INSEAD

The Business School for the World®

Faculty & Research Working Paper

Designing and Leading Virtual Teams

José SANTOS

2013/76/ST

Designing and Leading Virtual Teams

José Santos*

I want to thank Guilherme Azevedo, Thomas Deisboeck, Yves Doz, Don Lessard, Erin Meyer, Susan Schneider, Bert Spector, and Peter Williamson, for their comments and suggestions on previous versions of this paper. I also want to express my gratitude to the many managers who shared their experience of virtual teams with me. This essay is dedicated to them.

* Affiliated Professor of Practice in Global Management at INSEAD, Boulevard de Constance 77305 Fontainebleau, France. Email: jose.santos@insead.edu

Abstract

This paper condenses the outcome of my study and research on virtual teams – which took shape in parallel with my research on the management of multinational companies since the mid-nineties and as virtual teams quickly emerged as a form of organizing technical and managerial work. Virtual teams are already relatively common in research and development, procurement, operations and supply chains, or client accounts, and are growing in all other functions, even top management. Virtual teams function quite differently from classic or traditional teams. Properly designed and managed, virtual teams deliver superior performance for an organization and become an important new source of value creation, a key source in a globalizing world. But if managers try to apply rules that govern classic teams to virtual teams, the results will be disappointing. What matters most in "virtual teams" is "virtual", not "teams". This implies that we may need to forget a lot of what we know about classic teams while developing new knowledge and skills to design and lead virtual teams effectively.

Introduction

In a world that is increasingly integrated, virtual teams have become an important new source of value creation. Virtual teams function quite differently from classic or traditional teams, which have been common in business for many years. Properly structured and managed, virtual teams deliver superior performance for an organization. But if managers try to apply rules that govern classic teams to virtual teams, the results will be damaging.

Virtual teams arose with globalization. In the 1990s, as the pace of globalization quickened, virtual teams proliferated. Multinational companies organized and deployed groups of employees around the world for a variety of functions, including product development, supply chain management, client relationships, and even top-level management.

When considering virtual teams, there is a tendency to focus on physical distance and how team members can bridge that distance. There is an implicit assumption that virtual teams *should be* like traditional teams. If effective classic teams exhibit a certain feature, then virtual teams need to exhibit the same feature, according to this view. In other words, the emphasis is on "team," not "virtual."

In fact, virtual teams and classic teams are fundamentally different. Managing virtual teams requires a focus on *the virtual side, not on the team side*. This means that as we move to virtual teams we may need to forget a lot of what we know about classic teams.

Members of a virtual team function in different local contexts. We should not believe the myth that distance is dead and that the right combination of information and communication technologies are all that is needed to overcome distance. If that were true, there would be no point in having virtual teams: Classic teams would have the same value at a lower cost. *Distance is alive and well*.

The notion of virtual teams

In its most common usage, a team consists of three elements: a small group of individuals acting together, interdependent performance, and shared accountability. A *group* of individuals is necessary when the task requires resources not accessible to a single individual. What makes a group a *team* is the nature of its performance: The output of a team is different than the sum of each member's output. What individual members of the team produce depends not only on the specific resources they can access but also on what each produces concurrently. Such tight coupling and resource complementarities raise the value of acting together. This reciprocal interdependence makes it impossible to ascertain each individual's contribution and calls for shared accountability (Alchiam and Demsetz, 1972).

What is rarely highlighted in the common notion of team is the importance of the attribute "together." The kind of integration that fully solves reciprocal interdependencies among different team members requires that they be together, a *real* together. Team members need to fully understand one another. They need to be in touch and in synch, with a shared space and time and a shared context and background. Almost everything academics and practitioners know about teams – particularly how to manage or lead teams – is about such

real teams, which I call "classic teams." If we drop the "together," or if it becomes metaphorical, we have a virtual team.

The most widely used definition of virtual team is one in which members are dispersed in different geographic locations and use technology to mediate communication. A virtual team resembles a classic team because its members work as a group to produce something that otherwise would not be possible. In both classic and virtual teams, the marginal contribution of each individual is difficult to determine, and accountability is shared. But in virtual teams, the members are not together.

The value proposition of virtual teams

The great advances in information and communication technologies that occurred starting in the 1990s—email, video conferencing, cloud computing, and others—enabled the growth of virtual teams. But these technologies are not the reason virtual teams arrived when they did. Virtual teamwork emerged because of globalization.

Globalization implies integration across national boundaries. Multinational companies, which had used classic teams for many years, discovered that to optimize global performance they needed managers and skilled workers to collaborate across national borders. The need to access resources dispersed around the world and required by a team meant that individual members could no longer be colocated.

While virtual teams have important advantages, they also bring costs. Evolution did not prepare human beings for virtual teamwork. For a multinational company, if there is a similar but lower quality resource set available locally, the value proposition of a virtual team may disappear in the face of the trade-off between the added costs of virtual teamwork and the lower quality of the colocated resources.

While companies use virtual teams in many areas of business, their most important function is in high-level management. The top management teams of many global business units are fast becoming virtual teams. Indeed, the hallmark of a globally integrated company is its virtual top management team.

Companies that have successfully implemented virtual teamwork throughout their organizations often have done so by starting at the top. The virtual headquarters is becoming the norm. A multinational company with a classic team at the top and virtual teamwork at the bottom is prone to tension and missteps. A classic top management team does not understand the challenges virtual teams face. These managers can't begin to fathom what it is to work together when not together. This is a possible explanation for evidence that colocation of top management teams is positively correlated with performance (Cannella et al, 2008).

Examples of virtual teams

The merger of two roughly equal semiconductor companies, one French and one Italian, formed ST Microelectronics. ST was incorporated in Amsterdam, had a central office in Geneva, and operated other key offices New York and Paris. ST has had a virtual top

management team since 1987, making it one of the first of its kind.

ST top executives were located in Geneva (although none was a Swiss national), and in Milan, Catania, Grenoble, Phoenix, Tokyo, and in Singapore. They were predominantly French and Italian with smaller numbers of American and Japanese. With few exceptions, all members resided in their home countries or commuted between Geneva and their homes in nearby Italy and France and were located in major ST sites or in major markets. They met four times a year for two days. This was a top management team that met around a table for a grand total of eight days a year.

The top management team of the banking software maker i-flex solutions is another early example of virtual teamwork. Leaders of i-flex, now owned by Oracle, had four executives of Indian nationality dispersed to different sites for their functional roles: Mumbai for finance and administration, Bangalore for operations, and the United States for technology and sales. The CEO was in New York.

Several other high-profile companies have implemented top-level virtual teamwork. In 2006, IBM moved Chief Procurement Officer John Paterson from New York to China, marking the first time a major American corporation had moved an officer away from the United States. Soon thereafter, Cisco placed a corporate executive of Dutch nationality in Bangalore. The chief executive of HSBC moved from London to Hong Kong in 2009. More recently, GE designated its vice-chairman John Rice head of "Global Growth and Operations," a new position based in Hong Kong.

The top management groups of multidimensional organizations already increasingly are virtual teams. For example, a matrix with a geography dimension is managed at the top by a virtual team—although executives at the top of the matrix rarely see themselves as such. Indeed, much of the ineffective performance of matrix organizations in multinational companies can be attributed to the failure of the virtual team at the top to function properly.

There are, of course, exceptions. Several Japanese companies still have the top managers of different global functions and regions colocated at corporate headquarters in Japan. But as the world of business becomes more global, dispersion of top executives will be the norm. Many multinational corporations have assigned global mandates to offshore units. Siemens, for example, had nine global business units headquartered in the United States in 2011. The proposition here is that *the more global the world, the more location matters—especially the location of senior managers.*

Although virtual teams represent a major change in management at the corporate level, their most visible impact has been at operational levels in certain functional areas of multinationals. One field in which virtual teams have had a strong presence is management of global accounts. The typical global account management operation consists of a team leader located close to the headquarters of customers, with other members deployed to regions or countries where customers' other sites are located. In some cases, global account management teams have grown to sizeable units with a virtual team at the top. Permanent virtual teams now handle other traditional functions—including procurement, manufacturing, IT, and finance—as well as new activities—such as global supply chain or global service delivery. Steering committees in multinational companies often are virtual teams. And strategic alliances between companies from different countries often involve both permanent and temporary virtual teams.

Virtual teams are often formed for special projects in both research and development and new product development. Semiconductor maker ST developed its systems-on-chip for hard disk drives and car navigation through a globally distributed team. A number of landmark products, including the IBM System 360 and the Airbus 300, were developed by virtual teams.

A case of nationally dispersed new product development is the B2 Stealth Bomber, which was designed and built by four American companies—Northrup, Boeing, GE, and Vaught in the 1980s. Although the engineers and designers of the aircraft used highly sophisticated information systems and all-digital 3-D tools, the cockpit wiring still had to be redone three times. Integrating dispersed teamwork is not a trivial pursuit.

In the late 1980s, Hewlett-Packard formed an intercontinental team called Project Alex to develop a new printer. (Leonard, 1993) Project Alex was structured as a virtual team because of the complementary competencies HP had in two sites—innovative design in Vancouver and design for manufacturing in Singapore. Before Alex, new HP inkjet printers were developed in the United States, and then shifted to Singapore, where they were re-engineered with for improvements in cost and quality. HP eventually abandoned Project Alex, and this outcome underscores the consequences of institutional misalignment, cultural misunderstanding, and poor coordination between the American engineers and their Singaporean colleagues.

