see that there are being developed ways of looking beyond systems toward an understanding of meta-systems. We really only see non-routine work as an explicit part of what we do when we take into account the meta-systemic level of analysis. Gigch has written an excellent summary of how to extend modeling into meta-modeling. Notice that he has as an explicit task -- the determination of the epistemology of the inquiring system at both the modeling and meta-modeling level. Modeling follows the normal course that one would expect any "systems" approach to take. Meta-modeling extends these by branching out to explore other possible levels of the hierarchy within which the system is embedded. The recognition of these other levels are then used to look at the context of the system again using these other levels. Then basically there is a recursion of the methods at the system level through all the possible levels of the hierarchy. At the meta-model level we begin to look at rationalities and meta-rationalities. That is, we look at our reasoning processes as they are effected by dynamics of the level about which we are reasoning. Also at the meta-level we look at degraded system modes of operations. Meta-modeling allows us to have a specific idea of what we mean by non-routine work because that is work that operates at the meta-levels and generates meta-models.

Routinization

- Klir's General Systems Theory uses a hierarchy of meta-models to describe system change
  - Structural systems demand at least second order formalizations
    - micro formalisms of content within form
  - The creation of structural designs pushes out of the merely routine work into non-routine meta-work
- Using models, meta-models, etc. we are able to climb the staircase of meta-levels of change and learning
  - Modeling at meta-levels is the major contributor to the necessity of non-routine work
  - Whatever can be captured by a first order formal model can be routinized

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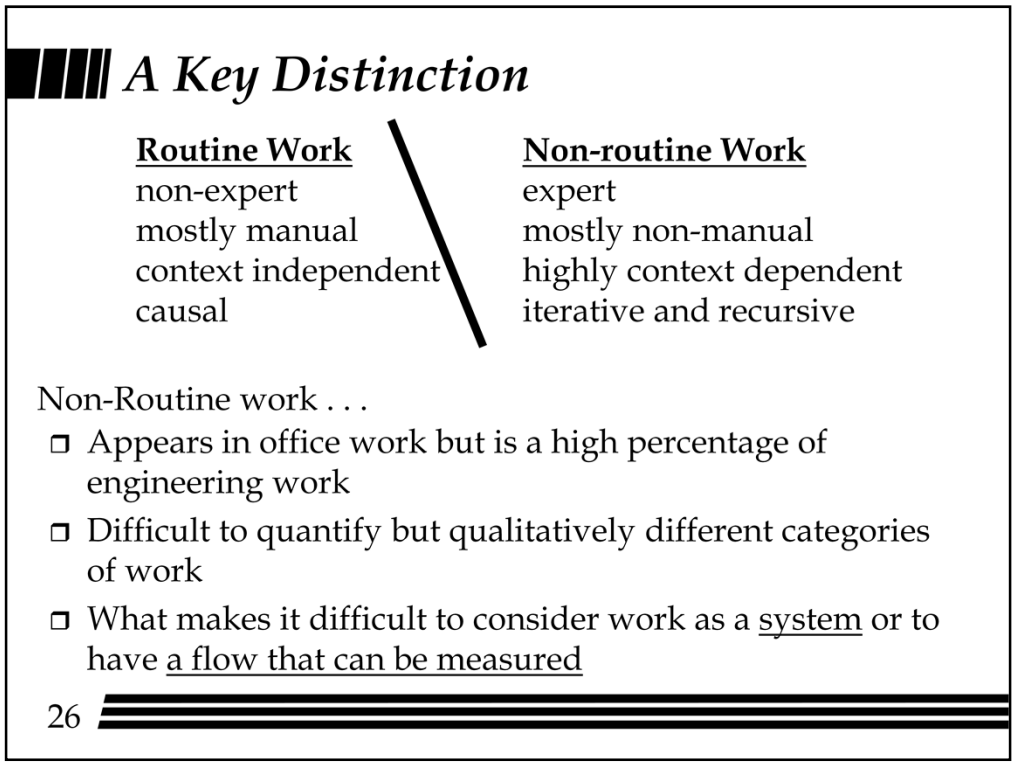
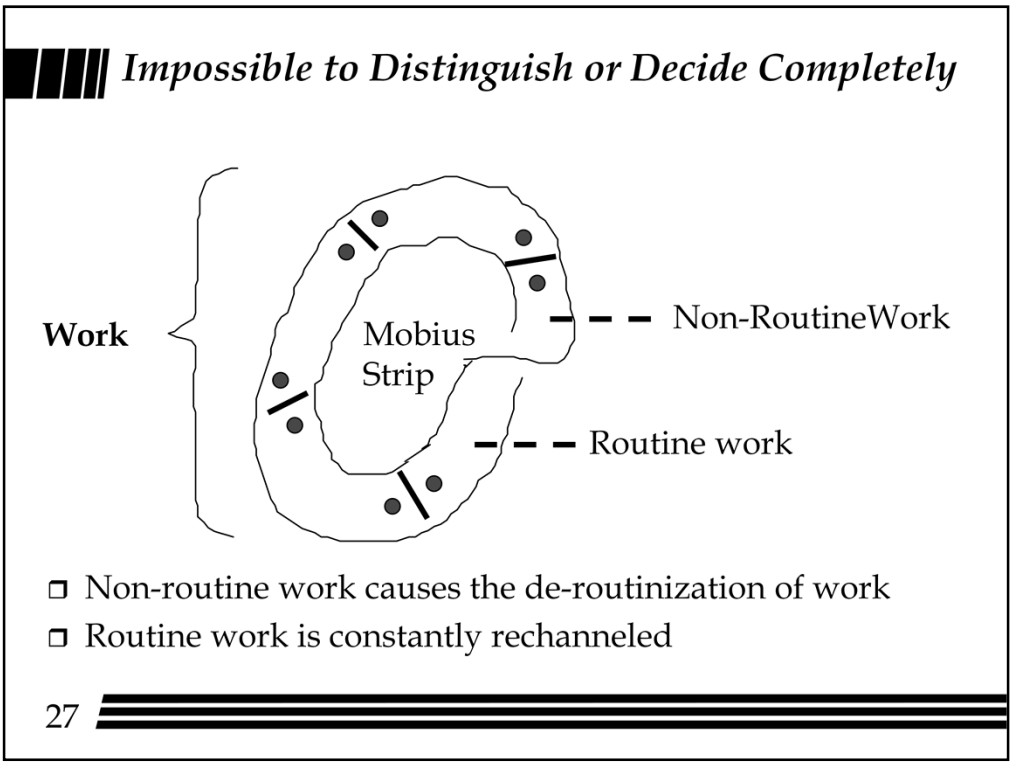
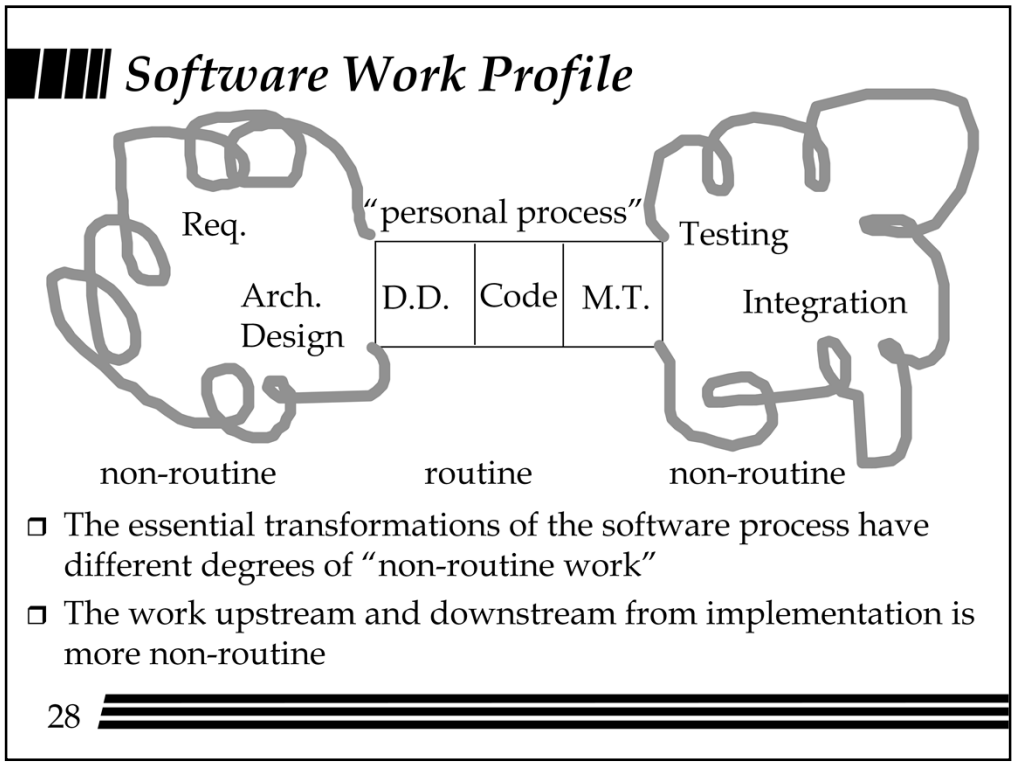
Using the concept of models, meta-models, and ever higher level models, we are able to climb the staircase of the meta-levels of learning and change. George Klir in Architecture of Systems Problem Solving (Plenum Press) gives us a similar picture with different "epistemological" levels for the constitution of formal-structural systems. A formal-structural system is one that is both a system model and a system meta-model simultaneously. It is a very powerful formalism for understanding discontinuous dynamic systems. Whenever we are confronted with discontinuities, we must build meta-models of them. In very complex technical work there are myriad discontinuities that disrupt the continuities that can be analyzed by normal means. Every problem, from difficult to complex, must formally or informally use meta-models to organize the models of the continuous parts of the problem and to understand how they are arranged to comprehend the whole problem. Whatever can be captured in a first order formal model can be routinized. Anything that cannot be captured in that kind of model and demands a second order model cannot be routinized and therefore entails non-routine work to understand it. Structuralism, which looks at the structures that allow content to transform between forms through discontinuous transformations, always involves these second order models like those proposed by Klir and van Gigch.



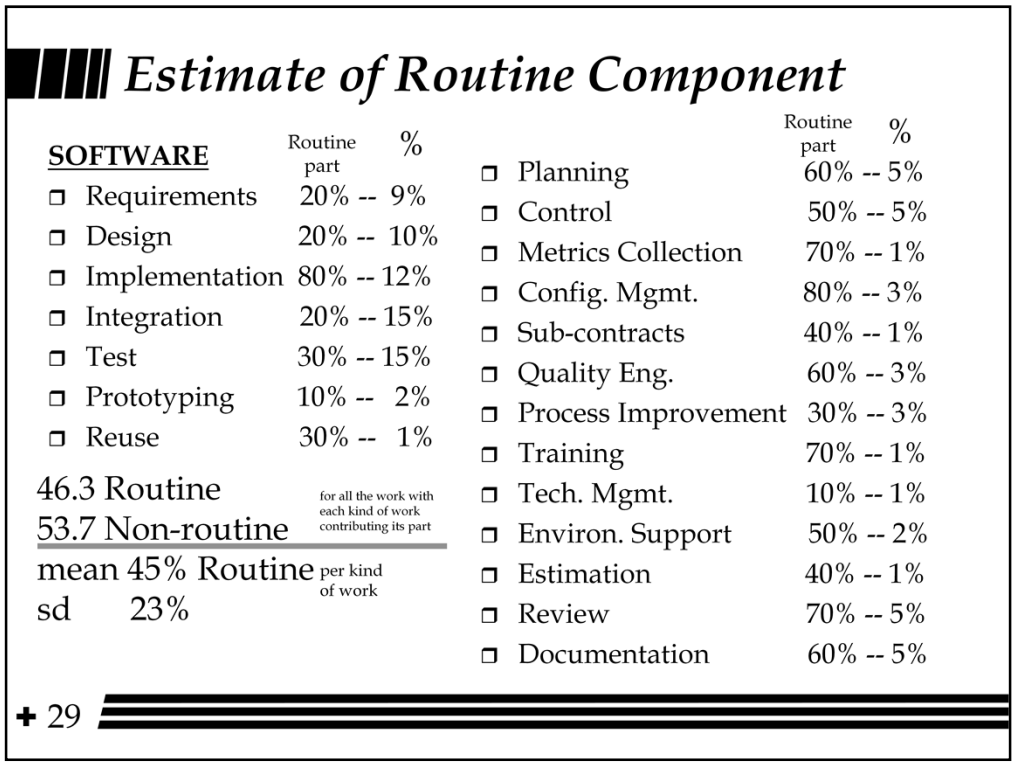
So the distinction between routine and non-routine work is fundamental. The non-routine is not that we just do not know how to routinize yet, but that which cannot be routinized. The fundamental implicit assumption that all work can ultimately be made routine that most process improvement process architectural design is based upon is wrong. There is a fundamental barrier that all process improvement must deal with eventually -- the non-routine work barrier. The more we routinize work, the clearer this barrier will become. It will appear as the residual work that cannot be routinized. For different kinds of work that percentage that is intrinsically non-routine will differ. But for highly technical engineering work and some management work there is a high percentage of non-routine work. Non-routine work is what continuously undermines and de-routinizes the routine work, creating the shifting landscape of process. We cannot just ignore it because like all dualisms, there is a trade-off between routine and non-routine work and globally you cannot ultimately tell them apart. It is non-routine work that causes the channels of the routine work, to continually shift like rivers that move their banks.



When we start out attempting to take a dualistic view toward work, it appears that work is just a mess -- so we make a value judgment from the sidelines that what people are doing is ad hoc or immature. What we do not realize at first is that this mess we see is not all one thing. One aspect of it is the confusion and inefficiencies that could be routinized and controlled if we wanted to do that. But hidden alongside that is the non-routine work that is driving the turbulence in the other kinds of work. That component of non-routine work is the expression of the chaotic and complex dynamics of the system. It is intrinsic to the system and cannot be taken out without destroying the system. Thus, when we blindly attack all "*chaotic*" behavior and look down on it as immature, we are really expressing our ignorance for what is actually happening and cannot do anything except destructive actions in such a system due to our ignorance. In fact, the ability for professionals to maintain such a system of chaotic and complex dynamics and remain productive should be a mark of respect instead of being considered a fault. They are walking a fine line between keeping up with the dynamics and having their whole program crash. To introduce causality and determinate process models into such an environment is to cause that crash. It is like distracting a juggler who has many more balls in the air than anyone has juggled before by telling him the trajectories of the balls. You do not juggle by trajectory, but by feel from an ongoing playing with the possibilities of the system as you do the work of juggling. When non-jugglers walk in with a course, they have written in how to juggle -- well, no wonder there is laughter after we leave the room.

