



GIGAOM RESEARCH

Visualizing Work: New Ways to Map How Businesses Operate

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Executive Summary

Most of the myriad approaches that visually represent what goes on in a business—such as organization charts and Gantt charts for project management—date from the start of the twentieth century. These outdated visualizations simply don't match up with the way today's businesses operate: they fail to provide strategic and quick insight into what people are doing. The rise of more recent business intelligence (BI) and business process for visualizing work still fail to provide much insight into the social dimension of work: where people are communicating, interacting, and sharing. The greatest degree of insight into today's business is likely to come from tools that build on visualizing work based on the social networks within and across businesses.

Key takeaways from this report, which takes a close look at many of the approaches to visualize work, are:

- The older the technique for visualizing work, the more out of step it is with modern work.
- In an accelerating and big data world, techniques that rely on dynamically tapping into live data rather than manual updating have great advantages.
- The work graph—the social network of people in a business, plus the information objects that they share in the performance of their work—will likely be the central motif for visualizing work in the years to come and is where the most exciting research and development is taking place today.

Introduction

In an increasingly sped-up and complex world, understanding truly understanding business operations can be difficult, if not impossible. The blizzard of emails, reports, and slide presentations creates a fog that blocks understanding rather than facilitates it. Conventional abstractions such as organization charts, business process diagrams, or Gantt timelines are often out-of-date or so removed from actual activities that the individual, the workforce, or management involved have difficulty knowing who is involved with what projects, has access to what data, or is working with whom.

Other data- and interaction-driven approaches to visualizing what's going on in business might offer a more dynamic and direct way to gain strategic insight into what's going on across the business. The question is, in a world in which the nature of work is changing, what is the most useful way to visualize work so that all involved—the individual, the workforce as a whole, and management—can gain strategic insight?

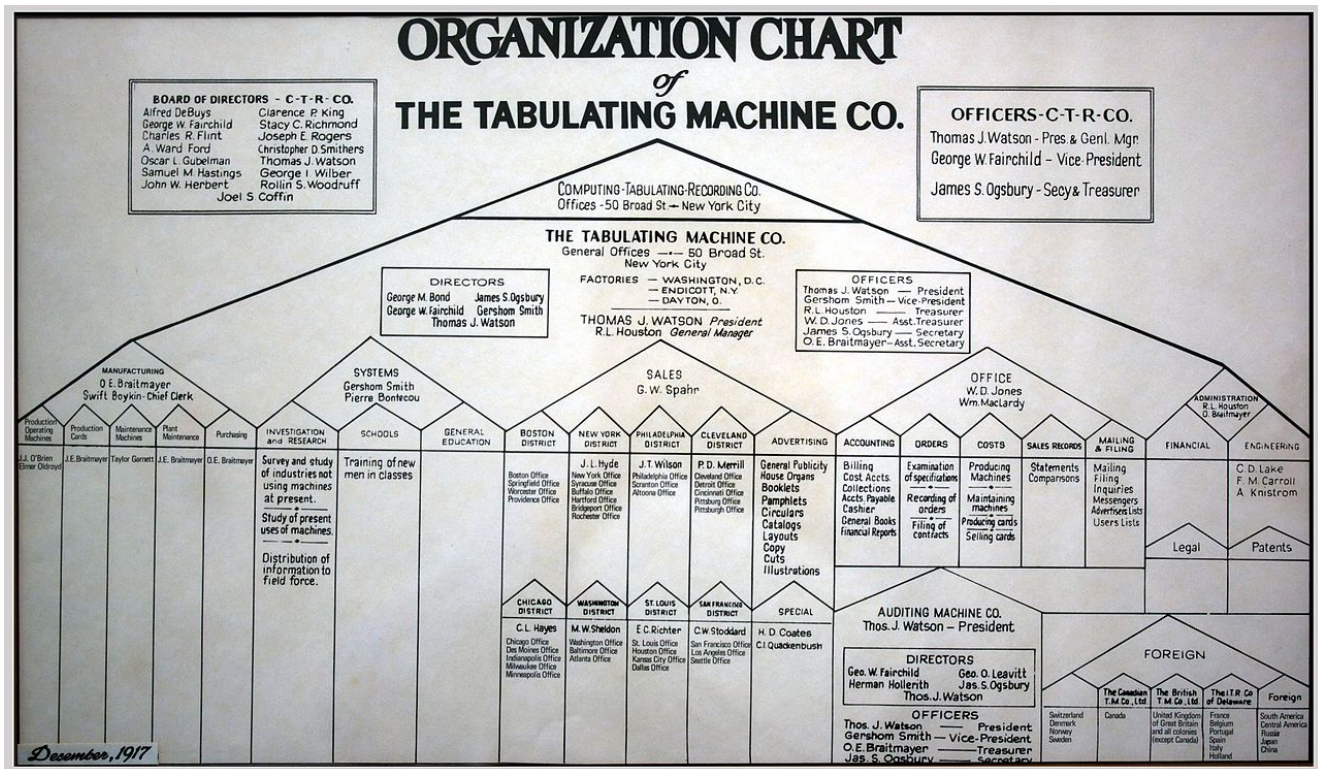
This report explores various approaches used to visualize work, particularly those building on the work-graph model: business social networks and the artifacts that people use to get work accomplished, such as documents, designs, code, chats, and tasks.

Strategic Insight through Abstraction

When asked to characterize their company in a diagram, most people will fall back on the organization (org) chart—or some part of one—to show their place in the overall scheme. But org charts are notorious for concealing as much as they show. As Geary Rummler once observed, the real work is done in the white space of the org chart. That white space, Mark C. Maletz and Nitin Nohria once wrote, is “the large but mostly unoccupied territory in every company where rules are vague, authority is fuzzy, budgets are nonexistent, and strategy is unclear—and where, as a consequence, entrepreneurial activity that helps reinvent and renew an organization takes place.”

So the org chart is the first visualization that we can rule out for gaining any real insight into the operations of business in 2015. This is not because we’ve seen a millennial deconstruction of the hierarchy—we haven’t—but because businesses involve much more than the direct reporting structure that the org chart reflects.