Teamwork as a process

The ideal team is made up of peers. Roles are differentiated horizontally according to member-specific resources, but there is no hierarchical or vertical differentiation. Members of a team are interdependent.

A team is a structure, but teamwork is a process. Teamwork is not instantaneous and rarely happens in one act. Even when a team accomplishes a task in a single meeting, some process will have been involved for the duration of the meeting. In most cases, teamwork involves a *sequence* of meetings. The resources required by the work of members of the team often entail the *pooling* of tasks executed by individual members between successive team meetings. The practicality of teamwork implies that even a classic team is not always located in the same room.

Somewhat paradoxically, classic teamwork is punctuated with dispersed work. It is a sequential process oscillating between two kinds of events: meetings of all members in one room and dispersed periods—each member's work in between meetings. Classic teamwork exhibits the limitations of human nature, not the specificity of resources used to achieve their team goal. We need to go deeper into the nature of teamwork to grasp the essential differences between classic and virtual teamwork.

Teamwork as knowledge melding

To explore the nature of teamwork, consider the task of assembling a jigsaw puzzle. When we open the box, we find the pieces that make up the puzzle and the picture of the desired

outcome. We need only to assemble the pieces to complete the puzzle. As we put the puzzle together, we know that the picture is precisely what we are supposed to create, the pieces in the box are exactly those required, and the shape and color of a piece does not change when we put it together with another. Assembling this puzzle is a task for one individual—though more than one individual working on it may speed the process.

Now, imagine a very special jigsaw puzzle:

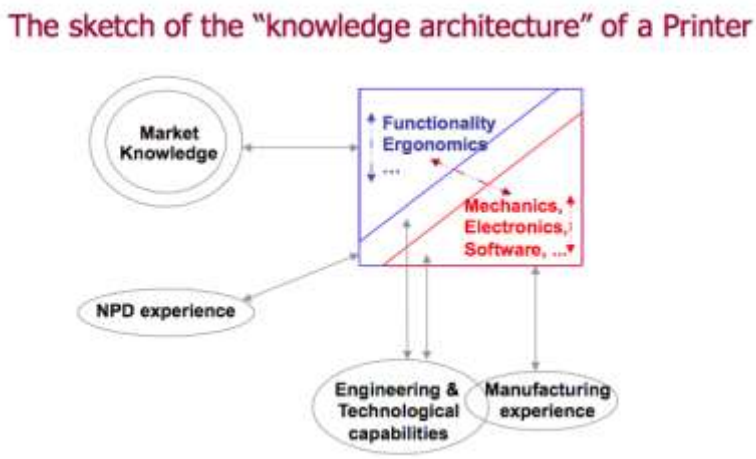
1) There is only a rough sketch of the assembled puzzle.
2) The pieces belong to different individuals and one person can't acquire them all. When the pieces pass from one individual to another, they are damaged.
3) The shape of some of the pieces can be changed–and this may be required for one piece to fit with another.
4) The color of some pieces change when put together with other pieces in a certain way–though we do not know how the color of each piece changes.
5) There are more pieces than necessary, although some may initially be hidden–and we can't know which ones before attempting to complete the puzzle.

I call this special puzzle "team jigsaw." The process of building the puzzle into the most beautiful picture possible *requires* teamwork. The outcome is almost surely different every time, and it is unpredictable. It is hard, if not impossible, to reverse engineer the puzzle, because of the high complexity of the teamwork involved.

The team jigsaw includes a task *architecture* (the sketch or picture of the puzzle) and the *components* that compose the puzzle (the pieces).

In any teamwork, the components are the resources accessible to each team member. We will consider these resources as *items or pieces of knowledge* that each individual holds or can access. The task architecture, which I call *knowledge architecture*, is only partially known in advance. Each individual uses his or her knowledge together with the knowledge of others to shape the pieces, and in so doing discovers new knowledge, in this case, the altered color of some puzzle pieces.

Below is the sketch of the knowledge architecture of a printer, similar to the one being developed in HP's Project Alex:



To build a "team jigsaw" we need to be aware of the process, the nature of the pieces of knowledge involved, how to mobilize and meld them, and how to make it all happen. The word "meld"—which is derived from "weld" and "melt"—describes the dense intermingling of complementary items of knowledge that combine to solve reciprocal interdependencies.

Melding involves *thinking* together, blending articulated pieces of knowledge, as in a brainstorming session or in a conversation with a user over the latest release of a product design. But melding also entails *working and feeling* together *in context* to combine complex skills or aesthetic judgments. Melding also involves *learning* together when the interactions of different pieces of the knowledge puzzle are not understood at the outset.

If the parties working on the puzzle are clear about the interaction of pieces of knowledge, melding may be straightforward. In some cases, the pieces can be melded in a certain sequence, or they can be melded after coming together at one location. But if the pieces of knowledge interact, then *parallel melding* is needed for an optimal solution, as with the special jigsaw, when the shape or the color of a piece changes when it fits with other pieces.

For example, some pieces of market knowledge are required to design a printer to give it a certain look and feel. But other knowledge also is required: knowledge about plastics and engineering, as well as injection molds design, and manufacturing. The team needs to bring the relevant pieces of knowledge together simultaneously, or the need for frequent design changes will bring delays and cost overruns.

With different specialists owning different pieces of the jigsaw, the need for parallel melding gives rise to a process known as concurrent engineering, as well as the deployment multifunctional teams. These methods often reduce time-to-market for products, but their central advantage is that they effectively meld the knowledge of the parties involved.

Knowledge melding is not always necessary. For example, if a programmer somewhere is developing a new routine for Linux, that knowledge can be easily combined with the work of many other programmers and system analysts who have already worked on Linux. Little interaction is necessary, and most of the pieces of knowledge are simple enough to have been effectively codified in specialized languages or manuals. As long as programmers have access to this knowledge, they can add their own pieces to it. Later, another programmer may even download the program and use it to develop another application.

Melding knowledge and transferring knowledge are quite different processes. Melding pieces of knowledge does not require that all team members *share* all their knowledge with each other. Indeed, this is a great advantage of teams: A producer, a sound engineer, and a singer can produce a new record without each knowing what the others know. But they still have to be able to think, feel, and work together, which is not possible if they do not have a common view of music and a mutual understanding of who they are and what they are to achieve. Therefore, melding knowledge in a team does require that team members have certain shared knowledge. Such *mutual knowledge* is also required to facilitate team coordination and control. It is also a major element of dispersed collaboration (Cramton, 2001).

Having mutual knowledge is not the same as sharing all knowledge. In fact, what is most valuable about teamwork – and collective performance, in general – is the combination of individual knowledge that is *not* shared. If we all knew the same things, teamwork would be a waste of time. A pianist and a violinist can play great music *together* without each having to share with the other the knowledge of playing the specific instrument. They do, however, need to know what the other is capable of playing.

Maximizing knowledge sharing for joint work or collective performance is inefficient. But there is a minimum set of knowledge that needs to be *common knowledge*. In the case of the duo playing music, they need a common language (music scores) and a shared understanding of aesthetics. When the duo is playing Mozart, it is as if the three—the two musicians and the composer were a stark form of virtual team—one in which members are not just dispersed in physical space *but also* in time.

Team configurations

In the architecture of collective work, two parallel worlds are important. One is the physical world of space and time, or *location*. The other is the social world of community and history, or *context*. Location shapes our ability to communicate and work together; context shapes our individual stores of knowledge and our ability to think and feel together.

Different team configurations have different implications for accessing, maintaining, and melding knowledge. Location and context are keys to this process, and they can be understood as attributes that distinguish different kinds of teams. Members of a team share location when they are in the same space at the same time. They share context if they have similar histories of belonging to the same community.

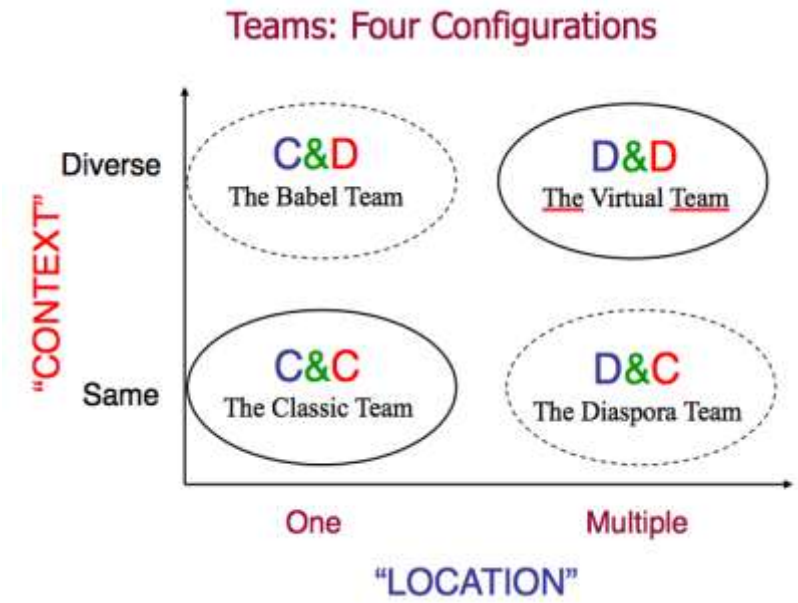
Context is not simply a theoretical consideration. We have empirical evidence that context matters in how a team functions. Virtual teams developed both Project Alex and the B2 Stealth Bomber. In the unsuccessful Project Alex, physical distance was compounded by the fact that the dispersed members were from different national contexts (United States and Singapore) with different national cultures and institutions. Furthermore, the two sites—the business unit in Vancouver and the manufacturing unit in Singapore—were distinct in organizational context and functional histories and had different operating cycles, internal politics, and external relationships. In the case of the B2, team members came from four separate corporate contexts, but these differences were mitigated by the fact that members shared nationality, industry experience, application, and professional experience.