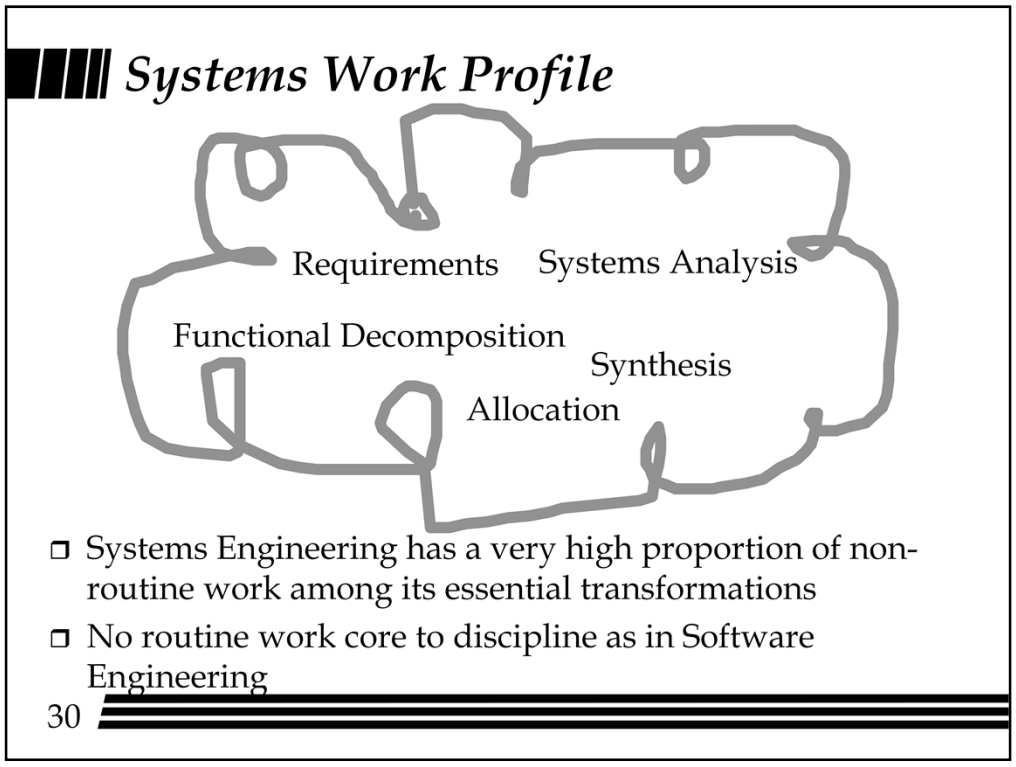


When we look at the software work profile we see that it has a large cloud on one end and a few discrete steps, and then another large cloud on the other end. These large clouds are the parts of the software job that are mostly non-routine. The boxes in the middle are the parts that are mostly routine. You will notice that the three boxes labeled Detailed Design, Code, and Module Test are what Watts Humphry calls the "personal software process." It is a Discipline for ***a part*** of software, the only part that can be disciplined and routinized almost completely. The rest of software engineering has too high a proportion of non-routine work to be so reduced. Mr. Humphry himself, I believe, mentions a figure of about 40% non-routine work in software. I myself believe that figure is more like 54%. But whatever the figure really is, it is not something that can be dismissed because the non-routine and routine work are intertwined, and the non-routine work has a powerful influence on the routine work. The non-routine work forms a dynamic chaotic regime which continuously alters the distribution and nature of the islands of routine work embedded within it. I agree that everything should be done to routinize what it makes sense to reduce to determinate routines. But we must beware not to try to routinize that which is intrinsically non-routine because that has the precise effect of destroying the process we are attempting to make more efficient. We cannot freeze out the dynamics from the process in order to make it safe for process descriptions and metrics. We must, instead, attempt to make the descriptions we create and the metrics we make serve the dynamics and our understanding of it. In other words, our number one rule should be that we do not destroy processes in order to make them mature -- when after that we see them only in glass cases next to butterfly collections in natural history museums. If we do that by ignoring non-routine work and trying to convert everything to routine work, then process improvement will soon be a museum piece as well.

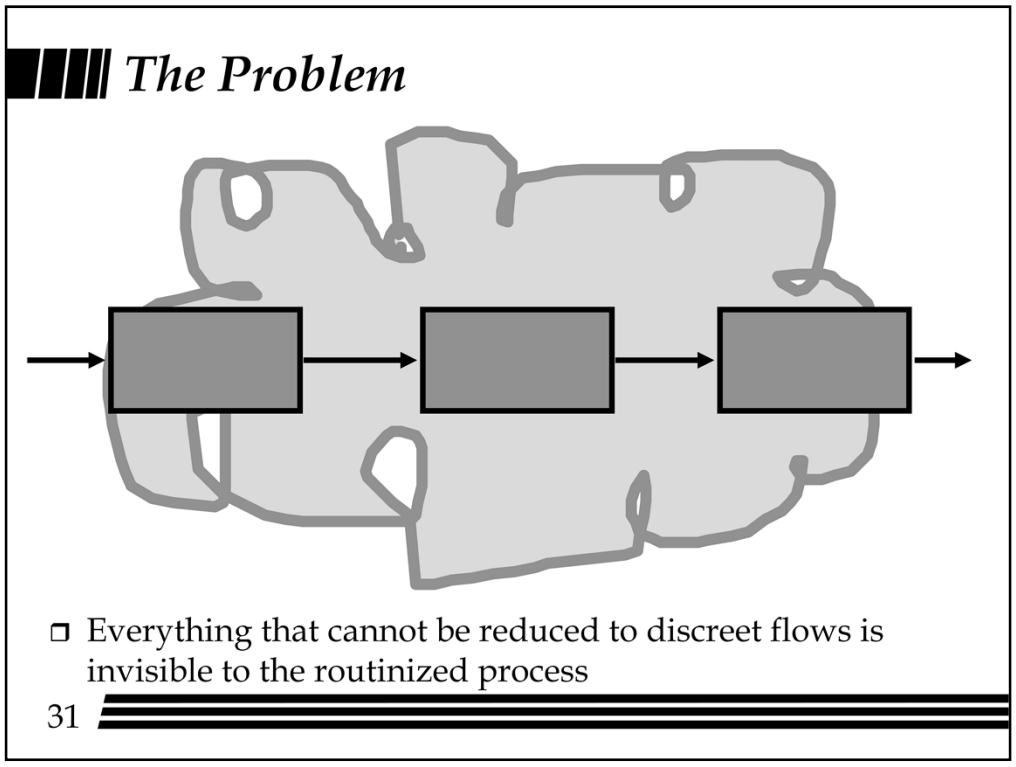


Here we offer a heuristic calculation of the routine component of each kind of work which we aggregate to find to be about 46% of the whole job. The mean routine part of each kind of work is 45% with a very high standard deviation as we might expect. Each of us can do this estimate for ourselves to come up with our estimate of the routine and non-routine component of each job and all of the work together. I would be satisfied with the rough estimate of 50% of the work being labeled routine, and the other half being labeled non-routine. It little matters what the exact number is, and I am sure it varies from place to place and from time to time. The point is that there is a large component of non-routine work because several of the major transformations such as requirements, design, integration and test have large non-routine components which cannot be wished away.

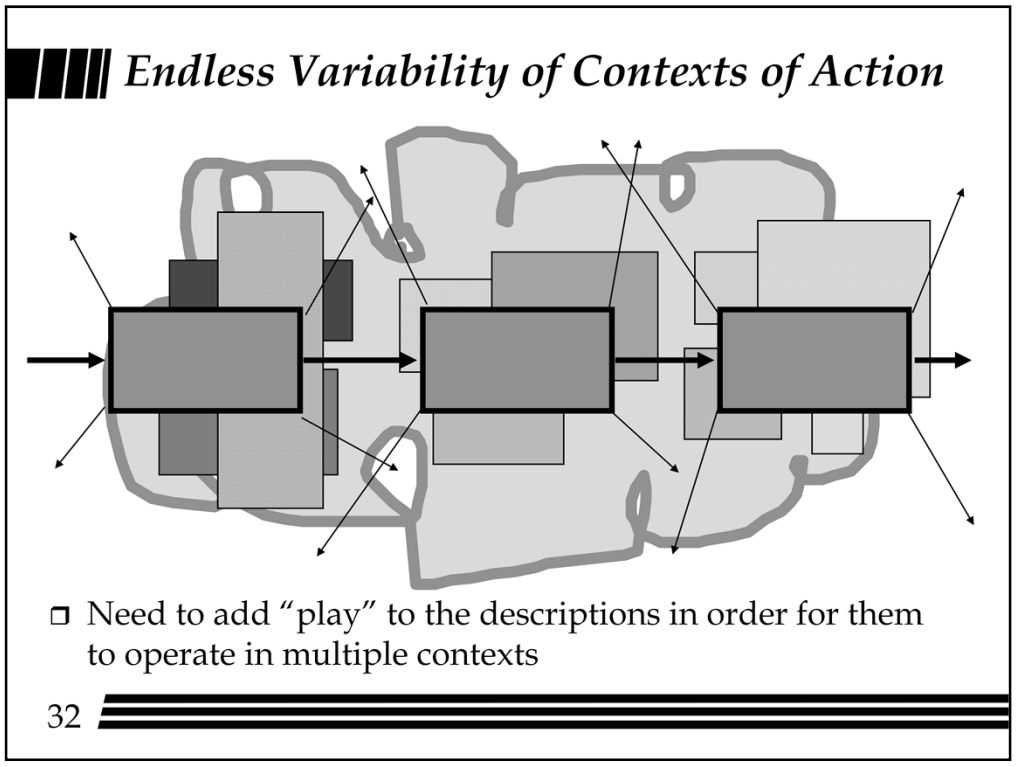
We must look at the presence of non-routine work not as an opacity and hindrance to our domineering processes, but instead as a challenge and a gentle reminder both of our humanity and the incredible complexity of the situations into which we are attempting to introduce more order. We want to introduce more order -- but not so much alien order as to destroy the integrity of the processes that are successfully occurring in these domains.



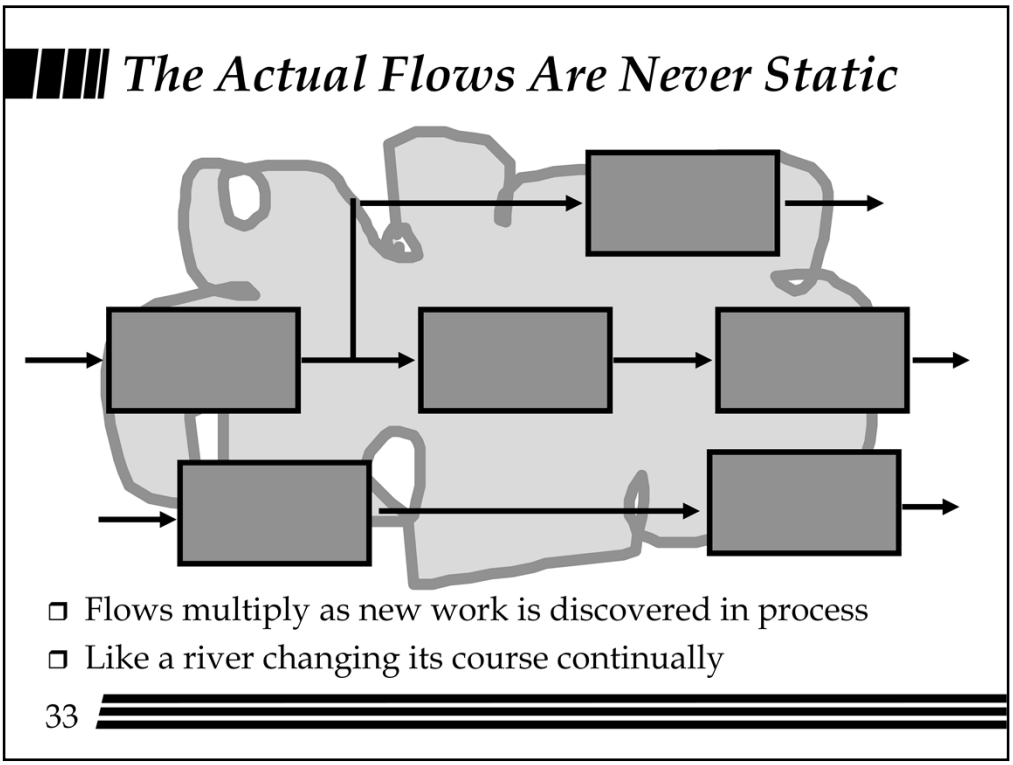
When we look upstream at systems engineering, this situation becomes even worse. There will be no equivalent of the personal process for systems. There is no routine segment to hang our hats on. Instead, there is one big cloud of non-routine work with some isolated fragments of routines floating about. As we extend our processes into other areas, we will find that they may be much more non-routine than software. So the models we use to routinize and hide non-routine work from ourselves in software will just not work in other areas such as systems engineering.



The real problem is to relate the routine flows we invent for processes to these clouds of non-routine work that are invisible to the process descriptions but very visible to the people doing the work. If we do not describe the processes they experience, then they will not be able to relate to our descriptions. It is not good enough to say we will solve this problem later because if we track the routine parts and do not track the non-routine parts, then either they are going to look like they are wasting a lot of time or they are going to be working the routine part and ignoring the non-routine part for the sake of a good score. Thus, routinizing processes have the potential to create major distortions in not just the view of process, but also how processes are enacted if we introduce lopsided process formalisms that ignore large segments of the work that is actually done. We need to give credit where credit is due. Our process descriptions need to be fair and to depict process in all its aspects, not just those that are easy to depict for the sake of expediency.