1917 Org Chart of the Tabulating Machine Co., later Known as IBM



Source: Wikipedia

However, understanding how work is done in a business is necessary for strategic insight, for management, the workforce, and the individual. So we must examine other models that businesses use: business process models and workflows, social networks and work graphs, project status and task management, and financial models. Each has its own strengths and weaknesses.

One dimension of major importance is whether the abstraction is a static mapping or a dynamic representation of live data being pulled from a system in use. Those that are static, or proscriptive, such as the traditional top-down project management tools like Microsoft Project are always out of date and require laborious tweaking. And even when they are up to date, they fail to show the rich social interactions that make work human.

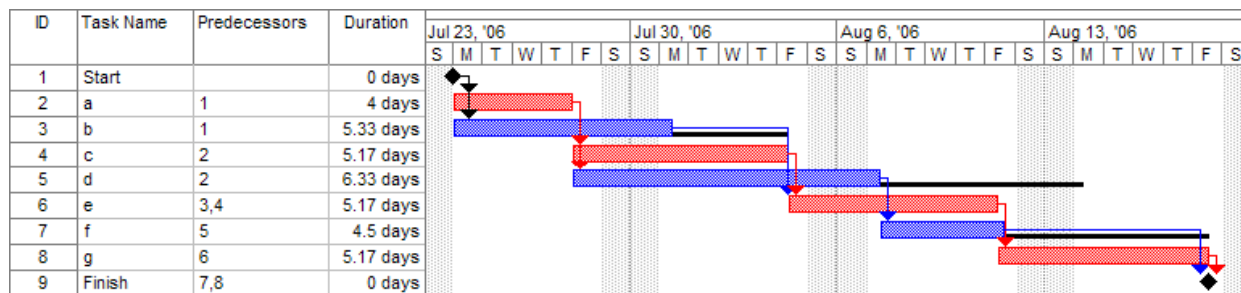
Clearly, we are better off visualizing work with dynamic tools driven by real-world data, but even with that baseline, there are still many potential ways to visualize work.

Project Management Visualization

Dozens of project management approaches visualize work. One well-known staple of project planning and management is the Gantt chart, named for Henry Gantt, who designed his chart between 1910 and 1915. Like the org chart, this technique is approximately one hundred years old, which may explain why these techniques, while well understood, are increasingly out of step with the way most work is performed today.

The Gantt chart's basic premise is representing project activities as tasks that are assigned to workers. Dependencies between tasks—task 1 must be complete before task 3 can start, while task 2 can start at any time, for example—are constraints added to determine work sequencing, along with estimates of time needed, and once the project has started, capturing actual time applied. Dependencies also lead to project analyses, like the critical path shown in red in the figure below. The critical path comprises the tasks that define the duration of the project. The grey bars in this chart are slack time: the amount of extra time associated with non-critical path activities.

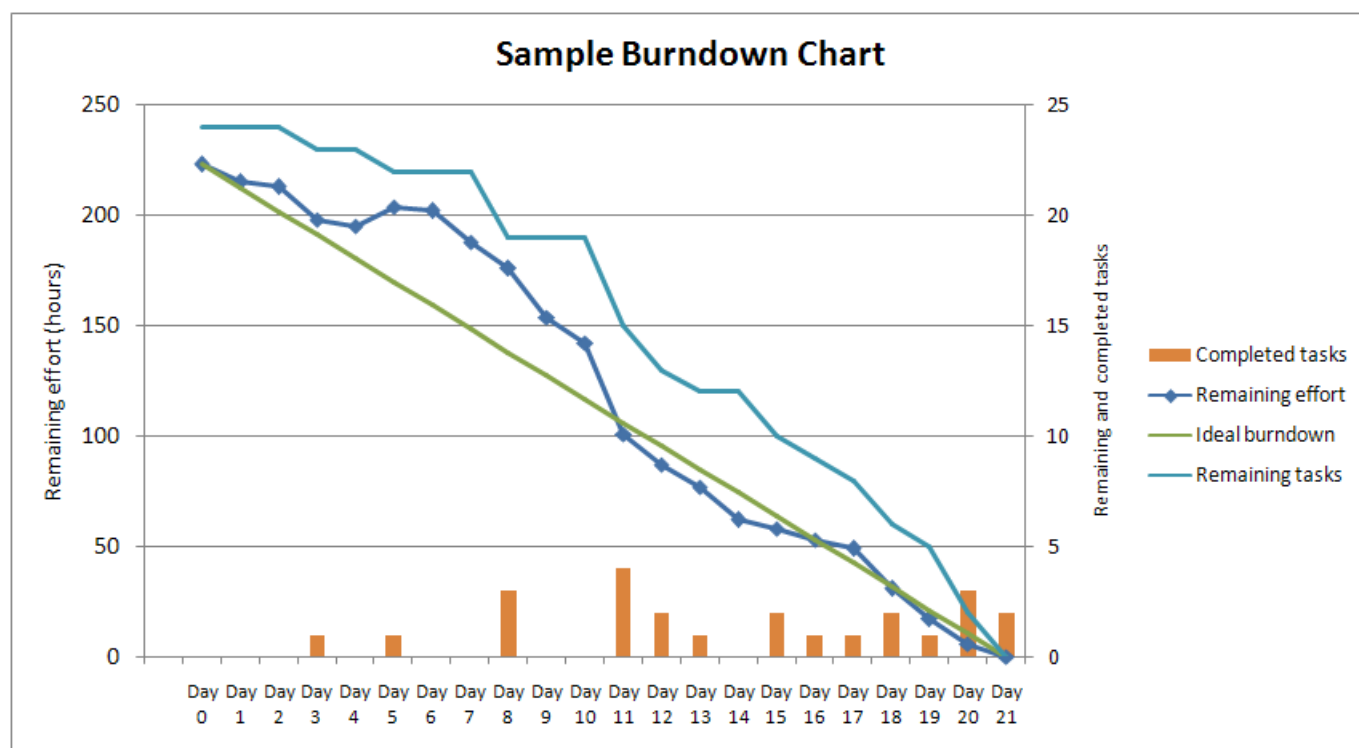
Gantt Chart from Microsoft Project



Source: Wikipedia

Gantt charts and other project management tools are largely proscriptive, and in general, require manual updating, although more comprehensive and expensive project management solutions tie into large enterprise work reporting solutions, so that as employees and managers enter data in timecards (or their equivalents, online), the actual time can automatically update charts. These tools require training and technical knowledge to be used effectively. Another approach is burndown analysis which displays the tasks in a project as a declining graph showing completed and remaining tasks.