A team of American computer engineers developing software can be deemed in the same context, but if they come from different companies (say, IBM and Red Hat) there is a level of contextual diversity. However, such a team is far less diverse than a team made up of American and Japanese executives, accountants, and lawyers from IBM and Toyota creating a framework for intellectual property rights across the two corporations.

Note that the diversity in question here is contextual, not individual. Individuals are different in personal attributes, and such differences are valuable for any team. Moreover, individual diversity is of the essence for classic teams. But individuals are also different in the sense that they represent or carry with them the context in which they have lived and learned.

For the purpose of this discussion of configurations, we assume that individual team members are located in their respective home contexts or have been in an alien context briefly enough that they still act as per their original backgrounds. When a team is dispersed, more than one member may be in the same location. The general case, therefore, is that a dispersed team is made of two or more sub-teams, each in a different location. In the extreme case, all sub-teams are one individual each.

In the team configurations proposed below, "location" and "context" are binary: one/many and same/diverse, respectively. We acknowledge that this is a simplification. For example, a team in one location could be a team in one room, in one lab, in one site, or in one cluster. However, if random encounters of team members are critical, the difference between one room and one site is huge (Allen, 1977).



The Classic Team

A classic team is composed of members who are *colocated*. Colocation is, of course, the sharing of a physical location, i.e., in the same place at the same time. When envisioning colocated individuals, it is usually assumed that they also share language, history, culture, institutions, and technology. I make such assumptions explicit: in a classic team the members

share the same context. Such common background makes them *confluent*. When the various members of the classic team look at something, they typically perceive the same thing.

When members of a team are colocated and confluent (C&C) they are not only in touch with one another, but also in synch. Under C&C, individuals are together in both the physical world and the socially constructed world. *Almost all of what we know about management applies only to C&C, and most of what we know and teach about teams applies only to classic teams.*

The garage is a preferred physical metaphor for C&C. Classic teamwork just happens: Members assemble pieces of a knowledge puzzle without being aware of the process—melding knowledge by thinking, working, and feeling together.

Under C&C, serendipity and trial-and-error determine which pieces of knowledge are used. When different pieces of interact, team members working together generate optimal melding. If the shape of a printer has to be curvy to please the taste of a market segment, the designer can just talk with the plastics engineers down the corridor, then call the nearby mold maker, who quickly comes to discuss alternatives that will minimize the cost and delay of completing the mold. Then the designer needs to ask the injection molder, who is a half hour's drive away, also to come see the new design. The knowledge of the market researcher, printer designer, plastic engineer, toolmaker, and injection plant manager all meld without their noticing, and a printer with an optimal, curvy shape will please consumers.

Pieces of knowledge can be harder to meld if they are tacit and context-specific. But by being colocated, individuals can share tacit knowledge by socializing. Through joint actions and interactions, individuals can meld tacit knowledge. It does not matter that knowledge is context specific if all members of a team share that context. This is why classic teams are so efficient relative to other configurations.

The Babel Team

In this configuration, team members are still colocated, but come from diverse contexts (C&D). When Ford began developing a car for the worldwide market, the company organized multifunctional and multinational teams at one site.
When people of different nationalities and different functions get together, they share few elements of context. Their diverse views of the world and different languages come between them, which is why we call these Babel teams.

Melding experiential knowledge is rather effective in a Babel team because of colocation. For example, the skills of a production engineer can be melded with a colleague in a team developing a prototype, barely necessitating verbal or written communication. However, most innovation activities involve knowledge that is contextual. It loses meaning when conveyed in an alien language to someone who does not have the same background. Knowledge that is necessary for innovation—such as R&D decision rules, escalation procedures, employee incentive systems, and market research information—are embedded in particular contexts. In other words, what is valid "here" is not valid "there." This kind of knowledge is inadequately processed by Babel Teams.

The head offices of many multinational companies are filled with multicultural teams.

Colocation combined with frequent and recurring misunderstandings tend to produce negative exchanges that eventually destroy teamwork. In these Babel teams, emotional conflict is inevitable and difficult to address. Talking about these misunderstandings usually doesn't help either. Other approaches, such as the use of visual aids and aesthetic activities may be more effective at solving these problems. (Glinow et al, 2004).

The diaspora team

The diaspora team is composed of members who are geographically dispersed but share background (D&C). They may have the same nationality or belong to the same community of practice inside a multinational firm. Such teams are virtually colocated: The absence of cultural and language barriers allows the effective use of technology—from simple phone calls to video conferencing. In diaspora teams, individuals are distant, yet near. Imagine a company with sites dispersed around the world but staffed with a cadre of individuals who share nationality, company experience, professional careers, and functional discipline. This is, by the way, a norm for Japanese multinationals. Team members "see" the world with the same eyes and mental models, speak the same language, and can easily match a distant problem with a solution.

A diaspora team can meld knowledge from various locations around the world. However, tacit knowledge in one location is not easily melded with tacit knowledge in another location. Although a Japanese manager in Europe can easily communicate with colleagues in Japan, explaining what it is like to drive on a German autobahn or in a crowded Italian city is more difficult. Knowledge embedded in a particular foreign context can be only partly accessed by the members of a diaspora team. The Japanese beauty products firm Shiseido tried for several years to grasp the fragrance business in France by locating Japanese managers there. But making perfume requires deep cultural understanding. It was only when Shiseido brought on a cadre of French managers and located them in France that it successfully entered the fragrance world.

The Virtual Team

The members of a virtual team are dispersed in various locations in different national contexts. They experience both dispersion and diversity (D&D). Under D&D, members are immersed in the context of their home base. The essential attribute of D&D is the multiplicity of contexts present inside the team: contrasting milieus and different cultures and origins.

D&D presents the harshest "team jigsaw" and the greatest challenge for knowledge melding. Relevant knowledge is scattered around the world. Sharing of tacit knowledge is inherently difficult, and sharing articulated knowledge also is problematic because of contextual diversity. Knowledge that is dispersed, tacit, and context-specific becomes intractable. But despite these drawbacks, D&D is the only configuration that allows for full access to knowledge from different locations around the world.

Virtual teams are slower than classic teams. It takes time to convert knowledge so that it can be shared or delivered long distances. Codification is a lengthy and costly process but a necessary one in virtual teamwork. Transcribing the design of a disk drive for a personal computer and specifying the components is technically feasible and the result would be a set of binders with blueprints and specification sheets. Any electronics engineer anywhere in the

world could derive the same meaning out of those binders. However, a hard disk drive has a short life cycle. Companies cannot afford the time required to codify knowledge in each design.

The emergence of simultaneous or concurrent engineering in product development shortens time-to-market, but it has an unintended side effect: Knowledge becomes immobile, placing distant suppliers at a competitive disadvantage with close-by suppliers—unless, of course, they develop the ability to manage virtual teams.

Virtual teams can bring a higher quality of life for team members, who can be effective while living with their families in their homes, instead of having to endure frequent relocations and constant travel.

In virtual teams, there are two sources of national diversity that should not be confused. One is the nation to which a team member belongs; the other is the nation in which the team member resides during teamwork. Both "passport" and "address" are significant but for different reasons.

National background has a definite impact on one's view of the world. If Jacques was born and raised in France, educated in a "Grande École," and experienced in sales in France, then his "French-ness" is a particular resource, a whole of knowledge, that Jacques *brings* to team – even if Jacques and the other team members are not aware of what that resource is. If Jacques' "French-ness" increases the contextual diversity of the team, as it will in a virtual team, such contribution is both positive—adding specific knowledge to the team—and negative, since it makes team integration more difficult.

But suppose that Jacques is stationed in China for the duration of the virtual team project. Jacques' "French-ness" is still there, but now he is in a different context that contains location-specific resources that may be valuable for the team. If that is the case, *both* sources of contextual diversity need to be considered. For members of a virtual team, address and passport are often the same—but not always. As we will see later, Jacques could be stationed in China by design to act as a "bridge" in a virtual team.