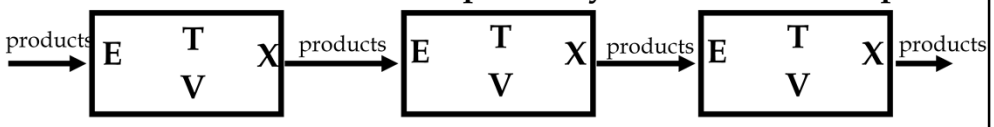
When we look at the difference between routine and non-routine work, what we see is that there is an endless variability in the contexts of action that are not considered in a simple causal workflow abstraction. What we need to do is to change our descriptions of workflow in order to add "play" which will allow them to operate in multiple contexts. The "play" in the workflow allows it to adapt to changing circumstances and changing contexts. But this fundamentally undermines our descriptions which are static and proscriptive. So we run into a fundamental problem with descriptions when it comes to attempting to describe non-routine work. By its very nature, non-routine eludes description which can only really cope with routine work. It is very difficult to write descriptions in such a way that will allow "play" in the workflow system which allows the description to remain valid in multiple contexts and in the face of changes in contexts of action.



Another fundamental problem is that the wiring or piping of the flows are never static. If we think of the flows like a river or stream, what we see is that because the landscape of constraints around work is continuously changing, the connections between fragments of the process are always changing as well. The stream of work is continually changing its course. New work is always being discovered which makes new connections between parts of the flow that was not connected before. Thus, if the process fragments within the workflows are not capable of encompassing all the situations in which certain tasks are done, then it is impossible to also keep static connections between different process fragments. To understand this situation we might turn to Deleuze and Guattari's concept of a desiring machine as a partial object. Process fragments are like organizational desiring machines. They are continually connecting in a myriad ways and then reconnecting in order to express their desire for continuous flow. Process fragments operate this way as well. We can see the process fragments as related more to the organizational level (what Deleuze and Guattari in Anti-Oedipus call the "socius") than to the level of the individual worker. The process fragments are what are needed within the organization for the flows to continue. But the landscape of constraints are continually changing so that the process fragments are constantly changing course and reconnecting with other process fragments in a never-ending dance of ad hoc revision and creative production of new connections and kinds of work. The static model of processes in a rigid ordering attempts to stem this flow and these changes. It is like a dike erected against the ocean of continuous change in the realm of workflows. It may hold for a short time, but it is likely to be overwhelmed by circumstances when process fragments are forced to change their course.

Standard Process Description

Non-routine work cannot be captured by this kind of description.



What this formalism of work does:

- Explicit descriptions of inputs and outputs with validation guards
- Explicit decomposition, sequence, and causality
- Describes simple routine work very well
- Excellent for control of precedent sensitive operations in process

The problem with these formalisms:

- Meta-formalisms do not describe meta-work
- Meta-formalisms describe the formalisms themselves

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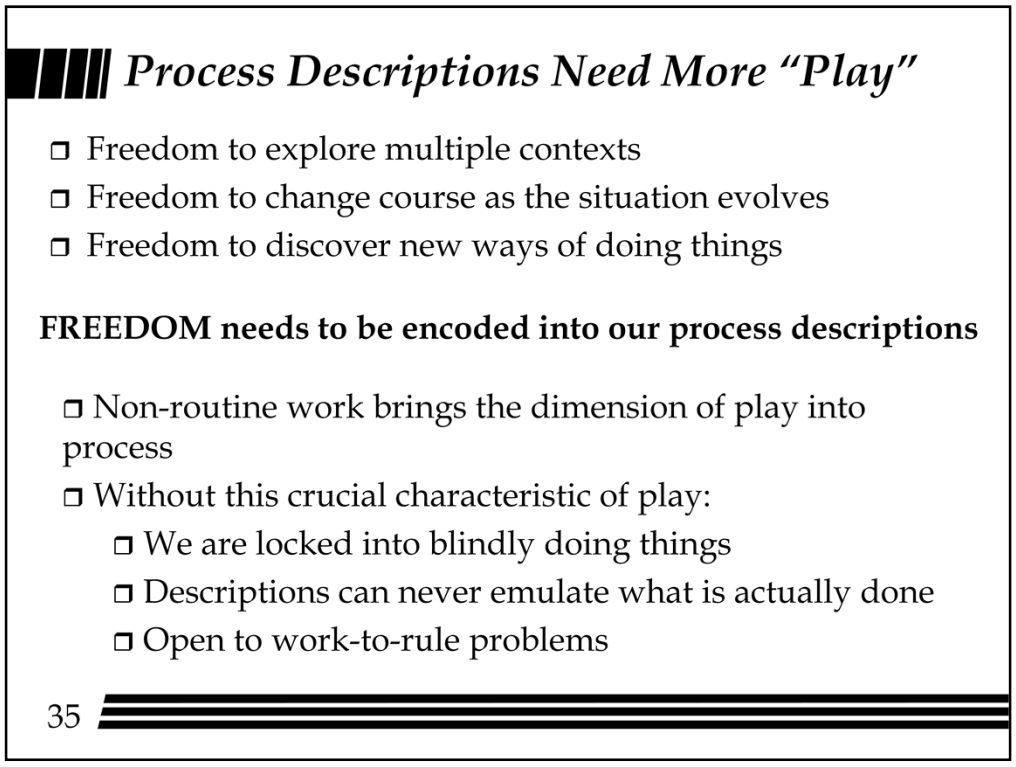
The standard description of process as regulated flows that connect process fragments in sequence is like a fairy tale that we tell ourselves which paints a picture of simplicity and stasis. In some cases these fairy tales come true and remain unchanging for some time. But for the most part, they are not true when they are first drawn. They are, in fact, idealizations that are seldom true. In fact, they only become true when we force them onto the situation and make the situation conform to these idealizations.

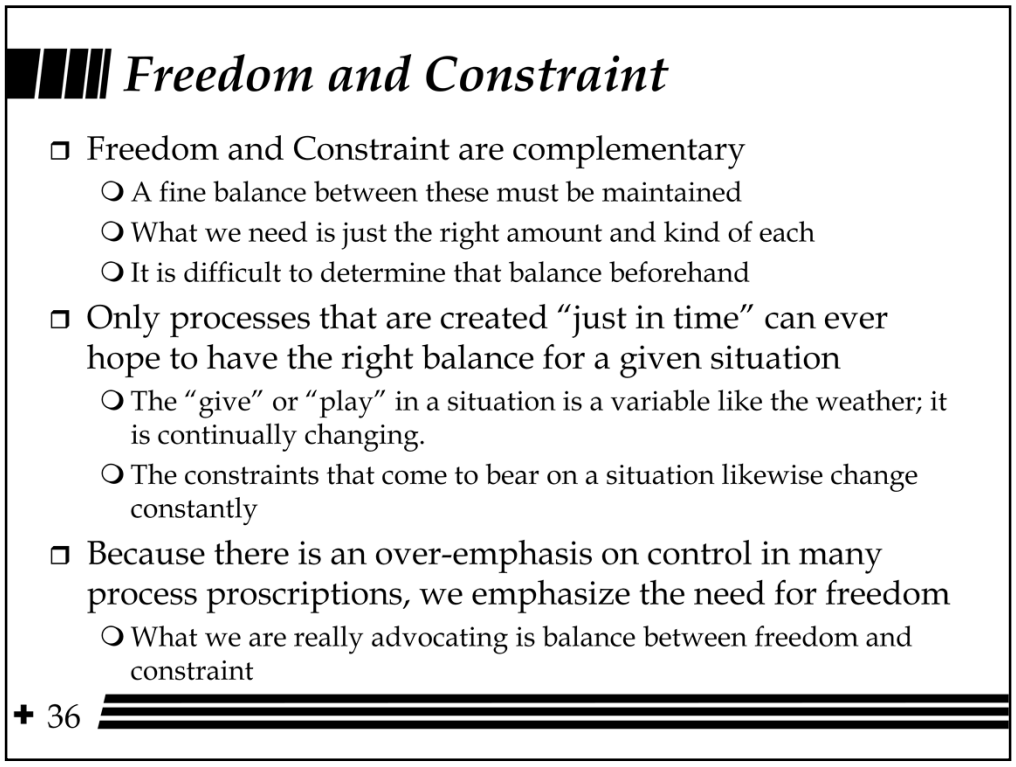
Another problem is that if we attempt to create meta-formalisms to describe these descriptions, we are no longer describing work but the formalisms themselves. So the formalisms do not help us climb the ladder of meta-levels of learning and change. As soon as we take a step on that ladder, we realize that we are dealing with something other than work but only with the ways of describing descriptions. Thus, these formalisms do not scale up the ladder of meta-levels of work but can only describe the lowest level and then only in the most static and rigid ways.

Occasionally, this kind of rigid and static formalism is needed. But if it becomes our major way to describe work, then we will, in fact, be distorting work by getting rid of its adaptive nature and reifying it into an unchanging structure.

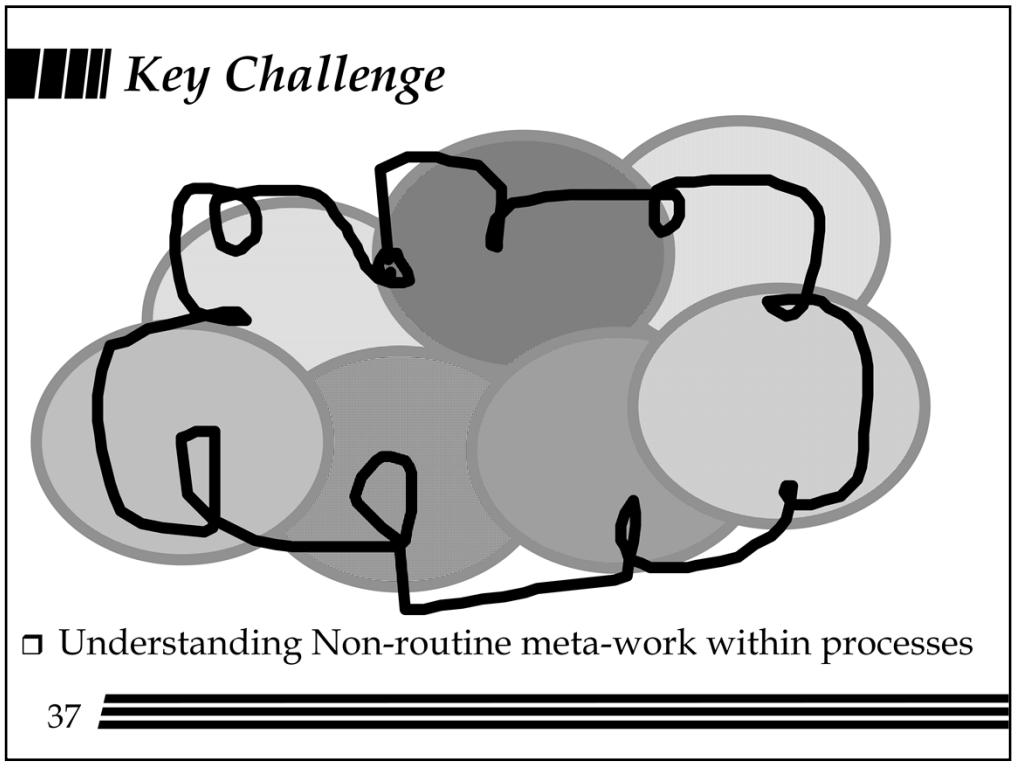


There is a dialectic between freedom and constraint that is working itself out here. We need to give the workflow the freedom to explore multiple contexts and to change course when necessary. We need to give it the freedom learned by doing and to discover new ways of working. This freedom needs to be encoded in our process descriptions themselves if they are to ever be useful. But the freedom needs to be balanced with constraint when appropriate. This balance needs to be formulated on a case-by-case basis as we describe each kind of work. By adding the freedom within the process descriptions, we place more responsibility where it belongs on the practitioner. This allows us to describe non-routine work and adapt the work we are doing in any circumstance. It prevents us from being locked blindly into a narrow-minded way of doing things. Introducing play into the description allows it to emulate what is really done instead of what ideally should be done but never is done. Rigid workflow descriptions are open to the problem of work-to-rule in which practitioners doggedly follow processes they know are wrong. We cannot allow process documents to operate as the final arbiter of what is right for us to do in any given circumstance. Instead, this responsibility needs to be placed squarely on the practitioner with the recognition that the rigid workflow is just an approximation of what is being done and that the real work is made up of both routine and non-routine components. The routine work should be abstracted out and described by rigid workflows, but it should always be recognized that the routine work takes place in the context of non-routine

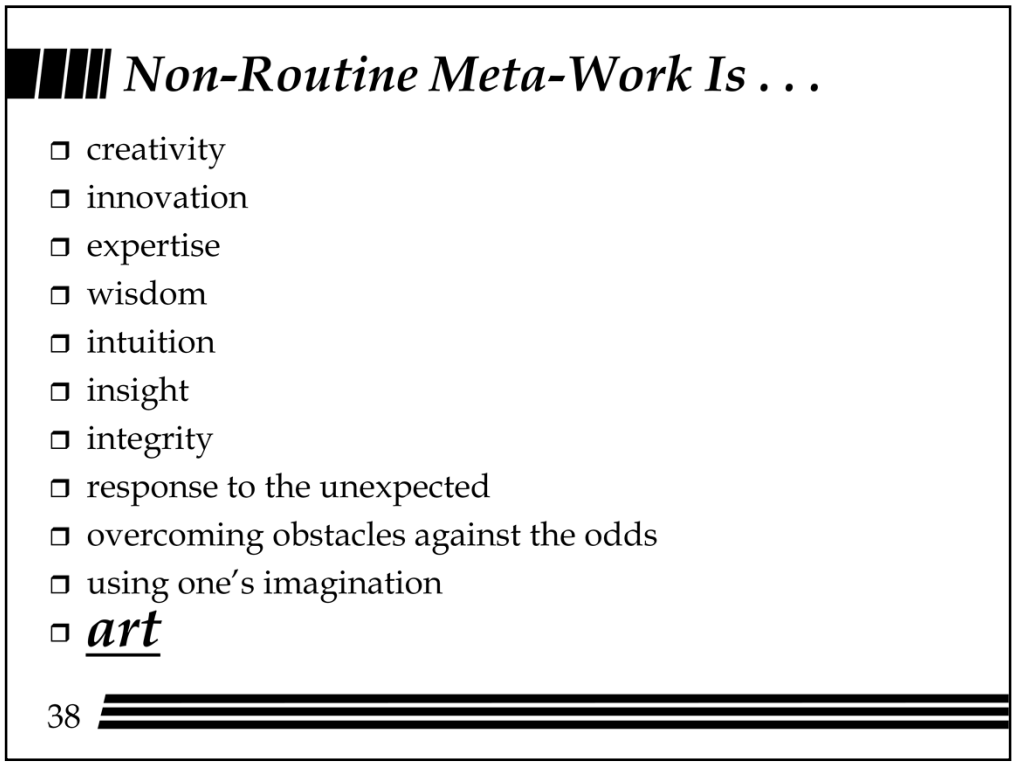
work that handles the continual changes and reworkings of the process in the face of revamped constraints on the work coming from the environment.