Burndown Chart



Source: Wikipedia

One of the factors making project management approaches to visualizing work less effective today is the changing nature of many people's work. Much of today's work is improvised and doesn't follow step-by-step from a plan created at the outset, and the rate at which work plans are altered is increasing. Likewise, as work is increasingly decentralized, changes in one part of a project may happen without others knowing.

Researchers from the New York Federal Reserve analyzed census data to find a key trend: more U.S. occupations are involved in non-routine and cognitive work, currently approaching 70 percent of all jobs (see [Work is rapidly becoming nonroutine](#)). As a result, much of what people are doing is not project related, or else the work activities are proceeding in a fashion where the work starts before all the tasks are identified and scoped.

The Percentage of Jobs That Are Non-routine Is Rising

The strengths of project management-oriented visualization approaches are that project management techniques are well understood, and that tools for working with project management techniques are mature, so they can scale and provide roll-up for sub-projects. In this way, they provide a comprehensive approach to thinking about project work, especially in large projects involving complex coordination of many individuals or groups.

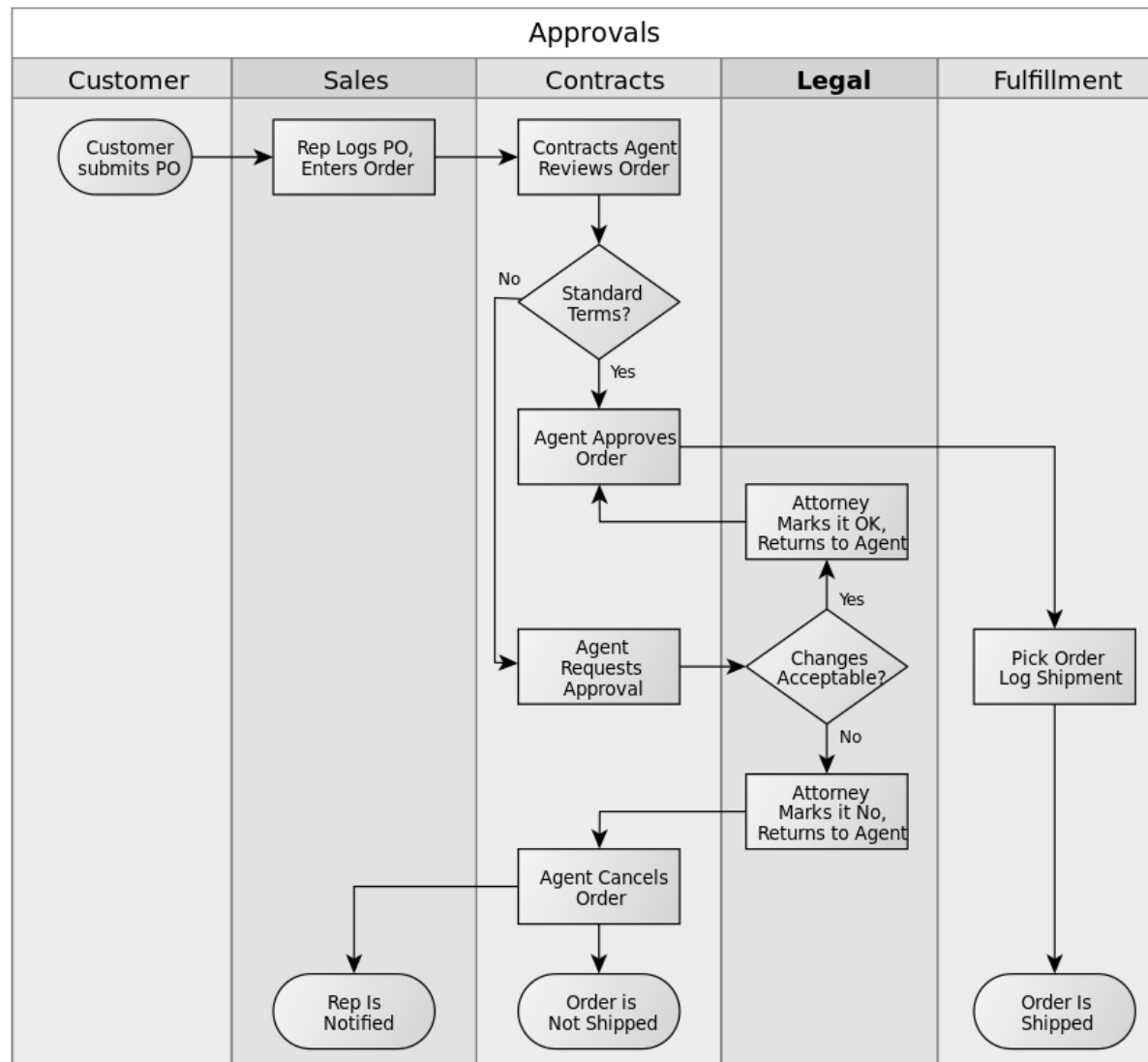
But the weaknesses of project approaches are many. They downplay the human dimension of work, too often treating workers like gears in a machine, and at any given time the most relevant information may not be easy to find. They miss what's going on in the whitespace.

Business Process Visualizations

While efforts to model business process, like Gantt and flow charts, have been around since the start of the 20th century, the term business process modeling has been in use only since the 1970s. It arose in the field of systems engineering, attributed to S. Williams, *Business Process Modeling Improves Administrative Control* (1967).

Most process-oriented techniques in wide use today share a task-oriented orientation with Gantt and project management approaches, but they add more attributes in the visualization of work. The next figure shows a process model with "swimlanes" that denote what agent or group is responsible for the tasks that are drawn within them. Two consultants, Geary Rummler and Alan Brache, proposed swimlanes in their book *Improving Processes* (1990).