Classic Teams Versus Virtual Teams

The fundamental managerial choice concerning the architecture of teams can be viewed as a choice between the two configurations:

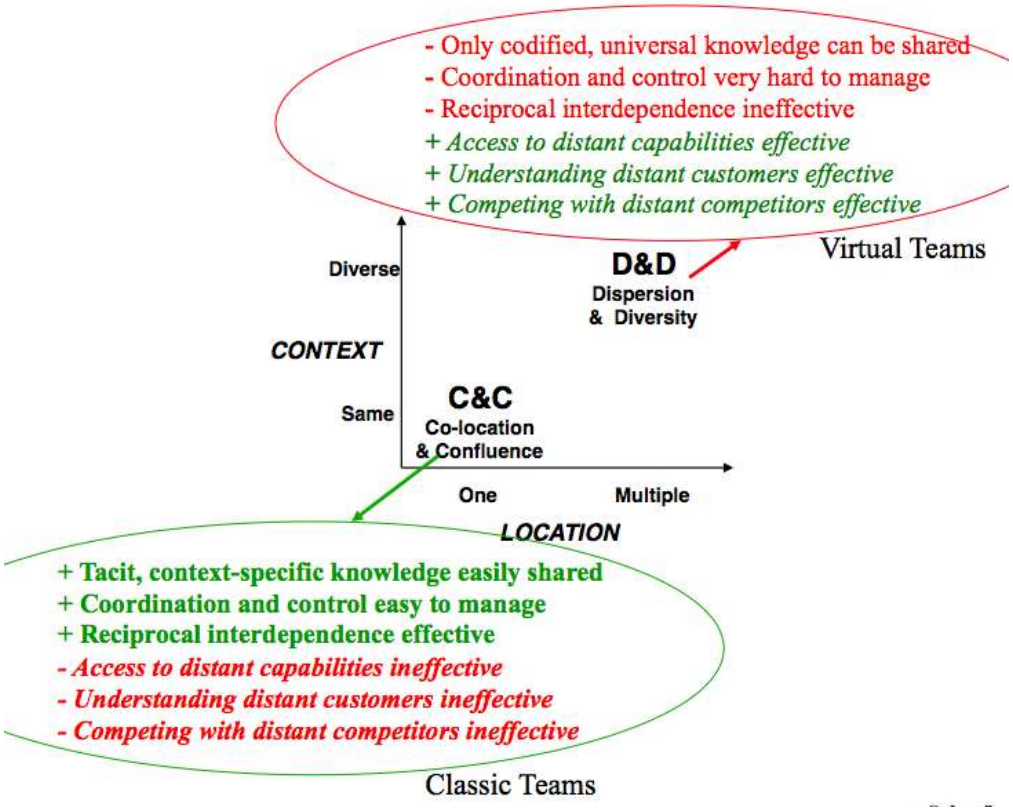
- A *classic team*, firmly situated in one location. The value of team output is directly related with the quality of the location–that is, the specific knowledge that exists in that location. Management of the classic team does not require great resources, and the cost of the running the team is small.

- A *virtual team*, involving a number of diverse locations around the world. The value of the team is its ability to access the knowledge in different locations. A virtual team requires important managerial resources, and the cost of running it can be quite high.

Of the four teams described earlier, two are optimal configurations: classic teams, which are

colocated and confluent (C&C), and virtual teams, which are dispersed and diverse (D&D). The Babel team, which is colocated and diverse (C&D), and the diaspora team, which is dispersed and confluent (D&C), are suboptimal modes, which may be useful as transitional phases when a company is trying to move from C&C to D&D.

The figure below highlights the shortcomings and advantages of classic and virtual teams.



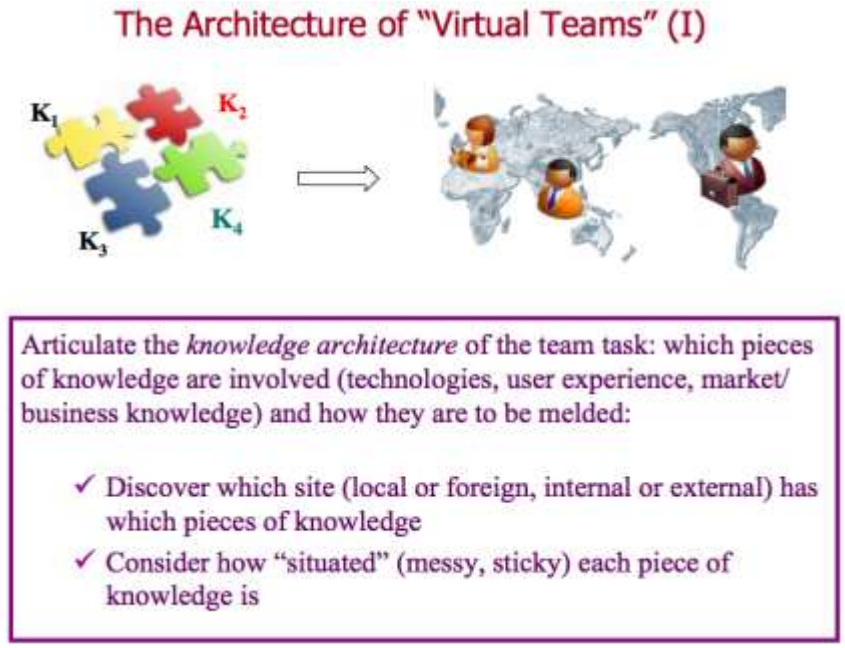
Another point to consider in weighing the merits of classic and virtual teams is how each configuration deals with politics inside an organization. Internal politics can be useful in resolving complicated problems involving multiple stakeholders. Politics is unlikely to thrive amid the D&D of a virtual team. Our evolution as social beings did not prepare us for influence-at-a-distance. But negative politicking—for example, going behind the back of a colleague—also will be less prevalent under D&D. As human beings, we tend to value more the limited resources that are physically proximate to us. Our ability to feel is seriously limited by distance. We are, as it were, "local beings."

C&C has been so natural for human beings since the cave of pre-historic times that we don't notice the remarkable attributes of this mode of collective work. On the other hand, *virtual teamwork is the most artificial mode of collaboration for human beings*. This is most obvious when the team task is non-routine and demanding, as in innovation. There is already sound evidence that the attributes of virtual teams that make them less natural hinder their performance of innovation (Gibson and Gibbs, 2006). The effective management of virtual teams calls for a conscious understanding of what we lose and what we gain when moving from C&C to D&D.

Designing Virtual Teams

Identify what location-specific resources are required

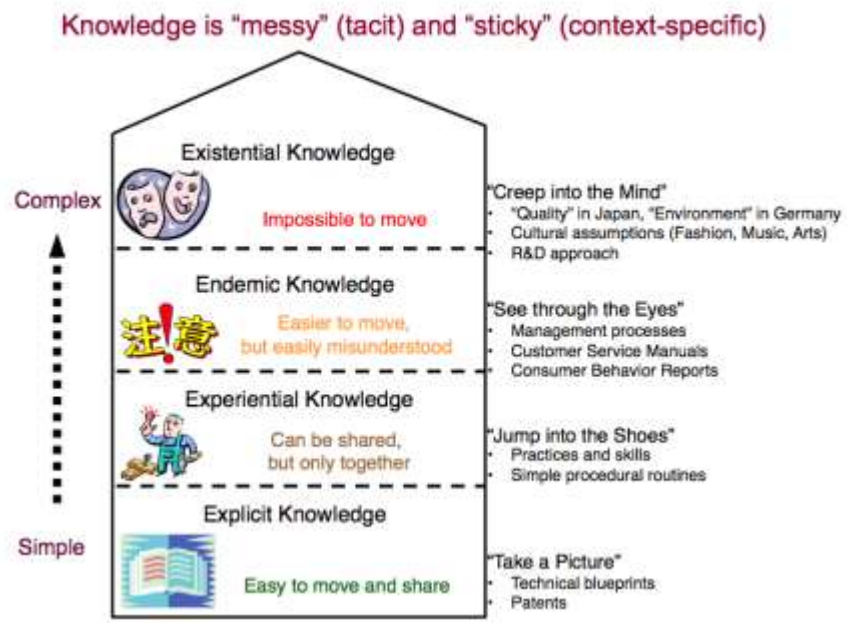
The first step in the design of a virtual team is to sketch a "picture" of the puzzle to discover what pieces are required and where they are. How hard it is to articulate the knowledge architecture of the task depends on what kind of task it is: Non-routine tasks, such as a breakthrough product innovation, will be the most difficult to sketch.



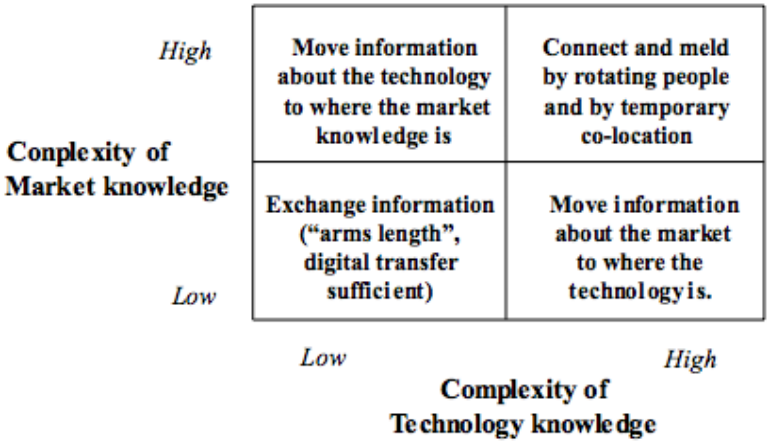
Under C&C, all knowledge is easily melded. Under D&D, only explicit knowledge (that is, codified and universal knowledge such as scientific knowledge and some engineering knowledge) can be easily shared and combined. This explains why virtual teams have functioned effectively in scientific research, R&D, and engineering.

The more tacit the knowledge, the more dispersion makes sharing and melding of such knowledge costly. And the more context-specific the knowledge, the more that the diversity in a virtual team makes it difficult to meld or share that knowledge. The more messy and sticky the knowledge, the more it will have to be melded by C&C sub-teams. What is required is a relatively new skill: *understanding the nature of knowledge involved in a team task.*

Explicit and endemic knowledge is IT-friendly and can be stored and moved using information systems. See the taxonomy below, presented in Doz and Santos (1997) and further developed in Doz et al (2001, chapter five). Experiential and existential pieces can't be stored or moved with IT. They require the relocation of individuals. Note, however, that the greater the complexity of knowledge, the greater its degradation when individual holder of that knowledge is placed in a new context. This is especially true for existential knowledge, which explains why virtual teams are relatively more successful in "the back" (R&D, supply chain) of a business than in "the front" (delivery, service).