Freedom and constraint are complementary opposite ways of looking at work processes. A fine balance needs to be maintained between these two views. In each case, the right amount of each is different. It is difficult to determine what the right balance between freedom and constraint is beforehand. Only processes created "just-in-time" have a hope of getting this balance right in any particular work situation. Thus, we need to advocate the co-production and the co-evolution of processes and products. This is what happens anyway as things stand. In every case, the way of creating the product is produced with the product because the product could not exist without this co-production of the process that is always already being produced in the midst of action. What we are are really advocating is rendering self-conscious the process. This means climbing the ladder of meta-levels and looking back down on the process in order to get a view on its appropriateness. As has been noted, Deleuze and Guattari in Anti-Oedipus talk about production, consumption and inscription being simultaneous aspects of production. To these we might add processing as the opposite of inscribing. Inscribing produces the product, and processing controls the inscription. Processing refers to the active transformation itself prior to inscribing in which consumption occurs. Production may be synonymous to the inscribing process. All of these are simultaneous aspects of production, and it is interesting that Deleuze and Guattari should forget self-conscious processing in their model of production.



The key challenge is to confront the problem of non-routine meta-work which cannot be captured by static and reified representations, but which demand freedom and play in our approaches to work description. We might say that if production is composed of production/consumption and processing/inscription, that the non-routine aspect connects these covalent aspects of work to the concrete situation within which it occurs. When we attempt to represent work in order to make it self-conscious as a co-evolving side-effect of working on products, then we enter the nexus of the two chiasma of production/consumption and processing/inscribing. What we mean here is that in the static and reified view, it is possible to separate out the consumed inputs from the produced outputs, and it is possible to separate the processing tasks from the inscribing of results of those tasks. But in non-routine work, it is not possible to clearly separate these moments of the overall production. In non-routine work, we may be making up or discovering our outputs and making up or discovering what our outputs should be. In non-routine work, we may end up doing different processing on a case-by-case basis, and inscription of results may become fragmented. Non-routine work is opaque to the kind of analysis that we would normally do to isolate and define routine work. We need to accept the existence of non-routine work and attempt to understand the role it plays as the opposite of routine work. We need to attempt to create positive descriptions of that strange kind of work.



This is a list of positive characteristics of non-routine work. Non-routine work is meta-work in the sense that it takes as its object lower level work and attempts to adjust that lower level work to the situation. Thus, we could say that non-routine work is continually manipulating routine work. So if we do not attempt to cover all work with our routine work descriptions, then we can see those descriptions as useful for meta-work as a means of controlling and channeling lower level work. The characteristics of meta-work are captured by the concepts of innovation, creativity and the other words on this list. It is meta-work that allows us to become flexible and adaptive in our adherence to the constraints of the environment. And it is what allows us to apply our research discoveries in order to change our course completely and thus invent new relations to the environment.

The real advantages we have to gain comes from tapping the resources of non-routine work in transforming ourselves and our projects. Whether routine or non-routine work is really the larger percentage of work accomplished is a moot point because even if non-routine work was a small faction of the work performed, it is still the term that signifies the greatest possibilities for gain.

Artfulness

- All work can be artful
- The reward of artful work is in the doing
- The ambition of artful work is joy
- All work is spiritual work
- To be artful I must own my work process
- Artful work requires the use of the self
- As the artist creates the work the work creates the work

Dick Richards
Artful Work
(Berret Koehler, San Francisco 1995)

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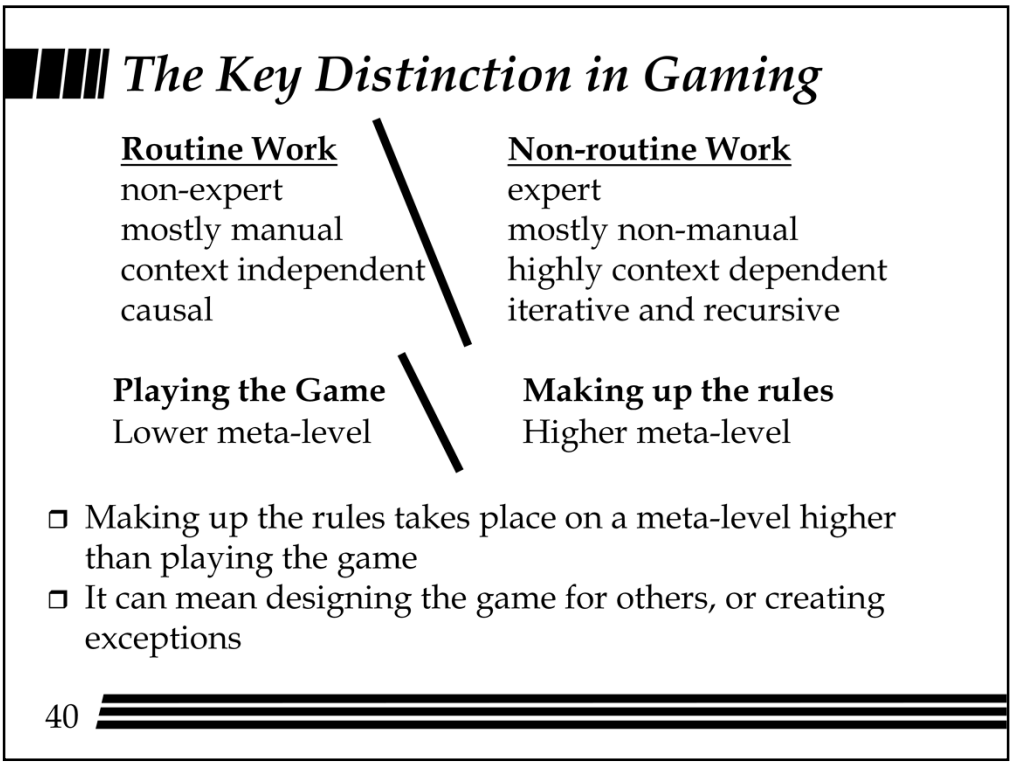
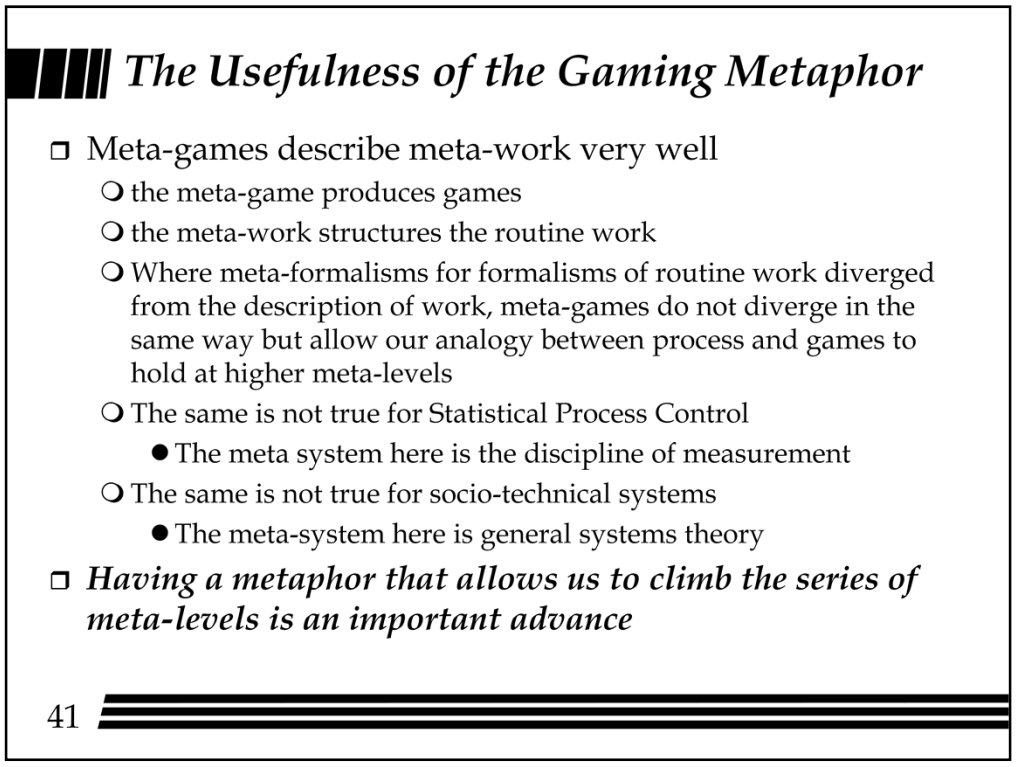
Dick Richards summarizes the point of view in which non-routine work is seen as ***artful*** work in his precepts. Artfulness here is similar to craftiness where the word craft has the Old English connotations of ***kraft*** or powerfulness, skillfulness and cunning. In our non-routine work we again enter the realm of kraft. Because there is some component of non-routineness in all work, all work can be considered to be a kraft. The reward we get for working in a kraft comes from the actual practice. As we meet the challenges and succeed, we discover the joy in the handling of the non-routine aspect of work. If work did not have this aspect, we would find it empty and meaningless. In this sense, any work can become spiritual to the extent that we realize that there is the possibility of mastery of the kraft in it, and the mastery of the kraft is self-mastery. However, to practice the kraft we must own the process even if we do not own the product. When we do the work, we use our self, and in that process, we learn how to center our consciousness. As we create our products, we are actually creating ourselves. Artful work or Kraft (in its original sense) occurs when we appropriate the non-routine part of our job and make it our own.

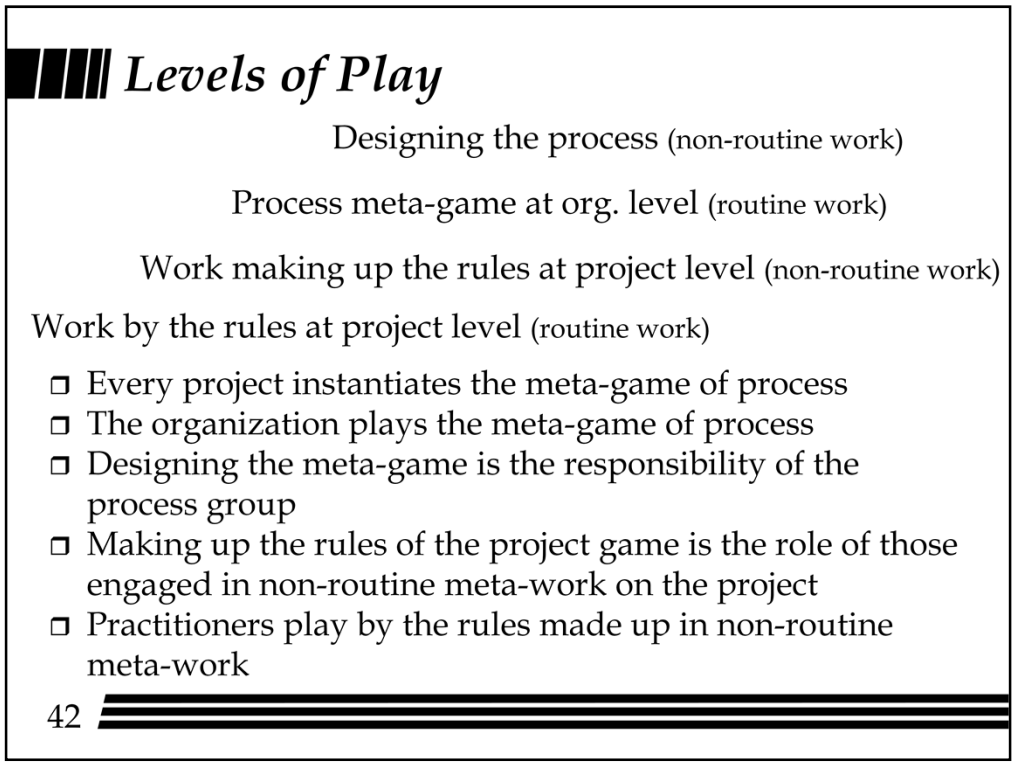


Even though we cannot take the formalisms of routine work to higher meta-levels, we can take our metaphor of the game there. When we move to the higher meta-level with respect to gaming, we find the process of making up the rules. Thus, this metaphor allows us to climb the ladder of higher logical types with respect to work. Creating good rules is an unusual kraft. Also, we must be able to deal with exceptions that violate the rules of the process when necessary. The game is equivalent to the process. The making up of the rules and handling exceptions corresponds to the process improvement meta-level. We can make up new rules for a game that already exists, or we can produce new games out of combinations of old games and this would correspond to the process innovation level. Occasionally we might introduce a completely new game in which case we will have an example of process emergence. So we can see that each meta-level of process corresponds to some level game design or game playing. The same is not the case for statistical process control or socio-technical systems metaphors. This is why gaming is such a good metaphor for process. It makes clear the relations between work and play, while at the same time giving us a way to work our way up the steps of the ladder of meta-levels.