Swimlane Process Model

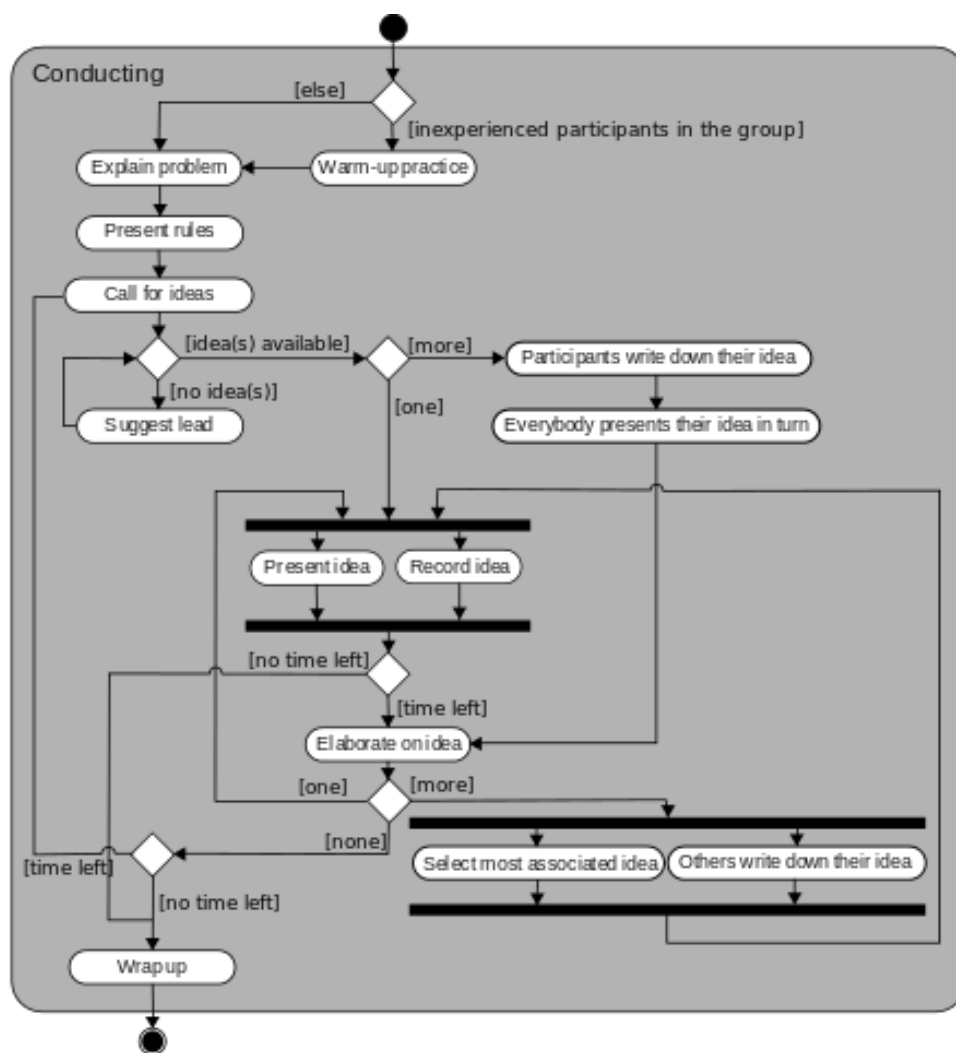


Source: Wikipedia

Swimlanes have been adopted in more modern and sophisticated techniques, like Unified Modeling Language (UML) Activity Diagrams. But in all cases, they focus on who has the responsibility for the task, the logic that drives alternate paths, as well as the sequence of the steps. It is a much richer visualization of what is going on in well-defined business processes and it counters the lack of the human dimension to some extent, since human agents are depicted explicitly. However, in any but the most deterministic business activities, there is clearly a great deal of human communication not surfaced in this diagram. For example, it might be reasonable for the lawyer and agent in the chart above to communicate about the approval of the order, but that isn't evident.

And the other weaknesses of project techniques remain: these representations are manual and require updating when changes are made. The more sophisticated methods, such as UML and Systems Dynamics models, require formal training and an inclination toward logical rather than social thinking. Following is the depiction of a brainstorming process in a UML Activity diagram (this one without swimlanes). Note diamonds indicate decisions, rounded rectangles are actions, and black bars enclose concurrent activities. Seems intuitive for programmers, perhaps, which is what UML is for.

UML Activity Diagram

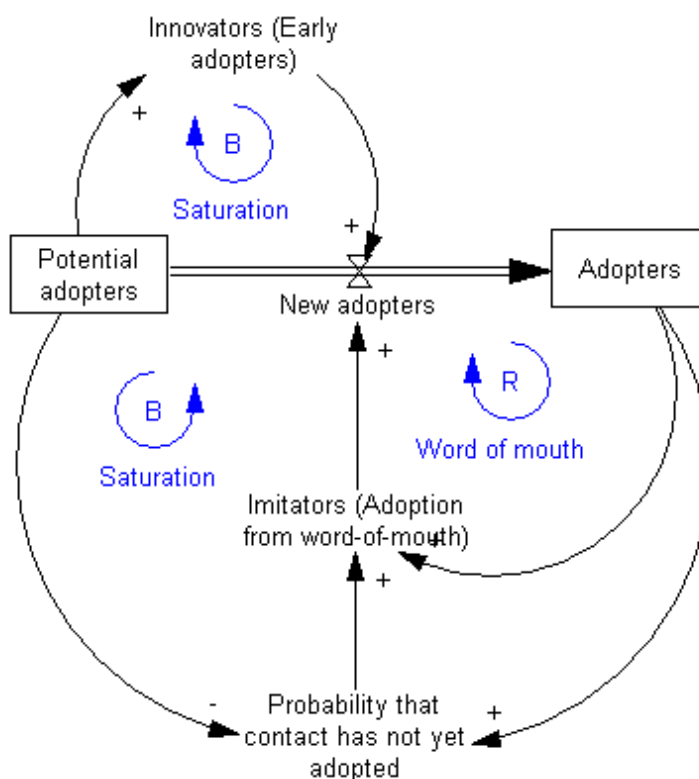


Source: Wikipedia

Systems Dynamics models, that Jay Forrester invented in the 1950s, are based around different concepts: feedback loops and stocks and flows. The following stock and flow diagram models the New Product Adoption system for a company making a product. Here we see the 'stock' of potential adopters being

transferred to the 'stock' of adopters, which is what we generally call adoption. The blue feedback loops show the impact of forces, like word of mouth. Here word of mouth is clockwise relative to the flow, meaning it helps convert adopters. Likewise, the plus and minus signs indicate positive or negative feedback.