Each member of a classic team brings specific knowledge or individual resources. The choice of individuals to be on a team depends on the knowledge requirements of the team's task. In a virtual team, what is particularly relevant is the location-specificity of the required knowledge. The exception to this rule is the case of experiential knowledge (e.g., specialist skills), which is member-specific but can be moved with the relocation of the individual. If such relocation is too costly or not feasible, the individual may remain at home, and his or her knowledge becomes location bound. Here is a framework (Santos et al., 2004) that may assist in location decisions and virtual teamwork.

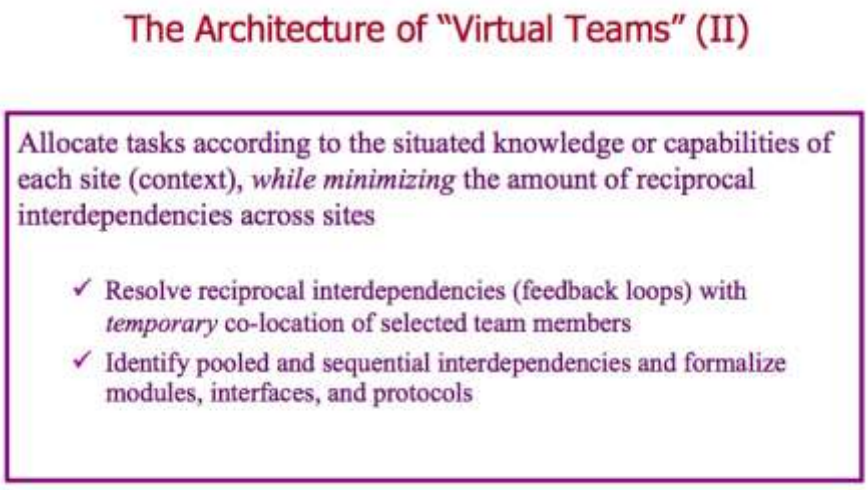


Allocate roles to each location

Under C&C, roles typically are allocated based on the competencies of members and their positions in the organization. The fact that this may create many reciprocal interdependencies

is not of great concern, since conflicts can be resolved in face-to-face meetings involving the whole team or sub-teams. In virtual teams, allocation of roles is more complicated, and barriers to effective coordination must be considered.

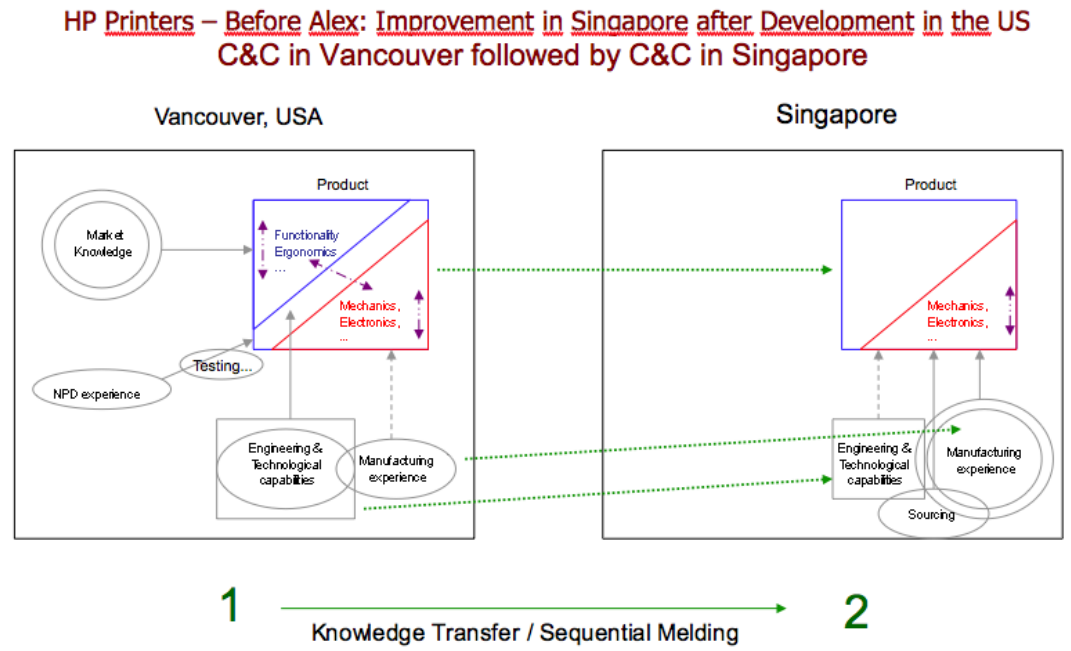
In allocating roles in a virtual team, the first step is to *identify the kinds of interdependencies that are involved in achieving the team goal.* Under D&D, the optimal plan still allocates roles to members best able to perform them. But there also must be some restriction on the number of reciprocal interdependencies created in the process. Determining that threshold is a major challenge for the management of a virtual team.

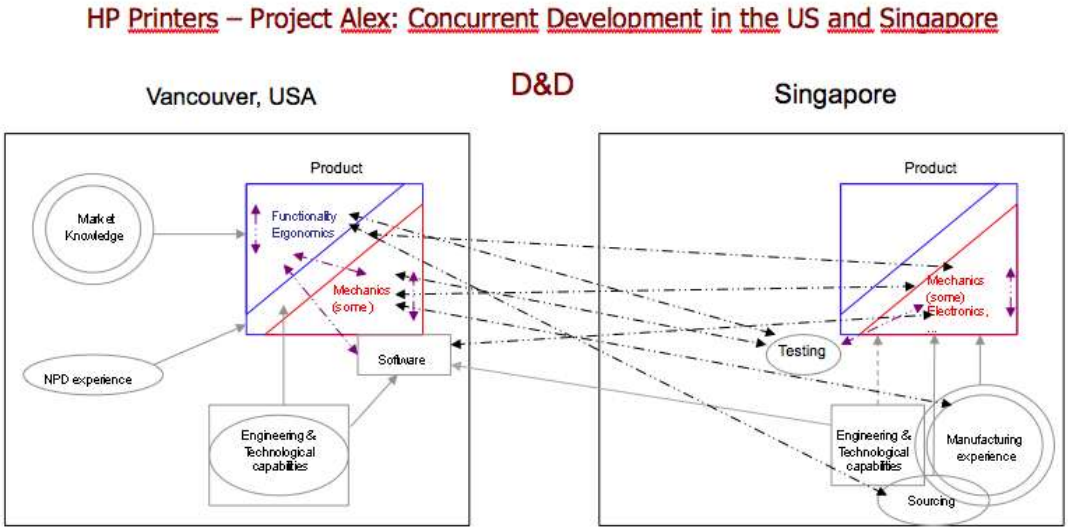


To illustrate the challenge of role allocation, consider the case of HP's Project Alex. The figure below compares Project Alex's team configuration and the configuration used at HP before Project Alex. In both instances, role allocation was based on location-specific competencies. Each site was given the tasks that it performed best.

This approach led to two very different outcomes for the two kinds of teams at HP. Before Alex, HP had two classic teams developing printers, one in Vancouver and the other in Singapore. The teams operated in sequence: The Vancouver team developed the printer and the Singapore team improved it. The company used several strategies to resolve reciprocal interdependencies: transferring data and tools from Vancouver to Singapore, temporarily relocating staff from Vancouver to Singapore, and arranging for Singapore staff to visit Vancouver.

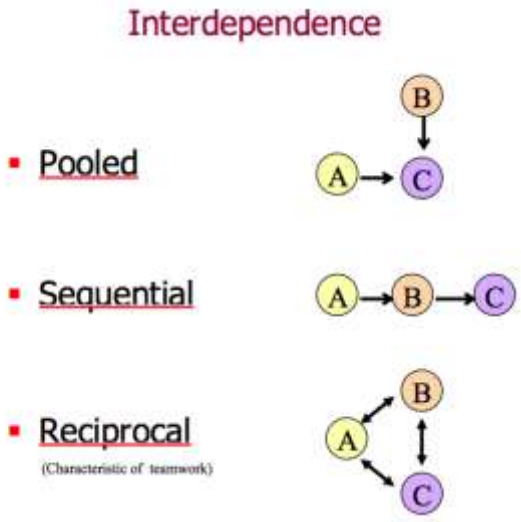
When the project manager used the competency-based role allocation for Project Alex, reciprocal interdependencies arose as they had with HP's classic printer development teams. But instead of being resolved as a matter of course, these interdependencies presented a major challenge. The project manager had no experience with D&D. The physical distance, different time zones, and the institutional and cultural differences brought successive delays and cost overruns. Alex was eventually dropped, a failure.





The task allocation based on location specific competencies produced many reciprocal interdependencies across sites!

To better understand the integration requirements of any type of teamwork, it is useful to review the forms of interdependence (Thompson, 1967) and the respective coordination and control modes. Every team encounters all three forms of interdependence depicted below, but it is reciprocal interdependence that characterizes teamwork.



Each form of interdependence is best addressed by a particular mode of coordination. For pooled interdependence, *centralization*, or the use of hierarchical authority is most effective. For sequential interdependence, *formalization* is the best approach. This includes the use of written scripts, templates, rules, or procedures to determine who does what, when. *Mutual adjustment* is the most advantageous strategy for resolving reciprocal interdependencies. This involves a parallel succession of minute, often unspoken negotiations among team members.