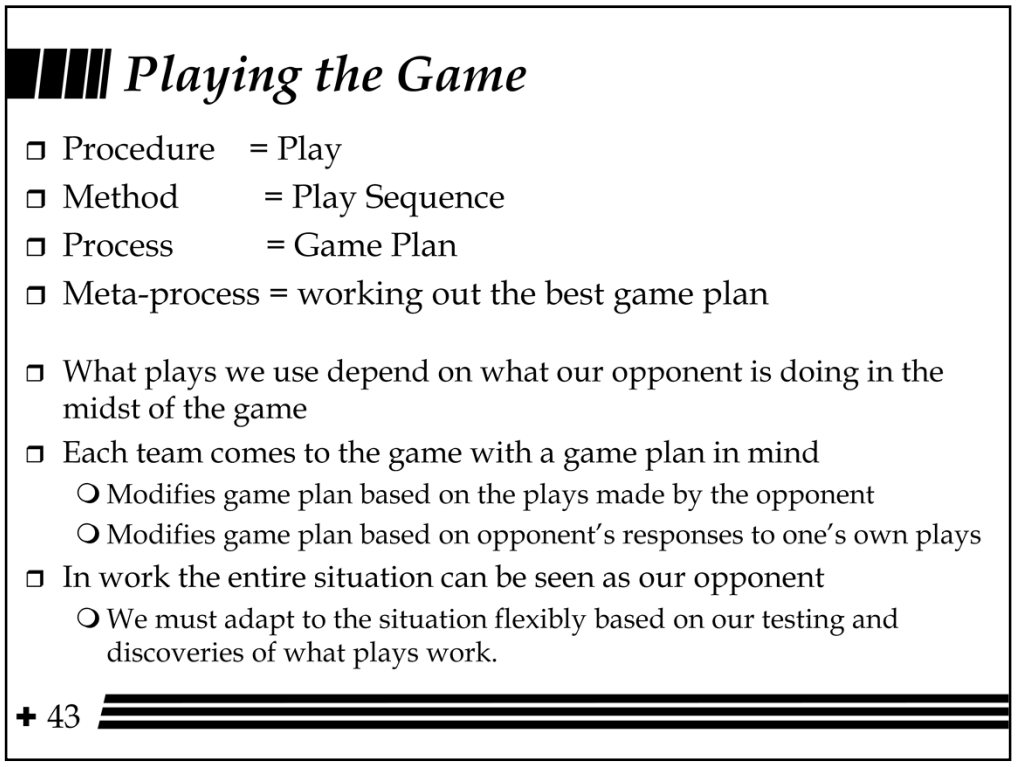


When we go to the meta-level for statistical process control, we get the discipline of measurement at the higher level. When we go to the meta-level for socio-technical systems, we find general systems theory. So neither of these metaphors allow us to scale the series of steps on the ladder of meta-levels. The fact that these metaphors do not allow us to go to higher meta-levels in our consideration of work is a major, non-obvious, drawback to these ways of looking at work. In fact, this aspect of the game metaphor is a very special characteristic which would be difficult to imitate in other metaphors.

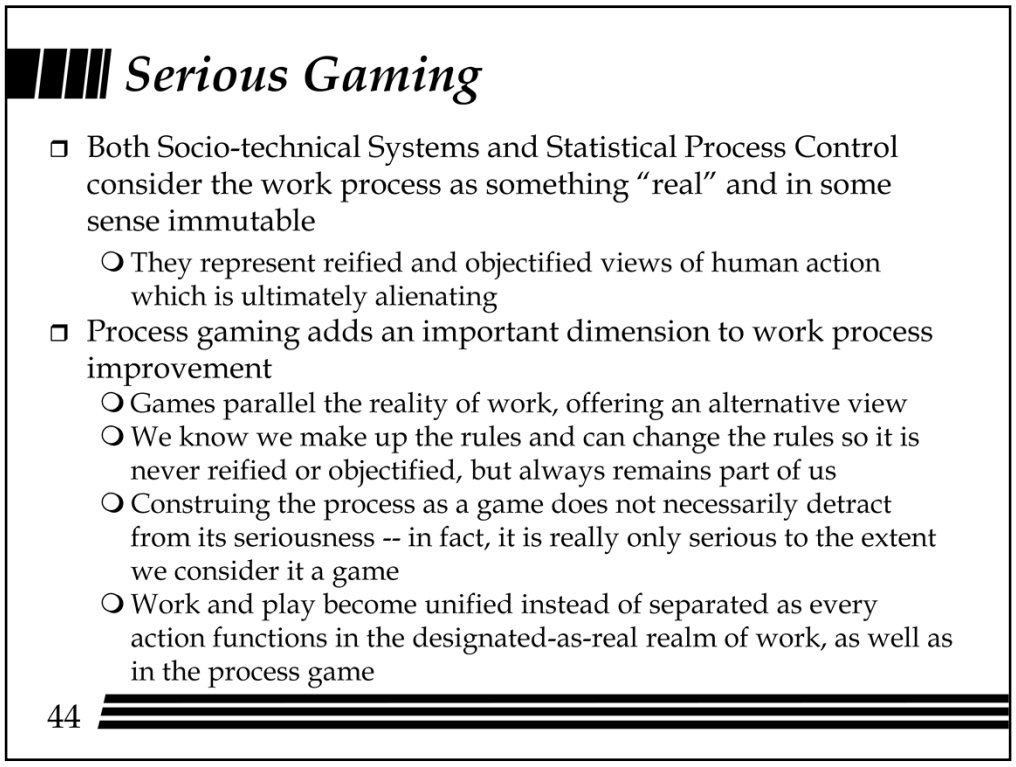
We can see process at the organizational level as a meta-game that produces subgames which are the instantiations of the game at the project level. This meta-game structures the way the game is played at the lower level by changing the rules and handling exceptions. This is similar to the way meta-work shapes routine work as an ongoing process. For instance, we see expert systems as being composed of heuristic rules that are known by the expert. Every expert uses his knowledge to do meta-work, applying heuristic rules to the structuring of work at a lower level by non-experts. The expert may create new work as needed and handle exceptions on a case-by-case basis. Thus, the expert is engaged to a greater degree in non-routine work that shapes the routine work of those relying on his expertise.



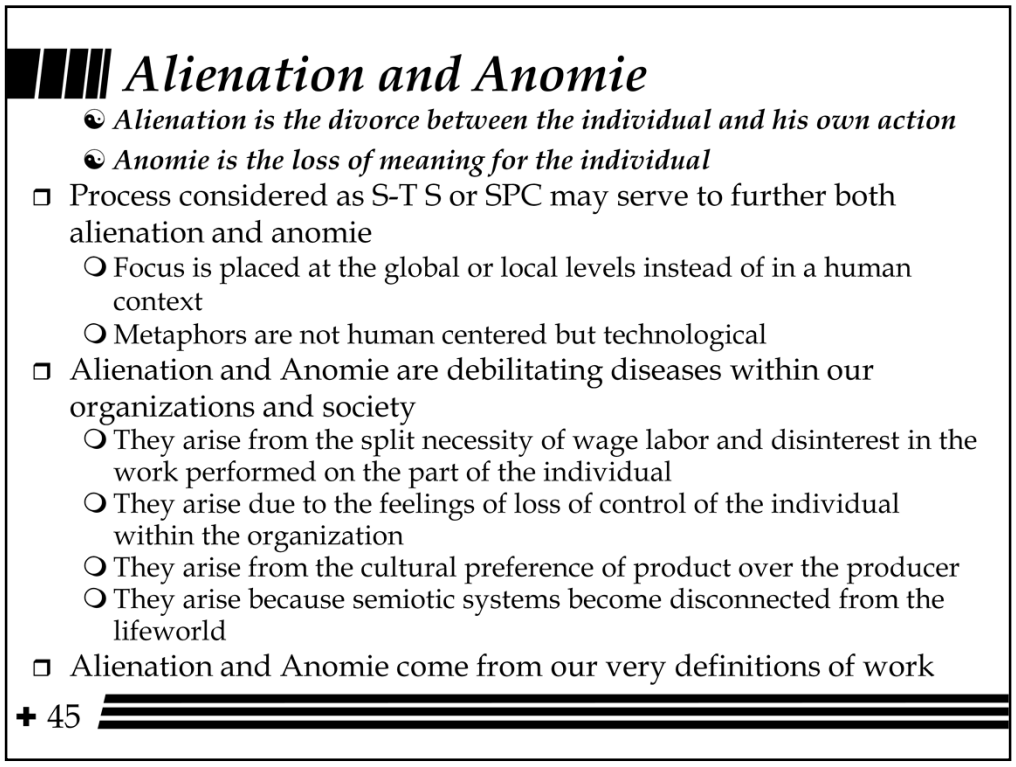
Thus we, can look at different levels of gaming and rule making. The designers of the process are rule makers at the meta-level. They create the meta-game of the organizational process. Then this meta-game is instanitated on a project by the experts that govern the work on the project. They specialize in the rules of the meta-game for the subordinate game that plays out the routine work of the project. Every project instanitates the meta-game of the organizational process. The organization plays the meta-game and the project plays the lower level game. This two-level gaming scheme allows us to have a precise way of applying the metaphor of gaming to our process work. It allows us to understand why the organizational process game is so different from the project process game and why both levels have their routine and non-routine work components that must be dealt with. Rules are being made up and exceptions handled at both levels. The meta-game is a meta-system, whereas the lower level game is a system. This is to say that the meta-game is played by the projects themselves who are, in turn, playing their own games internally. It is the balance between the external and internal gaming which which gives us our description of a healthy process. Playing one game at the expense of the other bodes ill for the attainment of process wisdom and maturity.



But how do we apply this metaphor? Who is our opponent in the game? At the meta-game level, our opponent can be the other projects that are working to improve their processes. But at the game level, we must consider the environment of the project to be the opponent instead of any one person or group. Sometimes when we are competing for work, there is an actual opponent but after the contract award in aerospace firms, this is unlikely. So we must imagine the entire environment of the project to be the opponent. We are constantly changing things in response to changes in the entire environment. This means that the game at the project level is lopsided. It is not a game in which there are two opponents matching wits. Instead, there is a total situation that is continuously changing to which we are attempting to adapt as flexibly as possible, and we are continually doing research and attempting to make discoveries that will give us an advantage against this diffused opponent.

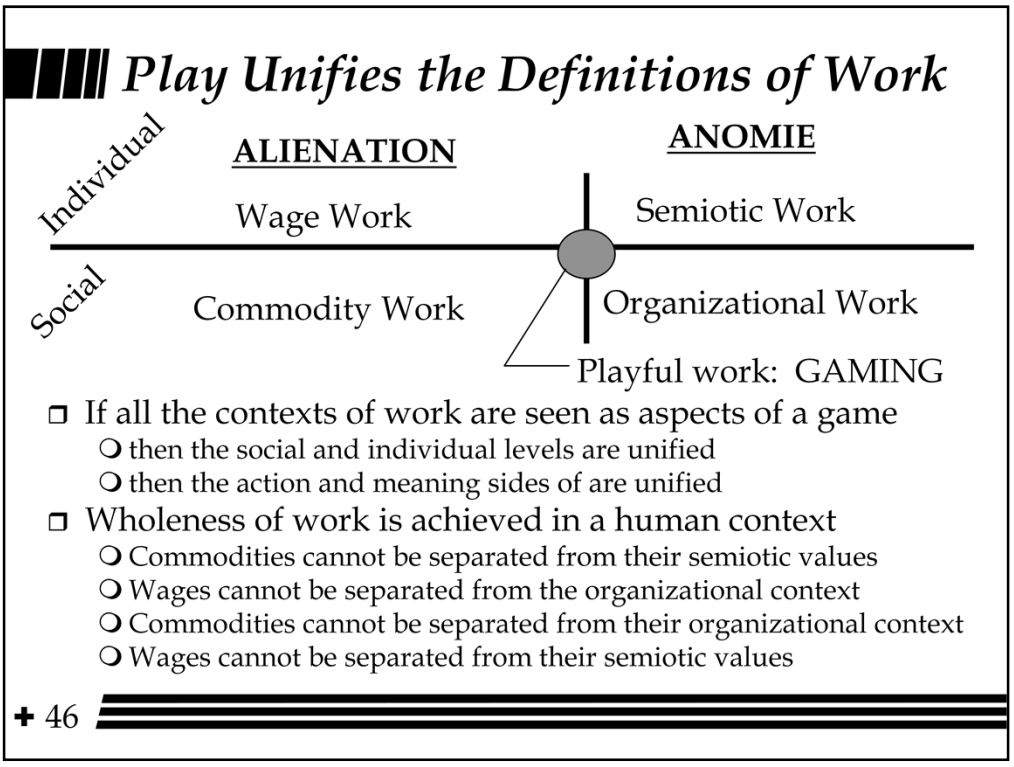


Both socio-technical systems and statistical process control consider work process as something "real." Instead we view work as designated-as-real and employ the categories of *Imaginary, Symbolic and Real* of Lacan as used in his work Ecrites. Under this rubric, Work is designated-as-real; that is to say symbolic, just as is play isolated from work, and the relation workplay is imaginary. Both of these arise out of what Lacan calls the Real as different aspects of it. What is real are the actual connections between process fragments that work and play together properly. The chiasma between work and play is an imaginary connection that we discover in trances of concentration when we are working with things and exploring their play with each other. It is only when we separate out work from play and designate one or the other as real that we enter a purely symbolic relation with the work we do as something objectified and separated from ourselves. Within a game we designate the play as real, while outside the game we designate the work we do as real. This designation process separates it from ourselves as a symbolic present-at-hand indication. But within the process of work itself, we fall into imaginary relations where we cannot separate work from play or subject from object. These imaginary relations are like the relations of an infant with its mother, which is to say they are symbiotic. They are founded on real relations between actual processes that work together. By using gaming as a metaphor, we are constructing a way to look at the imaginary relations of workplay by allowing the designated-as-real game and the designated-as-real work reality to be simultaneous and interpenetrating realities. These two symbolic realms, when they overlap, recreate the imaginary relations in which work and play cannot be separated. This allows us to get at the real relations that underlie the imaginary that are normally obscured by dualism. What is real is what works below the projection of imaginary trance and below the subject and object dichotomy.



Alienation and anomie are disfunctions at the symbolic level. In alienation an individual becomes divorced from his own actions (work behavior), and anomie is the loss of meaning. Both of these are the result of dualistic ways of looking at things. If instead, we allow the imaginary to become strong again so that we allow non-dual ways of looking at things to predominate, then we eliminate alienation and anomie as possibilities. It is our dualistic views of work that create the possibility for alienation and anomie. These are pervasive problems in a society that is fractured by dualisms from every direction. It is important to attempt to heal these wounds by fostering the recognition of non-dual states that are ever present but ignored because they do not fit the dualistic ways of looking at the world. We could look at it this way. The imaginary or non-dual state (like the symbiosis of the child with the mother) is a trance we fall into any time we concentrate hard on something -- fall into conversation, or fall into a reverie -- where we are considering options for a design. The symbolic is an anti-trance. It is just as trance-like, but it is self-split by the use of distancing through dualisms. This is the symbolic realm where we designate things as real. We think of our world in these terms, but we actually participate in our world through the imaginary. The imaginary is the construction of an illusory connection between partial objects, desiring machines, or process fragments. When we double this tissue of illusion over on itself, we create the symbolic realm in which self-consciousness is possible. The imaginary moves between consciousness and the unconscious or the non-conscious, whereas the symbolic moves between consciousness and self-consciousness or reflexivity. The real is the realm of anti-consciousness, of what Kant called noumena -- objects we cannot know completely and their relations. When we stick different process fragments together, they are real connections we are making, but they appear to us as escaping both toward the symbolic (self-consciousness/reflexive) and

toward the imaginary (unconsciousness/non-conscious).