Systems Dynamics Model of New Product Adoption



Source: Wikipedia

This is another example of an approach that requires technical knowledge to make sense of, and even more to construct such models. Like the other techniques covered so far, these fail the abstraction test: the user must read all the parts and construct a mental model of what's going on in totality before having a general sense of the process. There is deep insight, but no quick insight.

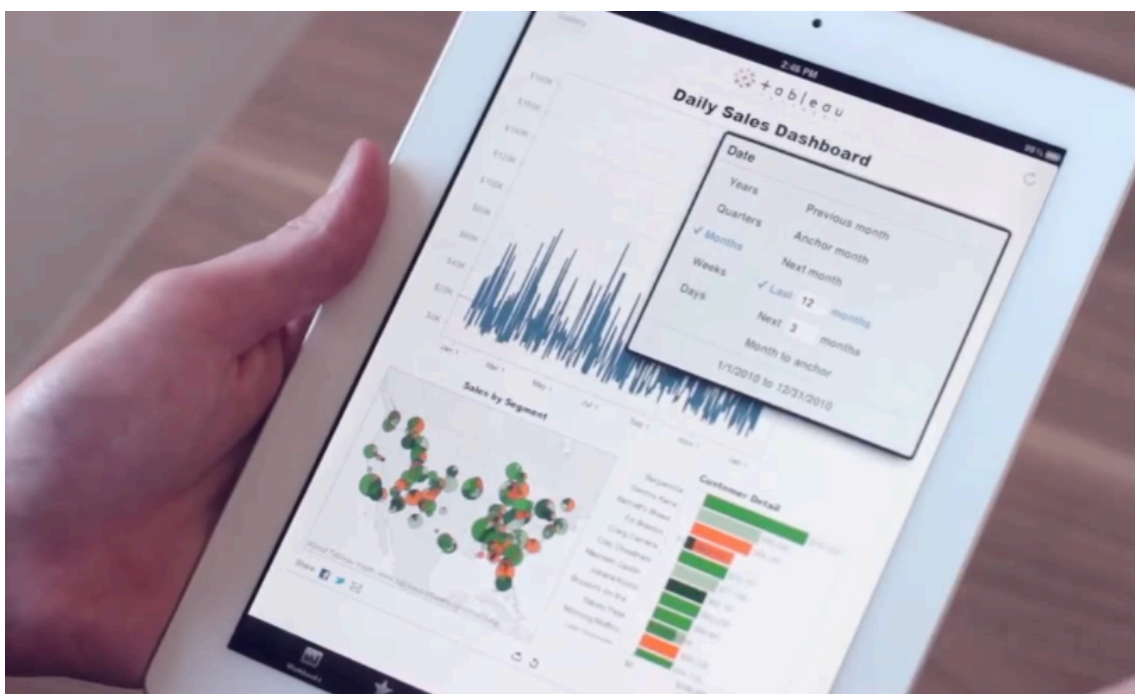
Business Intelligence Visualizations

BI is a set of practices and technologies that allow the raw data to be transformed into information for business analysis and insight. Unlike the techniques described earlier, BI starts with data rather than manual entry or diagramming.

The modern use of the term dates back to a 1958 article by Hans Peter Luhn in *A Business Intelligence System*. But in its modern form, BI allows insight into the various operations of a business through computer-mediated representations in financial charts, operations dashboards, milestones against business objectives, and so on.

The following screenshot shows a Daily Sales Dashboard from Tableau, one of the leaders in business analytics. It includes the characteristic features of BI dashboards: financial and other data is represented in various widgets, such as a sales chart, a geographical depiction of that data, as well as a customer demographic detail section. Dashboards like these are generally driven by live or very recent data, so the charts can be updating in real time, which is very unlike the earlier manual techniques.

Tableau Dashboard



Another example (following screenshot) from Domo Software consolidates financial information, information on sales, cash balance, expenses, etc., with performance goals, such as new-hire training program, fulfilled orders, etc.

Domo Dashboard



One of the greatest strengths is that BI dashboards and analytics can be driven by actual company data, and can boil down a great deal of complexity into a small area. Especially as companies are gathering ever more information from operations, employees, and customers there will be a mounting interest in making sense of that data.

Note also that these BI dashboards are significantly more intuitive for those without the formal and logical training involved in other representations. Any college graduate with an understanding of statistics and accounting basics can grasp what's shown in the screens above. And it's much easier to get the gestalt of what is indicated: BI supports quick insight once the short learning curve is complete.

However, BI does have some weaknesses. The social dimension may be underrepresented and it tends to resolve to an industrial orientation toward work as opposed to a human-centered approach, although that can be countered to some extent by creating widgets that focus on people data, like the new-hire training program example above.

Strategic Insight through the Work Graph

Social network analysis grew out of the social sciences starting in the 1890s, when Emile Durkheim and others researched social groups. But social scientists like Bronislaw Malinowski and Claude Lévi-Strauss began—in the 1930s—the work that has become the foundation for understanding the social nature of human communities and society.

The anthropologist Gregory Bateson wrote in the 1960s that “a business is best considered as a network of conversations.” This sentence establishes the deep context for thinking about businesses as communities and societies, with social relationships and how we communicate and influence each other at work.

In recent years the term “social graph” made a careful distinction between social networks that are made up of nodes representing people and arcs representing relationships, as shown in the following figure, and a more complex system in which social objects are also depicted. These are the items that people share in social networks, such as photos, messages, and tags. Social objects plus the social network result in a social graph.

