On Artifacts as Default

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The word 'default' is used in two different contexts. On one hand, it often implies a failure. The word has its root in old French word, faillir, which means failure. According to American Heritage Dictionary, default means a failure to make a payment, to show up at the court, or to participate in a contest. All of these usages of the word connote negative consequences. On the other hand, in computer science, default means an initial setting of variables that remains in effect unless canceled or overridden by the user. "Default" settings are often used in order to help users to create simple and standardized usage pattern without knowing the technical details. In this context, the word is often used with positive connotations. As computers become ubiquitous in the society, this particular meaning of default is often used in non-computer contexts as well. In fact, I first learned the word default in this context before I learned its original meaning.

While it is striking to note how the same word can be used in different contexts, the quality of the word that underpins its various usages is the absence of reflexivity. In this article, I would like to explore the connections between default and the creation and use of artifacts in distributed knowledge work.

Artifacts and Distributed Knowledge Work

As shown by the work by Star and Griesemer (1989) and Carlile (2002) artifacts such as repositories, drawings, and models are often used as boundary objects between different communities. These boundary objects enable perspective taking (Boland and Tenkasi 1995, Karsten et al. 2001) between communities of practice. According to Star and Griesemer (1989), boundary objects are "both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (p. 393). Plasticity, or malleability, is particularly important if knowledge needs to be created through the interactions between different communities of practice (Henderson, 1991).

Often the malleability of boundary objects was not taken as problematic. It is assumed that individuals are able to "interpret" boundary objectives in taking others' perspectives into account, while making their own. However, it is the reflexivity of individuals that makes the boundary objects to be malleable, which in turn enables transformation knowledge. Carlile (2002) observed that boundary objects could be used for syntax, semantic, or pragmatic. It is pragmatic aspect of boundary objects that enable the knowledge transformation, a generative process of new knowledge creation through the combination of perspective taking and perspective making. Distributed knowledge creation is a result of dialectic cycle between perspective making and perspective taking. Thus, it needs to be said that malleability of an artifact is not an inherent characteristic of the artifact, but rather enacted by reflexive agents. Thus, when agents fail to exercise their reflexivity upon the receipt of artifacts, that artifacts fail to serve as an effective boundary object, interfering the dialectic cycle of generative knowledge creation processes among a network of communities of knowledge.

Two stories

Complex System

In summer of 2001, National Research Laboratory, along with other several federal agencies, private companies, and universities, was designing Complex System, which would be a part of the next generation aviation industry standard. A larger goal of Complex System was to dramatically increase the aviation safety by providing integrated information from various different sources. A core of Complex System consisted of at least six large subsystems all developed by separate groups of engineers. None of these six subsystems have been built before, not to mention the overall system itself. While the overall goal and the system architecture of the system were somewhat clearly defined, the exact nature of the system itself at a low level detail was in flux because its components and subsystems were still in their design stages.

At the time of my observation, the project was somewhat behind the schedule for its major milestone—a live system test with the first prototype. Up until that point, each engineering group, all part of different organizations, was designing its own subsystems separately. While the system architecture allowed them to have continued to design subsystems using minimum number of parameters that would glue different subsystems together, engineers had to leave many options "open" due to the uncertainty of how to exactly put these subsystems together. However, leaving many options open hindered the progression of the project since these subsystems were interrelated and all subsystems were still in flux. Thus, no subsystem engineering teams could "fix" their parameters.

A key subsystem that would communicate with several other subsystems was Land Radio. A particularly important issue that had to be decided was how often Land Radio would update data to ground stations. In one meeting that I attended, a concern was raised by the project leader that not enough progress had been made for the project. Mike, the only person with a PhD in the project team, and with irrefutable reputation for his technical competency among the team members, pointed out that everyone had been waiting for everyone else to "specify". He further suggested that the team should determine the full specification of Land Radio so that other subsystems could also be finalized. Technically, Land Radio was capable of updating as frequently as twice in every five seconds. On the other hand, other subsystems that were supposed feed information to Land Radio could provide information only once every 2-3 minutes. At the same time, the optimum update frequency rate was also influenced by the size of the data that will be transmitted. However, the data update frequency had not be finalized due to the flux nature of the design of the device that collect the raw data. Due to this technical complexity, everyone in the meeting had different ideas about how often the data needed to be updated from Land Radio. After about an hour-long passionate debate about the frequency of data update from Land Radio, Mike stood up and said "Ok, I will specify it in two days."