Playful work as gaming unifies the different definitions of work through the bringing of the marginal category of play to the center of the different kinds of work. All of these definitions are based on the dichotomies of the social/individual and alienation/anomie. When these dichotomies are brought together, we get workplay/playwork as the two phases of the chiasma of reversibility between the two sides of the dualism. Thus, we construct a whole person view of the relation between work and play which defeats the conflict between individual and society and which does not allow alienation and anomie to arise.

Applying the Theory of Games to Process

- Game theory has been developed in order to aid decision making in economic and strategic contexts
  - This theory focuses on the potential of gain and loss in various restricted situations
- But games do not have to be construed so narrowly
  - We are talking here about multi-person games aimed at mutual gain and avoidance of mutual loss rather than games of conflicting interest
- There is a vast literature on game theory to draw upon as a background for developing processes based on gaming

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We can call upon the theory of games to help us construe the process meta-game and its project sub-games. It is of interest that game theory has many of the same anti-process characteristics as work. Game theory focuses almost exclusively on outcomes of strategies rather then the process of game playing. Thus, to use game theory, we must change its emphasis to look more at processes rather then solely at outcomes. We are used to idealizing things and looking at them as frozen and complete presentations upon a background of illusory continuity. We seldom look at the substrata from which this illusory continuity is constructed. When we turn to processes, we suddenly are asked to look at the incomplete and dynamic process by which things are produced. It is work to get behind the present-at-hand frozen representations and to attempt to understand the complexities and dynamics of the flux that produced the things which are finally presented. There are many false starts and wasted efforts along the way -- lots of exploration and discovery. Game theory, like our product theory reduces all this to final outcomes -- bottom lines in a vast reductive and simplifying gesture that ultimately hurts us more then it helps us understand things and how they come to be within the process of production and creation. The connection between game theory and product theory allows us to see how every product can be seen in terms of gaming exchange between producers and consumers. By extending the gaming theory, we can approach the representation of processes that result in these outcomes between producers and consumers.

Game Theory

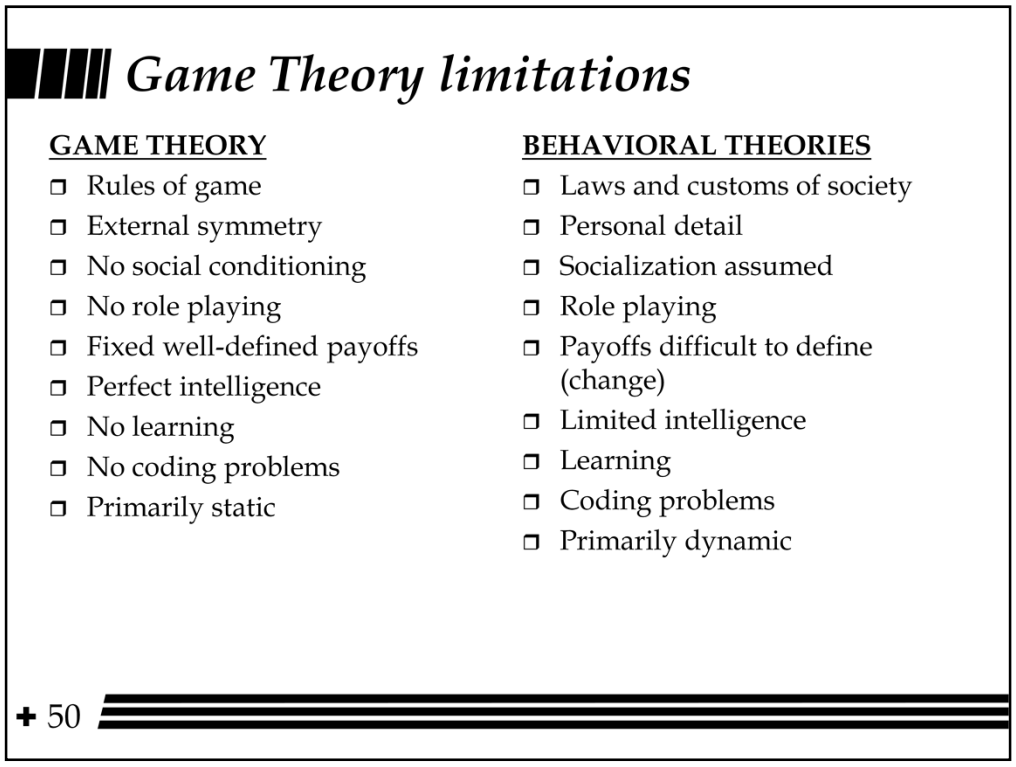
- Considers probabilities of outcomes based on choices of players in conflict
- Cooperative game theory is a new development
  - Considers coalitions of players and their differential rewards
  - Considers idealized voting schemes
- Extends utility theory to group from individualistic games
  - Considers equality between players
  - considers maximization of reward for coalitions
- Two views of games
  - Strategic tree form of game plays
  - Matrix of game outcomes

When we look to game theory, it is cooperative game theory that most interests us as it comes closer to describing what is occurring in a team process. What we are looking at in team processes are the defection and joining rates of individuals to a cooperative effort. Computational Organization studies by Hubermann (Xerox Parc) and others have shown that joining and defection may arise suddenly and create large shifts in alliances in spite of steady state regimes that last for long periods of time. Since processes are cooperative efforts, these studies have strong implications for modeling processes as cooperative games. We can expect large scale shifts away from or toward processes at any time. This means we must be extra vigilant in our deployment of processes as the chaotic nature of the social milieu may cause large scale joinings to and defections from the group process. The smallest fluctuation can start these large scale movements for or against cooperation.

Cooperative Game Theory

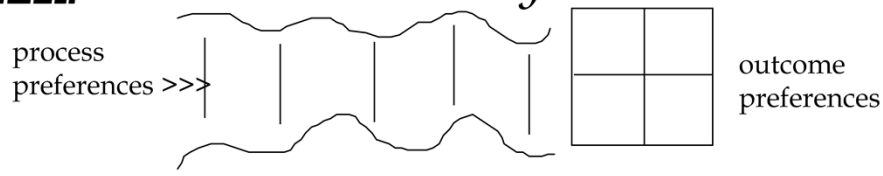
- Arrow Theorem -- Social Welfare Function
  - "By a social welfare function will be meant a process or rule which, for each set of individual orderings R_1, R_2, ... R_n for alternative social states (one ordering for each individual), states a corresponding social ordering of alternative social states, R" (Arrow 1951 p. 23)
- Characteristic Function -- Preferences of all coalitions 2^n-1
- Core -- Games in which all coalitions can be satisfied at once
  - These games do not tend toward conflict

The Arrow theorem gives the mapping between the individual and social levels of modeling. For us this operates on two levels. It operates mapping the individuals of the project to the project team preferences, and it operates from the project team level to the preferences of the organization. Once one has established this mapping, it is possible to consider coalitions of individuals or projects within the organization and their capacity for cooperation. If there is something on which they can all agree, then it is said that the group has a core. If it does not have a core, then the group will fall apart into competition rather than cooperation. Studies have shown that it is possible to have cooperation even through the medium of prisoner dilemma games if there are enough games in the series to be played. Single games break down into competition immediately, but multiple games over a longer period can sustain cooperation even in the face of the prisoner's dilemma of ignorance of the strategy of the other and perfectly rational choice of final outcomes. The characteristic function is the preferences of all the possible coalitions within the group. When we play cooperative games, the harmony or disharmony of every member in every possible combination with other members must be taken into account. This analysis of coalitions grows exponentially at a power of two so that for large groups it is very complex and may be non-computable given the time constraints of simulations. Cooperative game theory gives us a theoretical tool for exploring the harmonies and disharmonies in our teams as they reach for perfections on the backdrop of conflict and individual variation that is an ever present possibility.



We must be aware that game theory has its own limitations. If we look at this list of differences from behavioral theories, then these limitations become clear. Game theory is only a step toward a more complete social-psychological understanding of human behavior. But it is an important way station in that it allows us to build a comprehensive theory of process that is semi-formal and is true to our insights into the relation between work and play. Game theory allows us to bring that workplay relation into the symbolic arena out of the imaginary arena. It allows us to objectify our ideas about the process as a meta-game with sub-games. But we have still a way to go before we can fit these into a social science framework because the game theory is such a simplification of the real world. However, when we begin modeling these gaming abstracts in the way Nance and Hubermann have done, then we see the value of looking at organizations and processes from the standpoint of computational dynamics of organizations and game theory. Even iterated prisoners dilemma games give us some interesting results with far reaching consequences. For example, the concept of organizational fluidity as being a factor in the adaptiveness of the organization. This work intimates that highly structured and hierarchical organizations are rigid and inflexible and thus non-adaptive. The relation between processes and organization are an area that are just now being studied, and hopefully there will be more results out of computational organization studies using game theory that are useful for understanding how organizations use processes and the effects of different process models on different organizational types.

Social Game Theory



outcome
preferences

- Differentiates outcomes from process preferences
- Inverts coalition hierarchy and sees social group as an active player that differentiates into individuals
- Applies theory of moves giving significance to the order of moves by players
- Models the change and learning at various meta-levels
- Models role playing as agents perform different kinds of work together
- De-emphasizes utility theory and instead focuses on viability

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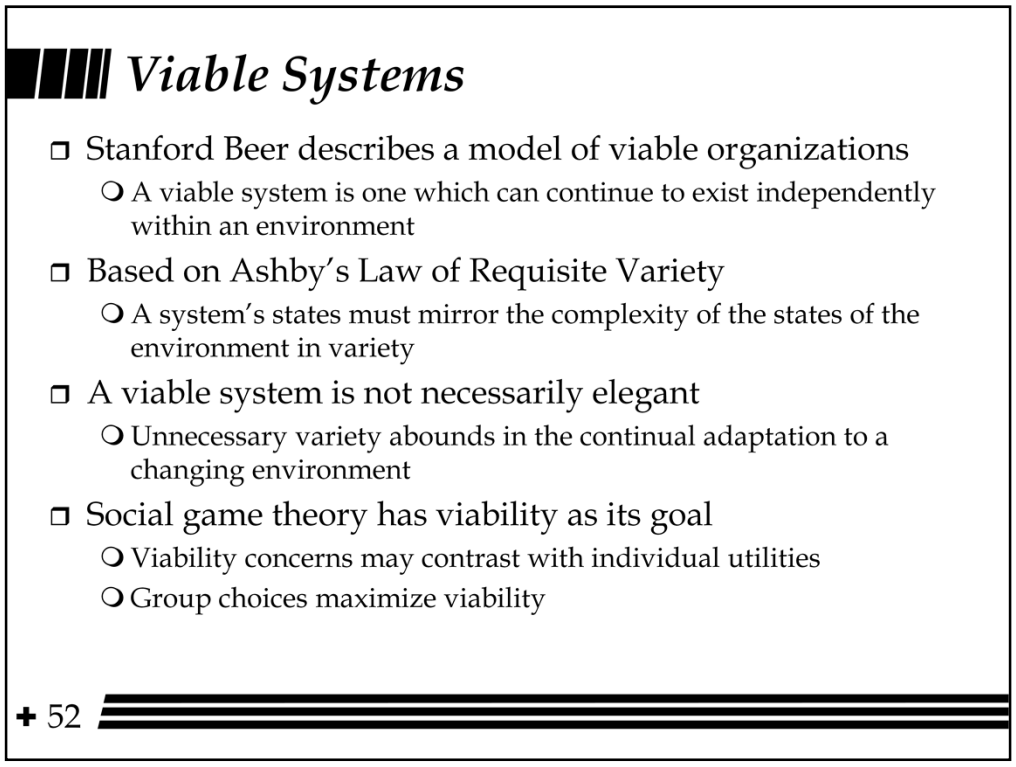
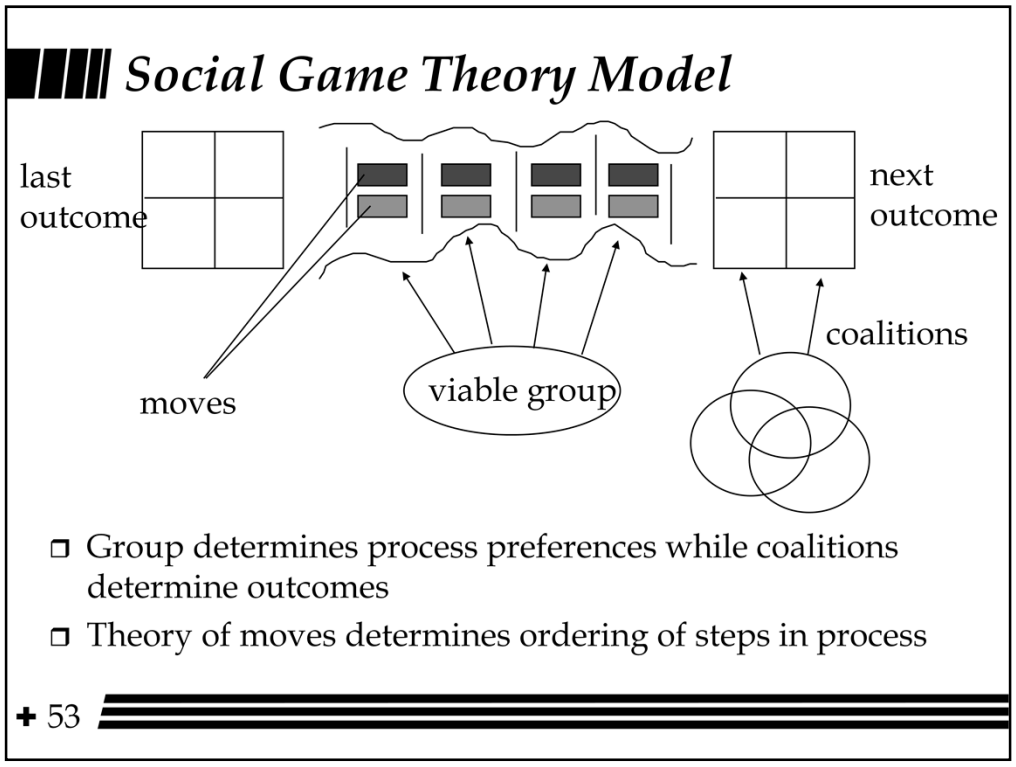
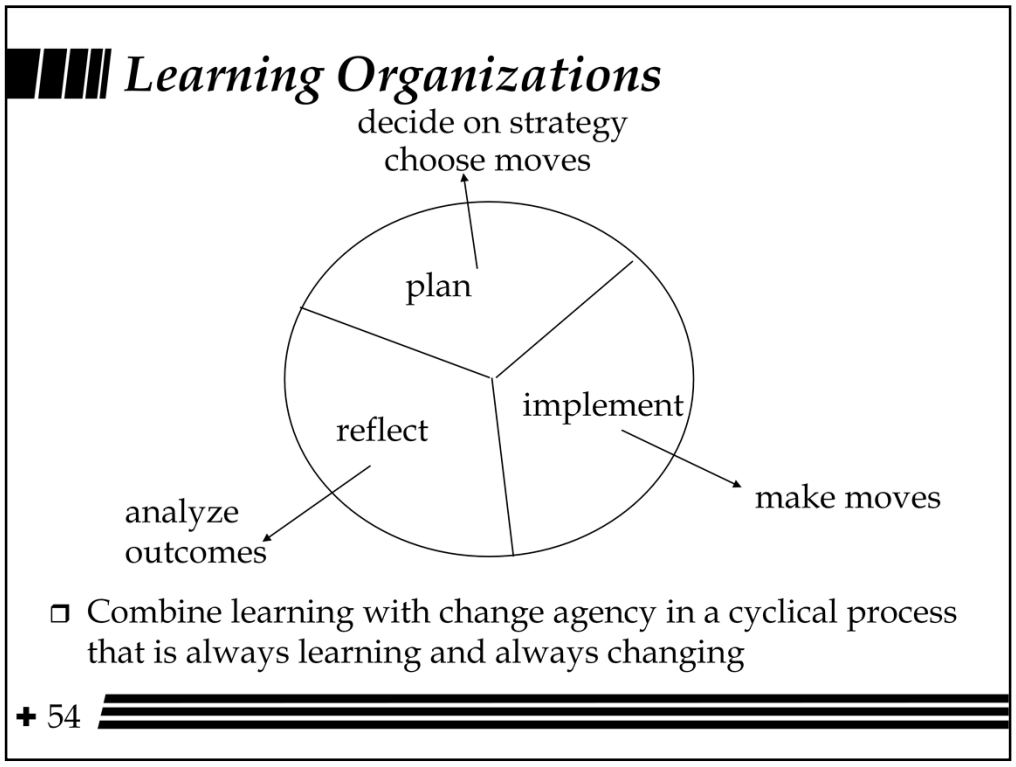
If we want to construct a social game theory, then it is necessary to distinguish process preferences from game outcomes. We must also take the focus away from the individual in coalitions and place it on the social group itself as a player. We must also consider the theory of moves, where the order of moves counts. In process the steps you take matter as much as the outcome. The outcome is really a product outcome and a process outcome which is related to quality instead of quantity. What we are really modeling with social game theory is viability of the group instead of utilities of individuals. In our individualistic society, these changes to game theory are slow in coming but are inevitable. Thus, we need to effect the development of game theory through the application of cooperative game theory to processes, making the necessary changes that will make cooperative game theory a good model for processes.