There are also three modes of control. *Supervision* is the use of authority to see if assignments are completed and to correct or prevent deviation. *Accountability* is the use of some code or formal method and metrics for checking and correcting. *Peer pressure* achieves the same results through the use of social norms.

As infants, we begin to learn how to work with others. Centralization and supervision we experience with parents. Mutual adjustment and peer pressure comes from siblings and friends. School teaches us accountability. In time, these skills seem so natural that we are not even aware we have them. However, not everyone is equally proficient in all of them. Furthermore, and most importantly, such modes of behavior are deeply cultural as they directly relate to *power*, *language*, and *social norms*.

The effectiveness of each mode of coordination and control depends upon a set of conditions. For example, in both classic and virtual teams, centralization will fail if the team leader does not know the skills of each team member. But knowing the skills of subordinates may be sufficient in a classic team and not in a virtual team. Team leaders need to understand the local context of each member, and in virtual teams, this is not easily achieved. For example, the leader might assign a task to a team member who has the skills to perform the task but is hindered by contextual circumstances that prevent access to an external resource. The team leader, operating from a different context, may misunderstand this circumstantial limitation and assign blame to the individual and not the local context. Lack of mutual knowledge increases the likelihood of false attribution in dispersed teams (Cramton, 2001).

Formalization is ineffective unless all involved fully grasp the language in use. This issue does not arise in scientific or engineering teamwork since mathematics serves as the language of coordination. But most activities call for natural languages, and even English exists in

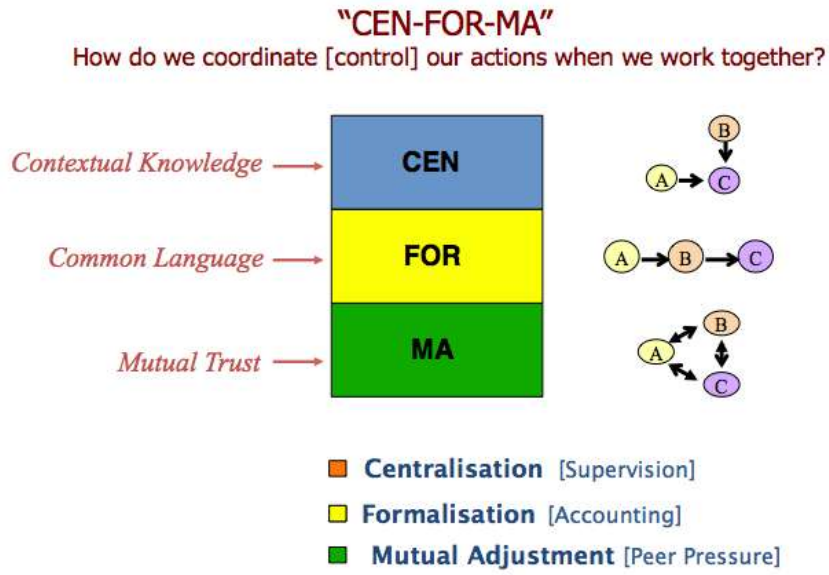
different local flavors. Many attempts to share best practices across borders fail because the written scripts used to transfer such practices are not universal and are easily misunderstood in different contexts.

Mutual adjustment and peer pressure are especially relevant in teamwork since they are offer ways to address reciprocal interdependencies. Our evolution and education prepared us well to apply these modes of coordination and control. For example, who goes first when two individuals arrive at the same time at a narrow gate? In most cases, cultural behavior determines what happens. Gender or age might resolve the matter, or if not, a simple exchange ("I'm late for my flight," answered with a nod) will do it.

But what happens when one manager is going out to visit a client and finds a colleague also leaving to see the same client? Should both go or only one? To resolve this matter, the two colleagues need shared contextual knowledge and a common language, verbal and nonverbal. They also need something larger—*mutual trust*. How could one person allow a colleague to visit a client without trust?

Trust among team members is crucial. Some suggest that trust is a societal attribute; others argue that it is instinctive, a part of our evolutionary legacy. In either case, we are not good at trusting those we don't know. A simple proposition then in assembling teams is whenever possible choose team members who know each other and understand each other's contexts.

Faced with a complex task, we need a mix of coordination and control modes. I've called such a mix "cen-for-ma"—Centralization-Formalization-Mutual Adjustment



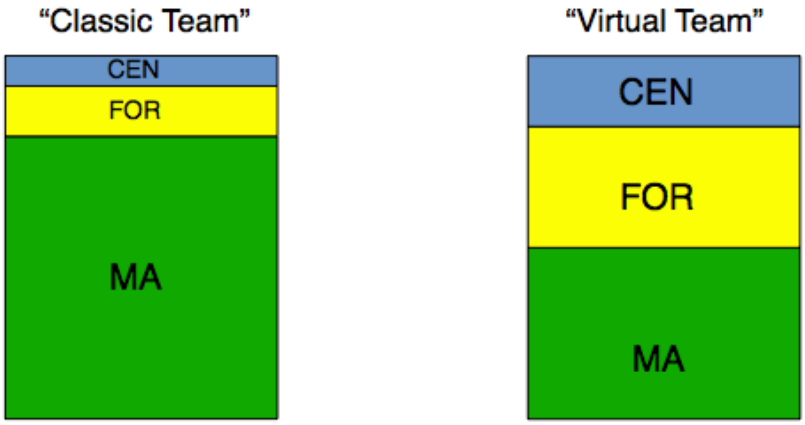
Classic teams function largely through mutual adjustment, with smaller contributions from centralization and formalization. Under C&C, all team members share contextual knowledge and language. Mutual trust develops naturally.

In a virtual team, however, all three conditions break down, and the cost of coordination skyrockets. Minimizing reciprocal interdependences is one way to limit such costs. Reciprocities can be replaced with sequences. Instead of a plan that says, "A and B work

together," a more effective plan might be, "A works, then B works on the output of A, then A works on the output of B." Similarly, a pooled approach can succeed: "A works, and B works, and then C works on the output of A and B."

Nevertheless, virtual teams will still need to draw on mutual adjustment and peer pressure, especially when the assigned task is non-routine or complex. In all configurations of teams, some level of mutual trust is mandatory, and it needs to be actively managed. For example, certain communication behaviors—exchanging social messages and expressing enthusiasm—have been associated with boosting initial trust in virtual teams, while predictable and uniform communication patterns have been found to maintain high levels of trust later on (Jarvenpaa and Leidner, 1999). Trust is a critical element of virtual organizations (Handy, 1995).

As a consequence, virtual teams require more centralization and formalization than classic teams. A virtual team needs a manager, not simply a motivator or facilitator, and it also needs the support of a well-crafted information system. *An effective virtual team will look more like a formal hierarchy than like an ideal classic team.*



In designing a virtual team, the identification of interdependencies in complex teamwork can be aided by techniques such as the "design structure matrix" (see, for example, www.dsmweb.org). Software also can be used to determine the sets of tasks with higher levels of reciprocal interdependence and also to guide the design of local sub-teams.

D&D as a set of C&Cs

A virtual team can and should be construed as a set of dispersed classic sub-teams. Minimizing the number of dispersed sites should also be considered: There is a tradeoff between the scope of differentiated, high-quality knowledge accessed with a larger footprint and the added costs of team integration and knowledge melding across sites.

Balance the virtual team

When choosing locations for a virtual team, balance is critical. Trouble will arise if a large sub-team is stationed near the organization's headquarters, while smaller sub-teams are banished to the periphery. Care also should be taken to avoid having individual members isolated in outlying sites.

A virtual team with one member per location may be ideal for routine tasks, such as global supply. The local team member also can serve as the liaison between team and the local office.

Some care is required to balance the relative power in any multicultural team. If one member holds a more powerful position in the hierarchy of the company, members of the team may tend to revere this individual, even though the person seeks to be treated as an equal. A similar dynamic can occur with pronounced age differences. Age reverence can prompt younger members to avoid contradicting an older member.

Design structural linkages and process linkages across locations

In assembling a virtual team, it also is wise to include a few team members with experience in multiple contexts—individuals with dual nationality or cross-functional experience. Each site involved in virtual teamwork should have least one cosmopolitan member to act as a bridge. It also is advisable to have some team members who are multilingual, eliminating the need for outside interpreters.

For example, semiconductor maker ST, which was formed by the merger of Italian and French firms, staffed its product development teams at sites around the world with a small number of Italian and French expatriates, while a few Americans and Singaporean were stationed in the company's sites in Italy and France. The company also encouraged members of teams to make short visits to distant company sites and to suppliers and customers. Such *process linkages* (Asakawa, 1996), as opposed to output linkages, are instrumental for both knowledge melding and team integration.

In large but relatively short projects, organizations would do well to consider the inclusion of a team member trained in anthropology to act as coach and expert on cross-cultural affairs.

On Language

Language is a sensitive issue for virtual teams. Different levels of fluency in one language have been found to hinder the performance of virtual teams (Beyene et al., 2009). Local sub-teams should be allowed to use local language in conversation but only the corporate language in written communications.

Even in teams with a common language, problems can arise. Words may have different meanings depending on where and how they are used. A metaphor might seem a convenient way to express a new insight or experience, but metaphors tend to be rooted in cultural settings, and their meaning is unclear to individuals outside the culture. In virtual teamwork, metaphorical language should be avoided.