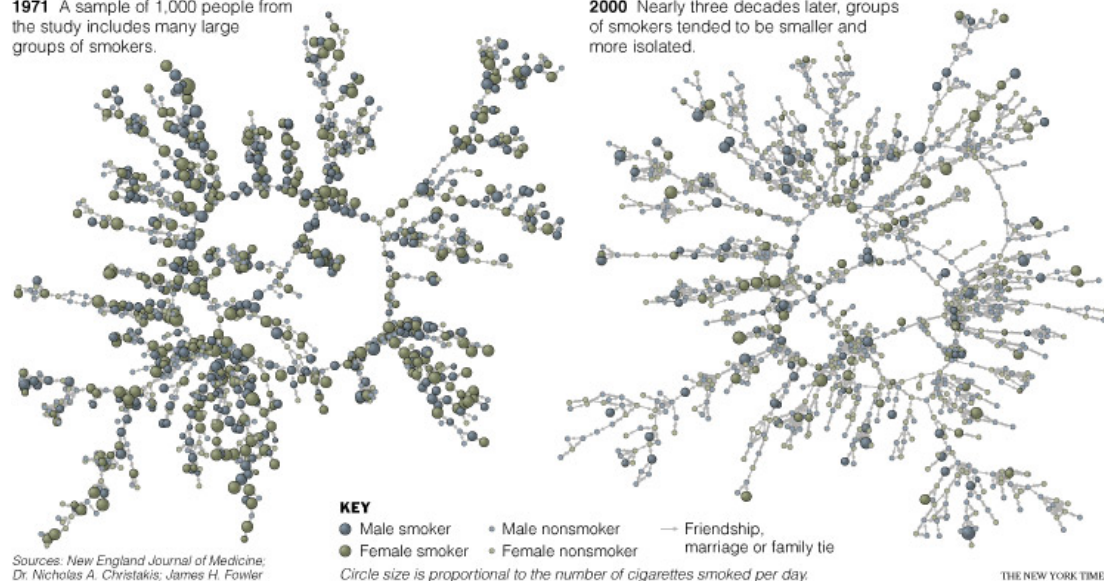
Social network in the Framingham Heart Study

Smoking and Quitting in Groups

Researchers studying a network of 12,067 people found that smokers and nonsmokers tended to cluster in groups of close friends and family members. As more people quit over the decades, remaining groups of smokers were increasingly pushed to the periphery of the social network.

1971 A sample of 1,000 people from the study includes many large groups of smokers.

2000 Nearly three decades later, groups of smokers tended to be smaller and more isolated.

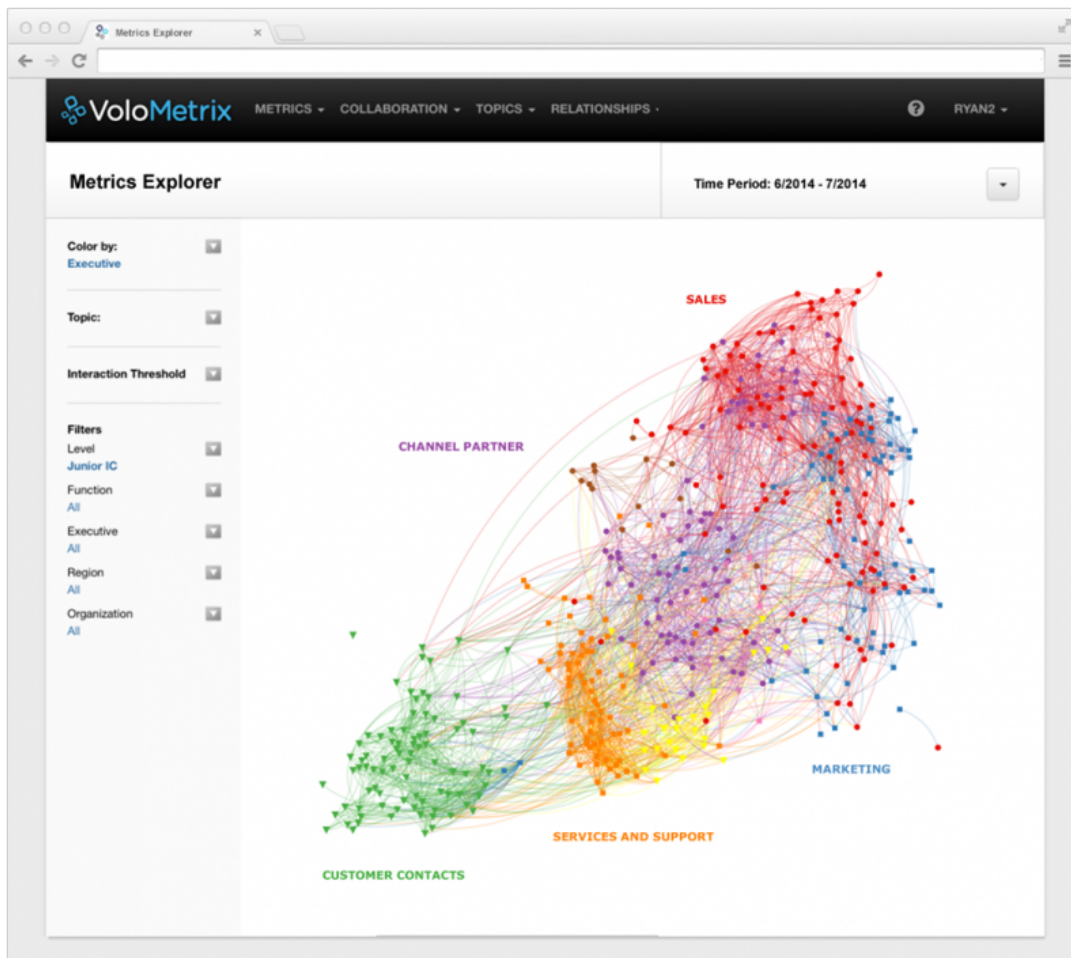


Source: *New York Times*

Modeling social connection as graphs, where the arcs are relationships and the nodes are people, has been a commonplace of sociology and other social sciences for generations. The analysis of social networks has a solid mathematical foundation, so the strength of a relationship between two people can be measured by how quickly and frequently those two people communicate via email, for example. This could be denoted by the distance between the two nodes in a graph depiction, or using wider lines in the graph to represent stronger connections, and thinner ones for weaker links

The social graph below was generated by computerized email analysis across a company and analyzing the communication between the folks in various departments and their partners and customers. Note, however that the emails involved aren't shown in the rendered graph because the volume would overwhelm.