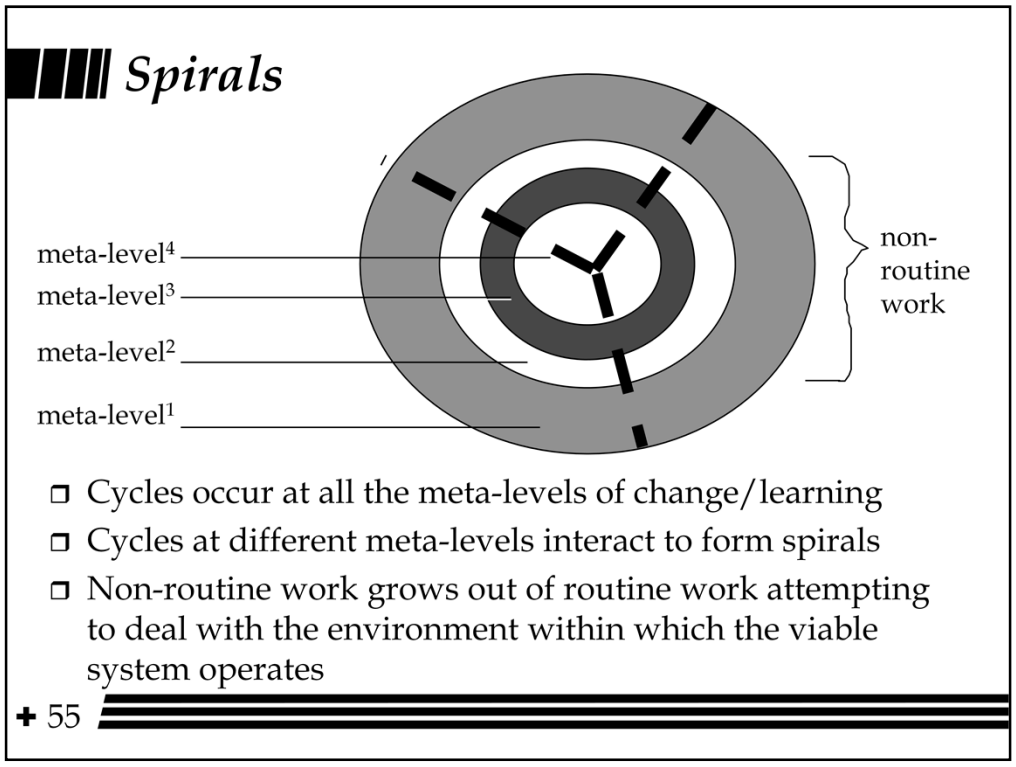
Stanford Beer describes viable systems in his book The Heart of Enterprise, These are systems that can last within their environment. Almost every social group has viability as its major objective. In order to be viable, such a system must produce what Ashby calls requisite variety -- that is, enough variety to match the variety of its environment tit for tat in order to be able to adjust to that environment. So it is unnecessary for a viable system to be elegant. It may overproduce variety in order to assure its match with the environment. Thus, viable systems tend to overproduce variety -- and this leads to a basic problem for processes -- unnecessary variety. The social player that is the coalition of coalitions has as its goal an increased chance of viability. This imperative may conflict with the goals of individuals who have their own utility functions to satisfy. The individuals may defect or join the cooperative effort to sustain viability of the social organism. Thus, there is a basic conflict between the social body and the individual that needs to be continually resolved. Part of that resolution is through the non-dualistic modes of interaction in which individuals are not separated from the socius. The other is the playout of rational choices that in some instances lead to cooperative solutions.



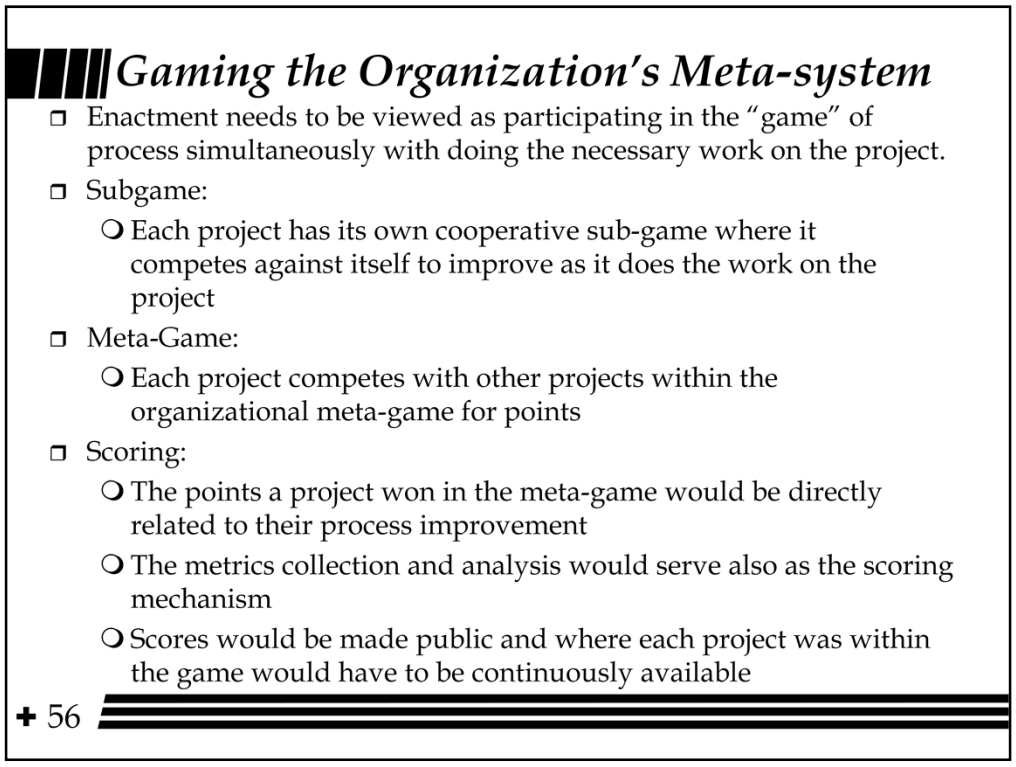
We can model social game theory by adding the theory of moves and process preferences to the ordinary cooperative game theory. We would posit that the viable group oversees the process of the game and exerts process preferences, whereas the coalitions of individuals are concerned with the outcomes. Thus, the social players would be concerned with the moves that are played, whereas the individuals as players would be deciding whether to join or defect from the ongoing process of the group. Constructing a model of this kind allows us to look at the whole process in terms of both outcomes and in-process preferences related to specific move sequences.



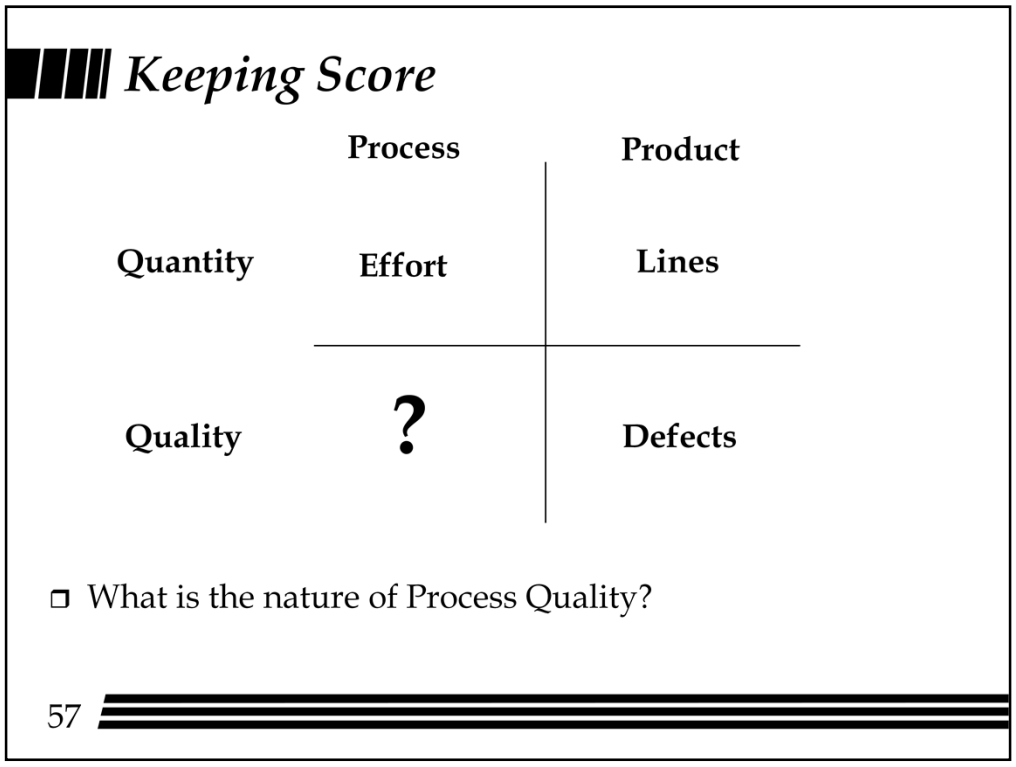
When we begin to look at our process within the organization in terms of game theory, then we are implicitly introducing a sequence of plays and are modeling a learning organization which plays each game according to a plan based on a reflection concerning what its results were last go around. Reflection is an outcome of moves made based on plans and estimates. By means of this cycle the organization learns by engaging alternately in action and reflection as well as progressive planning.



Once the plan, implement, reflect cycle has been established, then we see it operating at all the different meta-levels of change learning. When it operates at the higher meta-levels, then it is performing non-routine work. When a path is taken between meta-levels, then that is a spiral in which a strand of work rises through the meta-levels and then spirals back down again to the level of non-routine work.



Now if we are going to consider the meta-game and sub-games of process within an organization, it is necessary to consider the scoring mechanism. This brings up the problem of the nature of process quality and its measurement. We need a measurement with several qualities mentioned above. We note that the cooperative games occur at the process level, and that at the organizational level projects are most likely competing for resources and in terms of process development or improvement. This is why the meta-game must be a meta-system instead of a system -- it harbors this conflict between projects. But how do we score the meta-game and the project sub-games?



As I go to different conferences on software, I note that three of the quadrants in the table above have been filled in and mutually agreed upon. But the forth quadrant is still up in the air and has not been defined as yet. What is the nature of process quality? That is the big question that needs to be resolved for us to continue to make progress. Is the CMM the ultimate measure of process quality, or can we create some better measure to add to the others. Basically this diagram tells us that there are really multiple bottom lines in software production. There is the ultimate cost as related to the ultimate size of the thing. There is the ultimate product quality and the ultimate process quality figures of merit.

Possible Answers . . .

- Efficiency (industrial engineering)
- Standardization (DOD)
- Regulation (ISO, SEI)
- Systematic (Soft-systems approach)
- Constantly improving (TQM, ISO, SEI)
- Effective (commercial businesses)
- Homeostatic (Statistical Process Control)
- Customer complaints (pragmatic approach)

Many answers are possible,
No single answer has achieved wide acceptance

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There are many possible answers to this question. No single answer is deemed correct as yet. Taylorism takes efficiency as its ultimate indicator of process quality. Other characteristics are supported by different communities who have a stake in software working. For instance, commercial business concentrates on effectiveness. Waste is allowed as long as the end effect is adequate and occurs with the right timing. Up until recently, the government used standardization as the primary rule for judging quality. But now with the advent of commercialization, it could be that effectiveness will outweigh standardization as a judge of quality processes. Statistical Process Control seeks homeostasis with respect to the feedback loops within the system. Socio-technical systems looks at the health of the whole system as an indicator that the parts are functioning properly. There are many measures of process quality all competing for prominence.