The choice of team language can evoke strong feelings. A language is a symbol of a nation. To defuse national tensions, the first CEO of Airbus, which began as a consortium of European aerospace manufacturers, instituted a set of simple rules, including a requirement that in meetings, all parties would use the official jargon of flying, or "aeronautical English" – the standard for air-traffic control.

A "corporate glossary" is a partial solution to the predicament posed by language differences. With a corporate glossary, companies must invest in creating their own meaning for certain words, especially those that can be misunderstood. A glossary should include examples and stories illustrating definitions.

Managing Virtual Teams

Socialization before dispersed teamwork

Before a team is launched, many companies bring participants together for a social event. These occasions are especially important for virtual teams. Properly planned, social events can address matters that are at the heart of virtual teamwork.

Socialization initiatives should make team members aware of the various contexts in which the team operates, including national and local differences, as well as differences among units within the corporation. A session on cultural awareness for all team members is mandatory and should be complemented with individual coaching as needed. The point of these efforts is not to diminish differences among team members but to make members aware of the differences.

Below is an illustration of the contextual differences HP faced when it attempted to develop a new printer using a virtual team with members in Vancouver and Singapore.

Make *contextual diversity* visible

Articulate the contextual differences between the various sites in the virtual team. Make team members aware of such differences. Discuss the implications for team design and teamwork.

Context	HP Vancouver	HP Singapore
National Culture	Low Power Distance	High Power Distance
	Individualistic	Collectivist
	"Plain-dealing"	"Saving Face"
Education / Learning Style	Articulate	Listen
	Persuade	Demonstrate
	Value inspiration	Pursuit of detail
Teamwork	Individual decision making	Consensus decision making
	Clear task boundaries	Fuzzy task boundaries
Functional	R&D, Marketing	Manufacturing
Within HP	In the home-base of HP; strategic; global mandate for selected printers	Periphery; seeking recognition, legitimacy, and a "higher" position within HP globally

Other steps companies can take to improve understanding on virtual teams:

- Increase mutual knowledge among team members by creating a "yellow-pages" web tool on each of the sites with information about individual members.

- Make team members aware of the dangers of false attribution. Research has found that when something goes wrong, people who are colocated tend blame the context (as in "Joe is late to the meeting because of the traffic"), but people who are separated by distance tend to blame the individual ("Nakamichi-san is late to the call because he doesn't care for the team"). Attribution errors can easily destroy precious mutual trust.

- Identify time and deadlines as critical. Determine convenient hours for conference calls, and schedule off-office hours calls evenly across the organization. Time is of the essence in virtual teams – and this poses a particular challenge for individuals from polychronic cultures. There may be one time only, but there are many views of time – a matter that must be unambiguously addressed in virtual teams (Saunders et al, 2004).

- Make all team members aware of the need for a *common virtual ground* that must be both monochromic and low-context, i.e., "8:30 a.m. means 8:30 a.m." and "what you say is what you mean and what you mean is what you say." This is easier said than done.

Make team members experience the various locations/contexts involved

Encourage and budget for extensive visits across sites by team members who have been designated as bridges. Rotate face-to-face meetings among the various locations and make

sure that time always is available for visits. Visiting team members also should have the opportunity to meet local suppliers and customers and to attend local cultural events.

These exchanges will help team members see location-specific sources of knowledge, experience contextual diversity, and increase their ability to understand knowledge from a foreign context. Local contact also is a very human mode of control and a source of credibility and trust. Such visits carry a powerful symbolic meaning for those hosting the visitor. Locals feel included, and in many cultures, the anticipation of a visit by distant colleagues is a source of excitement and energy.

Enable random encounters at a distance

Random encounters have been found to be highly important in R&D and other problem solving, and colocation is a necessary condition for random encounters (Allen, 1977). This is one of the most serious limitations of virtual teams: random encounters don't happen across distance.

To foster random-like encounters in virtual teams, imagination is required. One simple way is to always schedule free time in conference calls and videoconferences. What is this free time for? To talk about anything that has nothing to do with the teamwork: perhaps odd things happening in your location or a problem or opportunity you encountered recently. When face-to-face meetings are held, make sure to schedule time for conversations with colleagues and partners who are not part of the team. Schedule meetings between team members you know would not meet otherwise.

In due course, we may have video walls in office corridors and elevators that will enable us to randomly meet colleagues and visitors in dispersed offices – time differences permitting.

Managing intra-team communications

Communication can take many forms. With so many different types of knowledge involved in virtual teamwork, an array of media is recommended for communication.

For explicit knowledge, lower bandwidth, such as email and Web content, is usually sufficient. For more contextual conversations, higher bandwidth—a conference call or video chat—is more effective. For complicated matters, a face-to-face meeting on-site—not in an airport or hotel—is needed. Rotating the location of face-to-face meetings is highly recommended.

Different integration modes call for different communication media, too. Matters involving normalization and accountability call for lower bandwidth communication, such as email. Centralization requires a higher bandwidth, perhaps a phone call, provided the team leader has sufficient knowledge of the foreign context. Mutual adjustment and peer pressure usually call for face-to-face communication, although when team members know each other well, such matters can be handled with a series of one-on-one calls or a conference call.

Other rules for intra-team communications include:

- Mix communication media (face-to-face, video, phone, email, and so on) and synchronous (say, conference calls or chats) with asynchronous communications (such as email or postings on a project website);
- Avoid or address uneven access to communication technology. If one site does not have broadband access, then use of video should be limited.
- Avoid uneven distribution of information. For example, if a report is distributed before a call, make sure all members received it and read it.
- Avoid delays between action and reactions across locations. An automatic email response telling team members you are not available is not very useful—they should know that in advance, and if they are trying to get in touch, it must be important.
- Make team members aware of the *meaning of silence* or non-response. Silence has even more cultural meaning than discourse. Not replying immediately may mean many different things: yes or no, respect or indifference.

Simple things can have a big impact. If three or four members of a virtual team are together at company headquarters and other members are isolated in their offices on other continents, the members who are colocated often will become engaged and energetic, while the more distant colleagues tune out. A simple solution is to send the members at headquarters back to their individual offices.

Research has found that effective virtual teams alternate between intense moments of face-to-face communication and periods of remote communication (Maznevski and Chudoba, 2000). To ensure regular interchanges among members an *orderly, pre-established pattern of communication across sites* should be the rule. An effective pattern might be daily emails, a weekly 60-minute conference call at a set day and time, a monthly three-hour progress review call with a set agenda and a set day and time, and a face-to-face meeting every six months, for two days at a set date and predetermined location, and phone calls as needed for urgent matters.

Small virtual top management teams tend to use repeated phone calls daily or more than once a day. These are short calls with no agenda, similar to the exchanges of colleagues in the same office at their desks. The calls are used to share information about anything and everything about the company, to discuss a doubt or ambiguity, to test an opinion, and, of course, to discuss the personal things that nurture mutual trust. There is nothing like a call or a face-to-face meeting with a trusted colleague to tackle important matters. It may also be that the daily calls are imperfect equivalents of "Daily Scrum" meetings, in which team members in an office take fifteen minutes every day at the same time to share what they did since the last meeting, what they intend to do next, and what impediments they face. This practice has been noted to improve performance in globally distributed teams producing software (Sutherland et al., 2007).

On virtual teamwork as a process

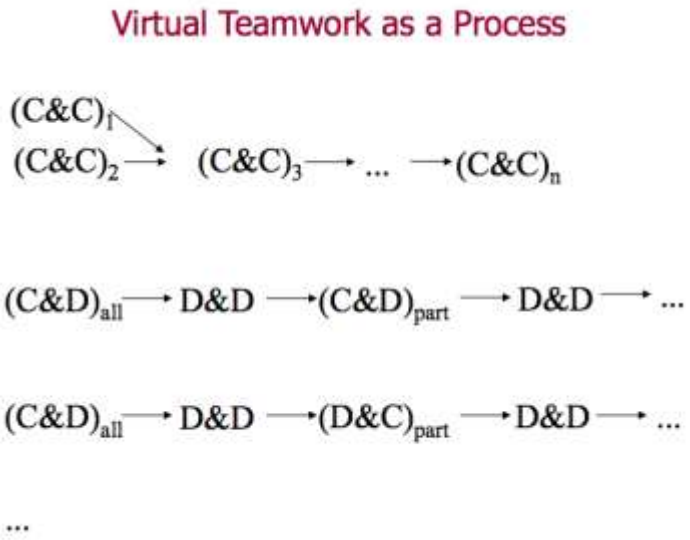
All teamwork is a process. Many models exist for the classic teamwork process, such as the popular "forming, storming, norming, and performing." Applying this process for virtual teamwork is unlikely to succeed.

Virtual teamwork requires a team design, coordination and control, a means to produce and

deliver location-specific contributions, and knowledge melding.

For a virtual team performing routine tasks, the most effective process may be a sequence of C&C teamwork by each of the locations involved. For non-routine work it may involve a sequence of teamwork in different configurations, including C&C, C&D, D&D, and C&D.

For example, the first phase for a virtual team could be a face-to-face meeting, followed by dispersed work, then a new face-to-face meeting, and so on. The choice of process or how to put together the "team jigsaw" will depend on the nature of the task and the team's knowledge architecture.



A general proposition is that *virtual teamwork requires a process in which work under D&D is punctuated by short periods of work under C&D* by selected team members. Or, put differently, virtual teamwork involves partial, periodic, and short-lived Babel teams. Such periods of colocation should be devoted to specific assignments: sketching the knowledge architecture of the team task, establishing location-specific contributions, coordinating and controlling knowledge melding, and planning task delivery.