A Social Graph Based on Email Communications



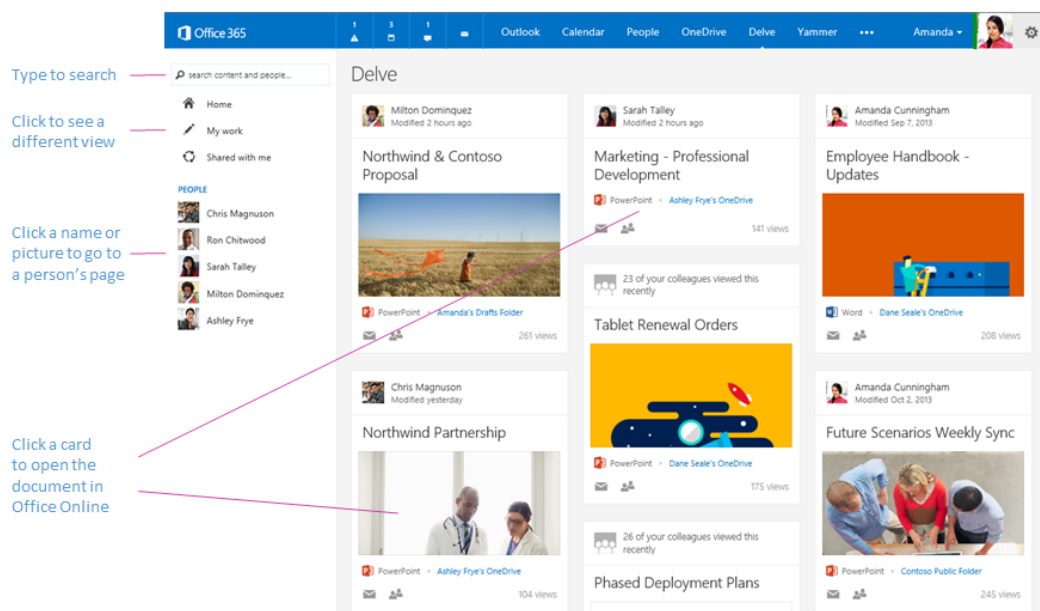
Source: VoloMetrix

This sort of presentation allows for quick insight. For example, imagine a CEO viewing this VoloMetrix display, looking to contrast it with the previous time period and to learn if the company's initiative to build stronger connections between customers and the company's services and support organization has been successful. Simply glancing at two social graphs might give her that insight. And of course, the numbers behind the chart are available as well.

So, adding work objects like documents, messages, blog posts, customer information, and links, to the social network leads to what many refer to as the "work graph." The Volometrix example above is based on analysis of emails alone, but analysis of communications in other media, such as shared documents, chat, and so on, are equally possible. Likewise, representations that correspond to group membership, trust, closeness, and almost any other dimension of social relationship are possible, given the corresponding data.

Microsoft's work on Delve is similar to VoloMetrix: Delve analyzes document use and other information in Office 365 to try to surface what's relevant for each user. However, it provides a dashboard-style interface based on a card or tile design metaphor to present each user an individual user experience tailored by the work graph, or as they call it, the office graph.

Microsoft Office Delve User Interface



Source: Microsoft

IBM Verse is a new, people-first email solution that also exploits the work graph, and also exposes it in part (see [People-first email from WeMail and IBM Verse](#)). Following is a screen shot that displays the social network made up of the people connected to a single email.

IBM Verse User Interface

The screenshot displays the IBM Verse email interface. At the top, there's a navigation bar with icons for Mail, Calendar, People, Communities, and Apps. Below this is a row of profile pictures of various users. The main content area is divided into two columns. The left column shows an email thread with messages from Gail Chao, Nancy Smith, Herb Medway, Pierre Dumont, Kristin MacGyver, and Gail Chao again, all dated October 7th. The right column features a 'People on this message' section with a social network graph. The graph shows connections between several individuals: 'You' (Paul Clemmons), Misha Tompkin (VP Marketing), Li Pan Tan (Marketing Director), Dina Maroni (Sales Associate), Paul Clemmons (Store Manager), and Helena Muzakis (Program Manager). A detailed profile card for Paul Clemmons is shown on the right, including his title, company, location, and contact information. At the bottom, there's a calendar view showing a meeting on Thursday, October 30th.