The gaming measure of process quality

- Gaming demands an easily understood scoring mechanism
- We need an overall measure of process quality
- The measure needs to be sufficiently separated from the results of work
- Needs to be isolatable
- Needs to be something directly connected to our humanity
- Needs to be something we can indeed control

Many measures would probably fulfill these criteria

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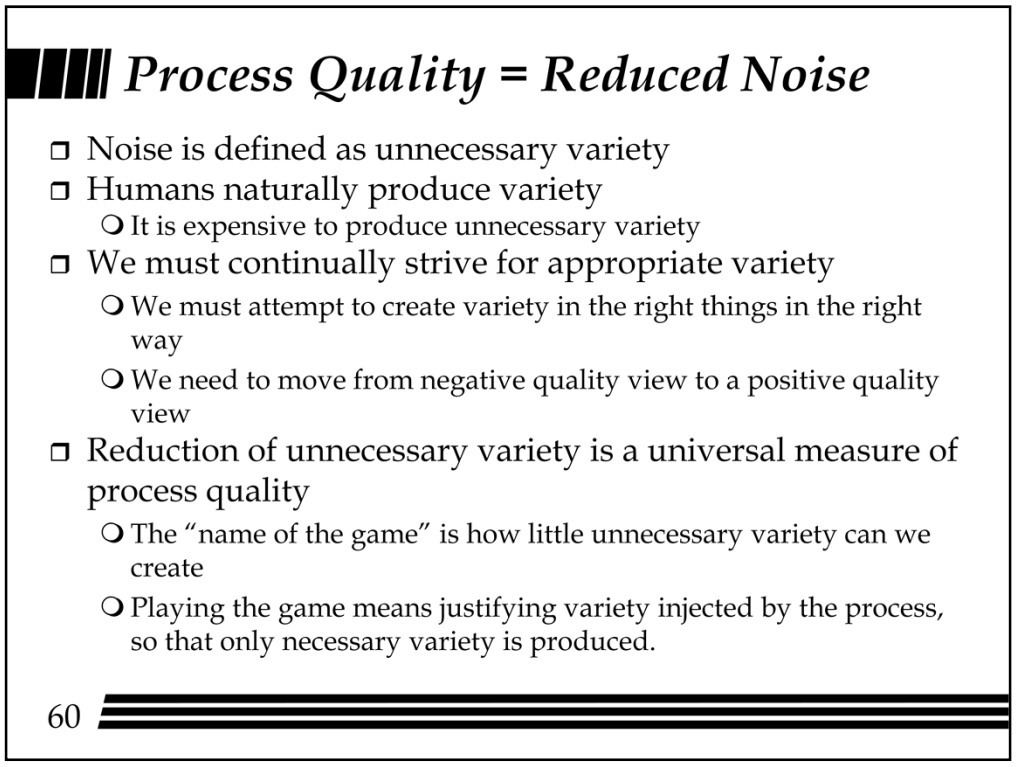
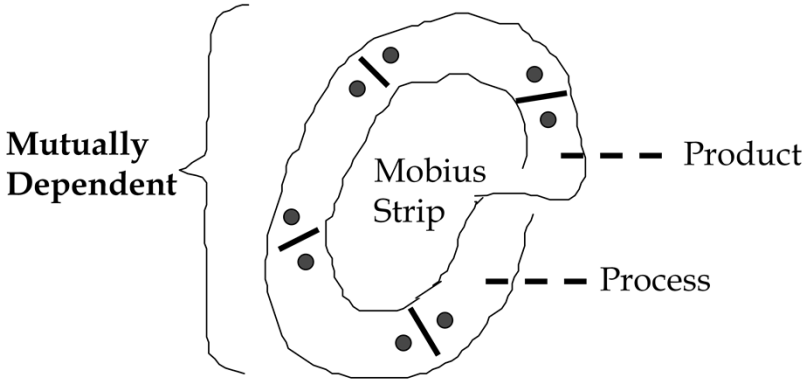
Gaming also places its demands on the nature of the measure of process quality. The different desired characteristics of a gaming score for process quality are listed above.



The measure that I think is most appropriate is reduced noise where that is defined as reduction of variety to optimal variety. That does not mean getting rid of all the variety, but it means getting rid of the unnecessary variety. In the Joiner Team Handbook there are three points mentioned in this regard -- getting rid of errors, slack and variability. Errors are defects, slack are temporal waste, and variability is what I mean here. It is unnecessary variability that is the cause of much wasted energy on projects. We want the variability that makes us viable, but the variability produced beyond that is a waste of time and effort and causes downstream incompatibilities.

Product / Process Duality



- Variety in intermediary products makes necessary variety in processes and vice versa

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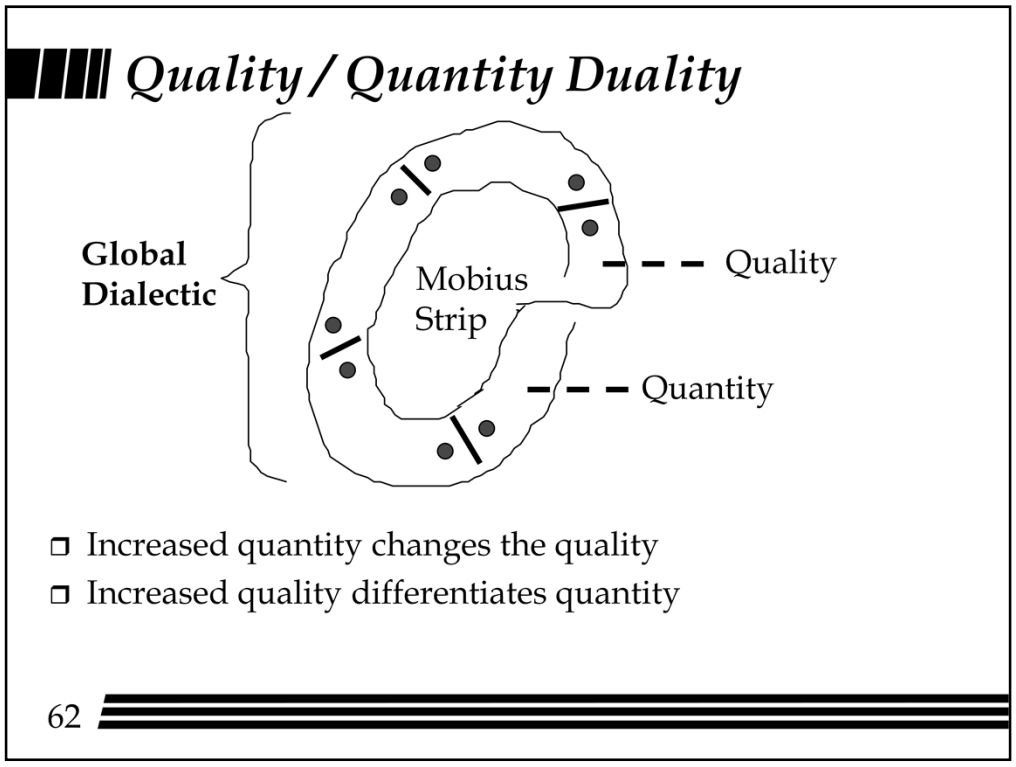
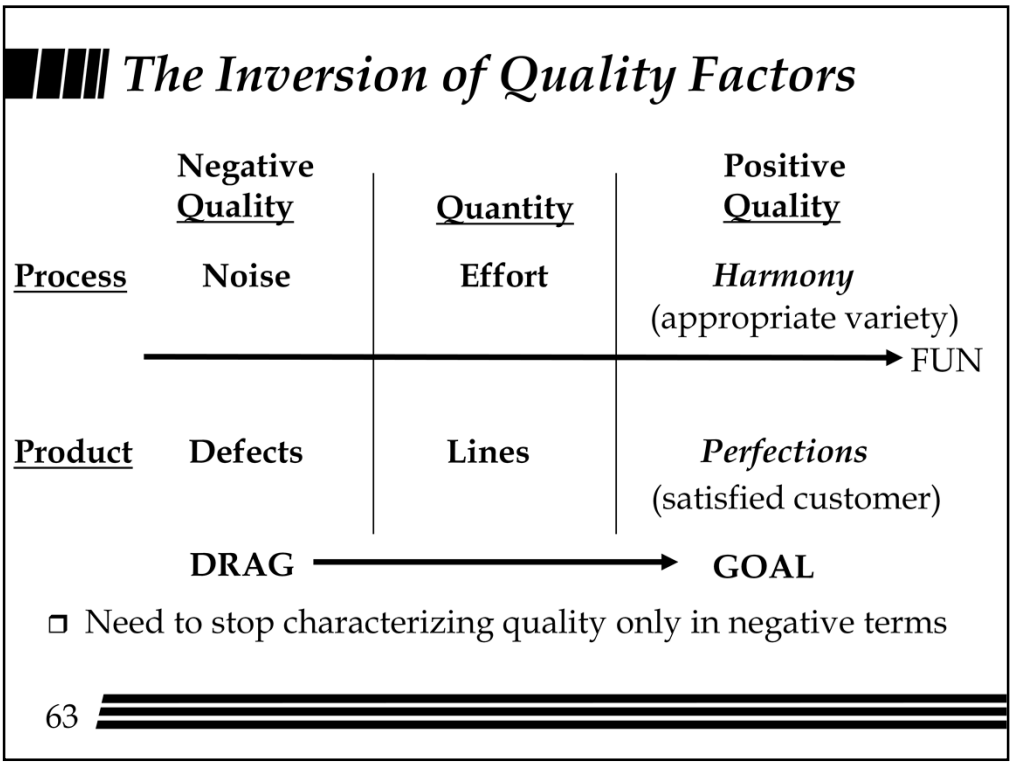
Process and product are mutually dependent and co-arising. So the process and products aspects of the table are dependent, not independent of each other.



Similarly, quality and quantity are dependent on each other and cannot be fully differentiated in any absolute way.

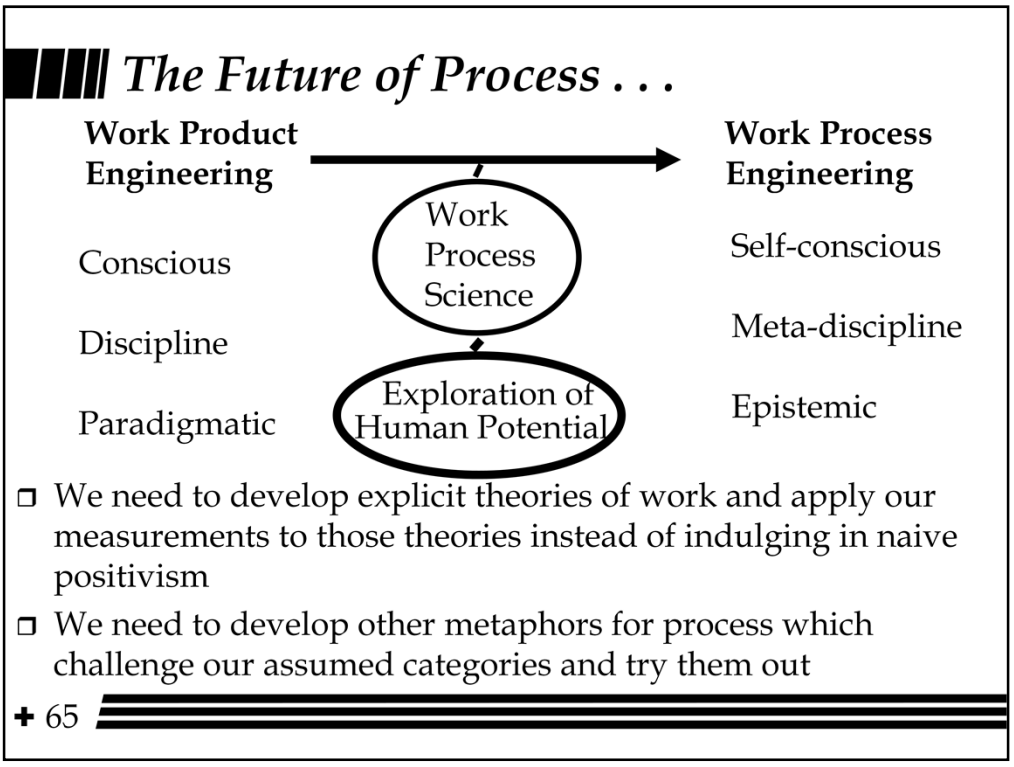


What we note is that in our analysis we are only making use of the negative process and product quality metrics. We can see that these are opposite harmony and perfections that are the positive process and product quality attributes for which we are striving. Here we define harmony as appropriate variety and perfections as satisfied requirements of a customer. The negative process and product quality attributes indicate the drag that keeps us from reaching the goal of harmonious perfection. When we are striving for that goal, a good measure is how much fun we are having as that indicates optimal variety as we meet challenges and overcome them. The question is, how close can we get to the goal of attaining harmonious perfections, and how much drag keeps us from reaching that goal.

Positive Quality View

- Keeps the global relations in view
  - mutual dependence between process and product
  - dialectical relations between quality and quantity
- Allows for the expression of human potential
  - Attempts to reach the twin goals
    - Appropriate variety
    - Satisfaction of customer
  - Fun is an indication of the correct balance between work and play
- Produces a realm in which the gaming metaphor can operate
  - Play tends to produce harmony as a natural outgrowth
  - Play allows for imagination of perfections within reality of imperfection
  - Play allows for the variations that are necessary to find the appropriate variety
  - Play gives a context for the pursuit of the impossible in tandem with the pursuit of the realistic
  - Play allows us to be self-conscious of our work in the midst of the work

When we take a positive quality view of process and product, we keep the global relations between product and process or quality and quantity in view instead of losing them from view. We relate our process and product goals directly to human potential as we strive for the twin goals of appropriate variety and a satisfied customer. That the work is fun indicates the right balance between work and play in our enterprise. By applying this intentional structure, we obtain a realm in which it makes sense to apply the gaming metaphor. Through this way of looking at processes, we build toward a conception of the whole human process.



The future of process moves us from work product engineering to work process engineering supported by a genuine work process science and the exploration of human potential within the whole human process. Other metaphors besides gaming may allow us different views of work processes. We need to develop these alternative metaphors that allow us to explore the nature of work processes within the context of the human process.