An example of such process for new product development could be:

1. C&D *(selected members, short, intense, and if possible with executive sponsor)*: First spec of the new product; sketch task or knowledge architecture; allocation of tasks to each site.
2. D&D: First design.
3. C&D *(selected members, short)*: Validate design; define modules and interfaces; review site allocation.
4. D&D: Development and prototyping (of the different modules).
5. C&D *(selected members, short)*: Test; final product design approved for release; plan delivery to sponsor.
6. D&D: Prepare release.
7. C&D: Delivery to sponsor.

In Phase 4 in the example above, each location sub-team would work autonomously (under C&C) to produce location-specific modules. Phase 7 would also include the articulation of lessons learned and would end with a celebration of virtual team performance.

The work of a virtual top management team is similar. ST Microelectronics' top management team worked physically together every quarter for two days. The first day had a set agenda and was quite formal, with a performance review and planning meeting. Lower level managers sometimes were invited to participate briefly. The second day was informal, with no agenda, no minutes, and no outsiders. It was a time for a vibrant exchange about what was working and what was not. Members brainstormed. They held open discussions on very sensitive ma7tters, including their own performances.

It is important to note that *the individuals and sub-teams that compose the virtual team must always interact with each other across locations in a heedful manner* for the virtual team to be effective (extending from an insight by Weick and Roberts, 1993).

Enhancing Virtual Teams With "Magnets"

Assembling a team jigsaw is a complex assignment. For a virtual team to perform effectively it needs a guiding list of the pieces of knowledge that are required and an understanding of how they fit together. A proxy for a knowledge architecture of this kind can serve as a *magnet* that brings together dispersed knowledge. The notion of magnet was developed in the process model of metanational innovation (Doz, Santos and Williamson, 2001) but it is applicable to all instances of virtual teamwork.

The multinational semiconductor and software company ARM used a novel standard design for RISC chips as the "magnet" that attracted knowledge dispersed between semiconductor manufacturers, chip users, and software developers scattered around the world. ST Microelectronics turned a car navigation concept into a proxy for a knowledge architecture that was a magnet for knowledge dispersed in ST's own units and in the operations of its customers.

The dispersed teams of ARM and ST above could not have functioned without the initial sketch of the jigsaw puzzle, which became the magnet for each location's capabilities. For routine teams, the magnet will often be a description of the process involved. With an understanding of the knowledge that is required, the places where this knowledge might exist can be identified, and the task of assembling the puzzle can begin.

And finally…

Virtual teamwork is the most artificial kind of joint work. It requires the conscious management behaviors that happen naturally in classic teamwork.

Virtual teams are a new form of organizing. Any new kind of organization is prone to the *liability of newness* (Stinchcombe, 1965). Overcoming this liability requires new roles and tasks to be created and learned. We need to get used to interacting with strangers, and we must compensate for the missing stable links we once had with co-workers and customers.

We can expect the cost and difficulty of dispersed teamwork to decrease. There are four main reasons for this:

- Improvements in information technology, communications, and transportation. Technological advances are lowering dramatically the cost of transferring knowledge, while progress in transport reduces the cost of the moving people who are involved in the transfer of tacit and location-bound knowledge. More efficient communication also reduces coordination and control costs.

- A growing supply of cosmopolitan entrepreneurs and managers. As multinational companies expand their use of

- expatriated employees, there will be more managers who are accustomed to diverse local contexts. Supporting this trend is the rapid expansion of foreign MBA programs and executive education, the growing number of foreign PhD students at world-class universities and international postings for R&D scientists, engineers, and marketing professionals. International outsourcing, strategic alliances, and joint ventures all will increase the supply of metanational startups, hatched by cosmopolitan entrepreneurs.

- Experience of companies with virtual teams. As companies deploy knowledge-intensive multi-location operations, these operations will become more efficient. Companies will develop or imitate new structures and processes, as well as new performance metrics and incentives.

- Diffusion of metanational success. As the number of metanational companies grows, other companies will observe and absorb the lessons of these success stories. A different mindset and style of management will become prominent. This will reduce the myopia of national entrepreneurs and top management teams and should dramatically reduce the cost of dispersed teamwork.

Virtual teams will succeed and grow, but the road will be rocky. We must remember that *humans are local beings*. We thrive on what is happening around us, not far away. Our senses and emotions, our instincts and intuition have evolved over generations to be effective when sensing and interpreting the nearby world, here and now. We can partly grasp and think about the world far beyond our milieu, but that's about it. For members of a virtual team, their local context will always matter more than some abstract global context, let alone a distant and alien local context. This is just because they are human.

References

Allen T. (1977). Allen, T. J. (1977). *Managing the Flow of Technology: Technology Transfer and the Dissemination of Technological Information within the R&D Organization*. MIT Press, Cambridge, MA.

Alchian A., Demsetz H. (1972) "Production, information costs, and economic organization". *The American Economic Review*, 62 (5): 777-795.

Argyres N. (1999). "The Impact of Information Technology on Coordination: Evidence from the B-2 "Stealth" Bomber". *Organization Science*, 10 (2): 162-180.

Asakawa, K. (1996). *The Multinational Tension in R&D Internationalization: Strategic Linkage Mechanisms of Distant Contextual Knowledge in Japanese Multinational Companies*. Unpublished PhD Thesis. INSEAD, Fontainebleau.

Beyene T., Hinds P., Cramton, C. (2009). "Walking Through Jelly: Language Proficiency, Emotions, and Disrupted Collaboration in Global Work". *Harvard Business School Working Paper*, No. 09-138. HBS, Boston.

Cannella Jr. A., Park J-H., Lee H-U. (2008). "Top management background diversity and firm performance: Examining the roles of team member collocation and environmental uncertainty". *Academy of Management Journal*, 51 (4): 768–784.

Caya O., Mortensen M., Pinsonneault A. (2009). "Understanding Virtual Team Performance: A Synthesis of Research on the Effects of Team Design, Processes, and States". *MIT Sloan School Working Paper* 4738-09 5/12/2009. MIT Sloan, Cambridge, MA.

Cramton, C. D. 2001. "The mutual knowledge problem and its consequences for dispersed collaboration". *Organization Science*, 12: 346–371.

Doz Y., Santos J. (1997) "On the Management of Knowledge: From the Transparency of Collocation and Co-setting to the Quandary of Dispersion and Differentiation". INSEAD Working Paper N° 97/119/SM, INSEAD, Fontainebleau.

Doz Y., Santos J., Williamson, P. (2001). *From Global to Metanational: How Companies win in the Knowledge Economy*. Harvard Business School Press, Boston.

Gibson C., Gibbs J. (2006). "Unpacking the Concept of Virtuality: The Effects of Geographic Dispersion, Electronic Dependence, Dynamic Structure, and National Diversity on Team Innovation". *Administrative Science Quarterly*, 51: 451–495.

Glinow M., Shapiro D., Brett A. (2004). "Cab we talk, and should we? Managing emotional conflict in multicultural teams". *Academy of Management Review*, 29 (4): 578–592.

Handy C. (1995). "Trust and the virtual organization". *Harvard Business Review*, May-June: 40-50.

Jarvenpaa S., Leidner D. (1999). "Communication and Trust in Global Virtual Teams". *Organization Science*, 10 (6): 791–815.

Leonard D. (1993). “Hewlett Packard: Singapore”. HBS case study. HBS, Boston.

Martins L., Gilson L., Maynard M. (2004). “Virtual Teams: What Do We Know and Where Do We Go From Here?”. *Journal of Management,* 30(6) 805–835.

Maznevski M., Chudoba K. (2000). “Bridging Space Over Time: Global Virtual Team Dynamics and Effectiveness”. Organization Science, 11 (5): 473–492.

Santos J., Doz Y., Williamson P. (2004). “Is Your Innovation Process Global?”. *MITSloan Management Review*, 45 (4): 31-37.

Saunders C., Slyke C., Vogel D. (2004). “My time or yours? Managing time visions in global virtual teams”. *Academy of Management Executive*, 18 (1): 19-31.

Stinchcombe A. (1965). “Social Structure and Organizations”. In: J. G. March (Ed.), *Handbook of Organizations* (pp. 142–193). Rand McNally, Chicago.

Sutherland J., Viktorov A., Blount J, Puntikov N. (2007). “Distributed Scrum: Agile Project Management with Outsourced Development Teams”. *Proceedings of the 40th Hawaii International Conference on System Sciences*.

Thompson, (1967). *Organizations in action: Social Science Bases of Administrative Theory*. McGraw Hill, New York.

Weick, K. E. and K. H. Roberts (1993). “Collective Minds in Organizations: Heedful Interrelating on Flight Decks”. *Administrative Science Quarterly*, 38: 357-381.

Europe Campus
Boulevard de Constance
77305 Fontainebleau Cedex, France
Tel: +33 (0)1 60 72 40 00
Fax: +33 (0)1 60 74 55 00/01

Asia Campus
1 Ayer Rajah Avenue, Singapore 138676
Tel: +65 67 99 53 88
Fax: +65 67 99 53 99

Abu Dhabi Campus
Muroor Road - Street No 4
P.O. Box 48049
Abu Dhabi, United Arab Emirates
Tel: +971 2 651 5200
Fax: +971 2 443 9461

www.insead.edu

INSEAD

The Business School
for the World®

Printed by INSEAD