In two days, Mike came back with a full specification of Land Radio in which he set the update frequency as every 30 seconds. Without any discussion at all, the specification was accepted by all members. Astounded by the lack of further discussion about the specification given the spirited debate just two days earlier, after the meeting I asked Mike how he made the decision. He said "it was an engineering decision" by which he meant an arbitrary decision. When I asked other members why they did not express their differing opinions in the second meeting, several of them said, "it's been already specified." Mike later told me that his decision would be even harder to alter once the prototype was built and successfully tested. Then, his "engineering" decision would be embedded into an institutionalized standard which he expected to live "for a long time".

Here, an artifact (an engineering document) became a powerful default condition for the second meeting. Combined with Mike's position, the document created by Mike gained an unassailable status within the community and became the dominant default setting for the minds of other engineers whose social and intellectual statures were not as powerful as Mike's. The emergence of the artifact as such a powerful default condition stopped the dialectic cycle of perspective making and perspective taking in the minds of these engineers.

The Use of Catia at Peter B. Lewis Building

Frank Gehry and his firm, Gehry Partners, extensively use Catia, a three-dimensional modeling tool, in order to design the buildings and manage the projects. In their practice, 3-dimensional models created and stored in Catia are important artifacts that serve as a boundary objects with contractors and sub-contractors. An important aspect of their design and construction process is not only the fluidity of the shape of the building, but also the fluidity of the process itself. There is relentless pursuit of perfection in the design and construction. Due to the unique nature of the building, the detail construction processes have to be negotiated and created as the process proceeds. One of the subcontractor commented:

"Because the format in which these documents was put together on this job did not complete the design, we found ourselves completing the design. So being that this was a magnified case of that, now we're paying more attention to the design of the other jobs to see where the architect left off so that we can address design issues early on, because a big problem here was the incomplete design. The shape was there, we always knew the shape, but we didn't know how we were going to create it because the documents didn't fulfill all, they didn't cover all the problems. And that's what they ran into in the field, was that they had this set of documents that they typically would use and it would tell them everything where they didn't have it. And so even the carpenters in the field became part of the design, because they had to figure out ways to do things…Actually, they had to help complete some of the design as far as structural elements." (Ed Seller, November 11, 2002, p.13)

Yet, Catia also provided more predictability in the construction process and the core essential of the design was not compromised in this process. The project architect for Peter B. Lewis Building project commented on his experience:

"…Catia makes the whole process and the whole method to build it somewhat predictable. And that's what all our processes are looking for. We give prices before we build… if you need to predict, if you need to give somebody, say, here is what you need to do. Give me a guaranteed price that you will not exceed. You cannot do this (with 2D). Because it is too complicated to document on paper. Without Catia it would have not been possible to do it (the Lewis Building)." (Gerhard Mayer, September 20, 2002, p.8)

In this example, Catia provided an extreme degree of precision translations in perspective taking across the boundaries of several communities, while providing enough plasticity for perspective making. One of the project architects who worked on Peter B. Lewis building made the following comment:

"I think the construction industry lags way behind those industries and I really think it needs to catch up and everyone needs to become vital. And because it is like everyone's neutral. It's kind of like the default situations where you do get the drawing. You get the drawings, the subcontractors gets it and everything is automatic. Again, you can't be automatic with the drawings and in this case with Catia that now people really change and readdress the way they work. 'Cause people don't know what they are going to get at the end of the day. People don't know where it is going to take you. But you can pretty much guarantee that it is going be really incredible…and a huge group of people are going to come togher and really pull off something that you couldn't have done otherwise, and it really changes everyone's perspective. I think what's really interesting here on these projects is the teamwork. They can't be done by one person. It's not just Frank, it is not just Frank's office, it is the team…" (Matt Fineout, December 12, 2002, p. 39)

He further commented the role of Catia in supporting this teamwork:

"You have set up, you set these pieces up but you can come back now and tweak them because you have the foundational pieces set and the things that's interesting is that people understand the game [with Catia]. So they can understand how to move within that game, so then you can come into the atrium and say, 'well, no, we need to bring these studs out or we need to push them back in' or whatever because people really begin to understand what's happening." (Matt Fineout, December 12, 2002, p. 37)

Here, artifacts (Catia models along with others) were used as boundary objects. However, in this case they did not create default conditions for designers and contractors. In fact, these artifacts were used to keep the design "open" until the last dry wall was hung. Catia enabled generative knowledge transformation across the boundaries of different communities that propelled the creation of new knowledge. The new knowledge cannot be seen by any one community in its entirety. It can be only seen through the actions taken by agents in different communities. This distributed complex knowledge is not created by a single omnipotent creator and given to these participants. Rather, it emerges through dialectic generative cycle of perspective making and perspective taking across many different communities.

Managing by Default?

What is the difference between the two stories? In both cases, artifacts were used in the creation of distributed knowledge. While the artifact created a default condition in Complex System case, it helped destroying default in Frank Gehry's work. On the surface, it looks as if it is technology artifacts that created or destroyed default. However, in reality, it was the relentless pursuit of new ideas by individual actors that made the difference. Then, one needs to ask why such a difference?

I can only speculate that it has to do with power. It is the power of individuals and the power of institutions that give the perception of insurmountable authority to artifacts, which then become default. In the case Complex System, Mike was the only one who had a doctoral degree. At National Research Laboratory, researchers and engineers with doctoral degree were viewed with more respect and authority by others who don't have the degree. As the documents go through ISO 9000 document control process and become a part of a larger system of standard, they attain an almost invincible status of authority as default. In aviation industry where safety is the primary concern, the documents for new systems that are certified and the testing equipments that have been tested and sealed as "flyable" condition should not be altered regardless how they are created. Thus, when the document was created by a PhD and certified for ISO 9000, it becomes too powerful to challenge.

On the other hand, in the case of Frank Gehry's project, individuals were encouraged to break the default conditions. Subcontractors' professional opinions were heard throughout the process by Frank Gehry and his associates. Unlike the case of Complex System, Gehry Partners used their power to enable individuals not to give in to default. Instead of using their power to create default that everyone else needs to follow, they used the power to create a condition for reflexivity for the less powerful.

Default is dangerously attractive. It simplifies. It provides easy answers. It gives you a quick way out. Technologists and management technocrats have been trying to create many defaults. Starting with Taylorism at the dawn of industrial age, to office automation, and more recently to best practices, management technocrats time and again try to build more powerful defaults for management. Appetite for default can be found even in our MBA classrooms. Students want PowerPoint slides from faculty members. If the slides have "lessons learned" at the end, it is even better. They are looking for authoritative default for their learning and management practice.

In an industrial economy, where values are created by building physical "stuff", default can be indeed a necessary virtue for management. Manufacturing processes need to be standardized for quality control. Default through standardization enables functional specialization. Production efficiency can be maximized through functional specialization. When everyone follows default, the coordination cost is minimum.

In knowledge economy where values are created through knowledge, however, default can be deadly. Knowledge in modern organizations is created through dialectic generative cycle of knowledge transformation in a network of communities of knowledge. Such generative knowledge creation cycles thrive in uncertainty, ambiguity, and the lack of default. But, they die quickly when default settles in.

Yet, many managers are still looking for default created by a hero. We are still looking for all-powerful, all-knowing, superman CEO and Chief Knowledge Officer. We are waiting for them to hand us over default. We want to build technology artifacts that capture their wisdom and want everybody to follow the rules and best practices. And, we wonder why we don't see enough radical new ideas around us.

In modern complex organizations, knowledge work cannot be carried out without technology. However, it is dangerous. Technology artifacts are persuasive and powerful. It can easily become default. At the same time, the same technology artifacts can be used to liberate individuals from default. The fate of technology artifacts as default can be decided by the powerful. When they decide not to attach their power to technology artifacts, but to use it to encourage and support the reflexivity of the less powerful, we can avoid making technology artifacts as default. It is time to go back to the original meaning of default when it comes to management. Management by default is failure to manage.

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