Source: IBM

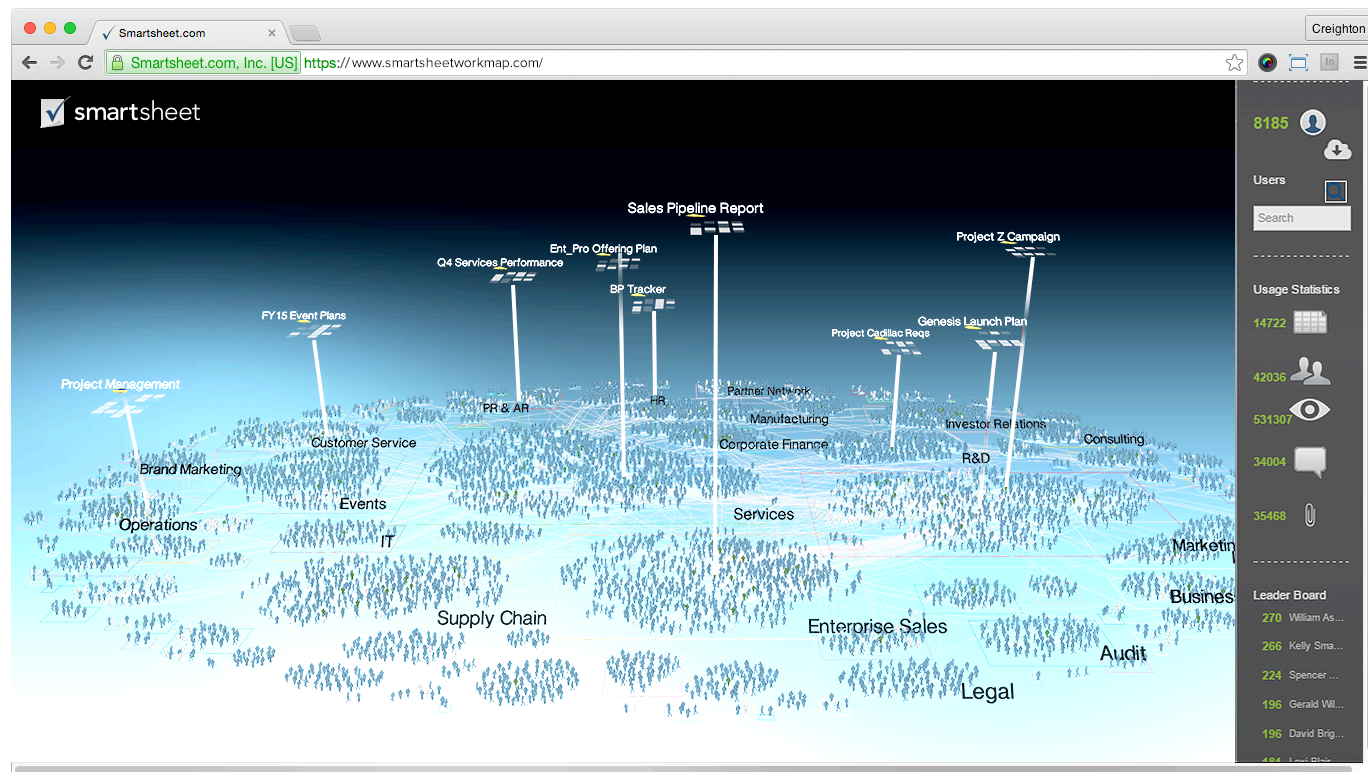
Surfacing that sort of information offers users awareness of the social fabric that connects them and their work artifacts, and makes their “social physics” more tangible.

Smartsheet, the work collaboration tool built on the spreadsheet design metaphor, has recently released a new visualization capability called Workmaps (see [Smartsheet announces Workmaps, a tool to visualize connections](#)). Smartsheet is the first collaboration vendor that depicts the work graph of its users based on their interaction with the tool. This technique is illuminating in part because one Smartsheet can be linked to another, just like spreadsheets can.

Following is a work graph of a fictionalized company, based on the collaboration clusters around specific sheets, and the cross-linkages. The likelihood of quick insight is clear. More compelling is watching the

simulation of adoption in a company overtime, as is displayed in the tool when the Play button at the top right is clicked.

Smartsheet Workmap



Source Smartsheet

These techniques for surfacing information about the work graph are all fairly new, and we've seen both ends of a dimension of scale. In Delve and Verse, the work graph is mined to present relevant information to the individual users, while VoloMetrix and Smartsheet are presenting a 30,000-foot view of the work graph suitable to gain insight at a big picture level. Note that Smartsheet also provides the lower-level views of Gantt charts, timelines, and visual status indicators, along with the higher level view of the Workmap.

The future of work visualization is providing the ability to shift from one end of that dimension to the other, as needed, and to mine all the work artifacts available—documents, messages, chat, images, and so on—to get work done at the individual level and to understand the status of work at any level of abstraction, for example in the C-suite.

To counter concerns that this sort of analysis steps over privacy boundaries, VoloMetrix's technology does not read the content of the emails that it analyzes. Instead, it relies only on the subject line and the sender's and receiver's addresses. Similarly, Smartsheet reads the names of the sheets and identifies with whom the sheets are shared, but does not have access to the sheet contents. In general, vendors must walk a careful line in shaping these tools, and the ways in which they undertake the analysis of our communications to get at the work graph. For example, during Microsoft "YamJam" about Delve, some wondered about the possible consequences of people accessing company HR documents, like psychological assistance, domestic partner coverage, and maternity benefits. If such documents became part of someone's work graph, and that work graph was available to others, it would in effect go past privacy boundaries. But Delve only shows whether someone modifies a document.

On one hand, those limitations restrict the benefits of work graph analysis and visualization for those parts of our working life that is about the work we do. On the other hand, it is obviously necessary to have strong privacy controls in force when dealing with more personal matters, such as HR issues, or emails sent to loved ones. People must have personal control and be able to make certain activities and information private or secret, or the benefits of such analysis may not be realized.

In the near future, we will see a growing demand for the visualization of work, and most specifically, the emergence of the work graph as the central motif in our perception of work on a social level. Its strengths are based on the intuitive nature of the work graph, and the mathematical rigor that underlies social network analysis. Plus the connections between people and the artifacts that they work with lead to contextually relevant collaboration, which is going to be a massive trend over the next few years, and which is driven by exploiting the work graph at a foundational level.

Conclusions and Takeaways

Walking through the various sorts of work visualization has been revealing. One important takeaway is that we are still using techniques from the early 20th century to understand 21st century work. That might be alright if the two time periods have a great deal in common, but the stark truth is, they don't, at least not in the ways that matter relative to succeeding in business, today.

The organization chart fails to show what is going on in the whitespace of the organization, where people collaborate, work gets done, and products ship.

Gantt charts and business process diagrams have their place, but much of the work being done today is non-routine, so those techniques are increasingly irrelevant as proscriptive ways to channel people's work. Such techniques are still powerful when tied to live data from ongoing projects or processes, but they often fail to capture the give-and-take going on outside the swimlanes.

The dashboards of business intelligence can provide powerful ways of understanding operational detail, but aside from quite modern ones, BI dashboards fail to cast a light on the social interactions that define organizational culture, which is the wellspring of creativity, innovation, and grit in business.

A new wave of tools building on the dynamics inherent in the work graph will displace conventional approaches, and establish a new dimension of enterprise software competition.

Companies such as VoloMetrix, Microsoft, IBM, and Smartsheet are taking quite different paths, but are building on analysis and visualization of the work graph to help drive strategic insight.

About Stowe Boyd

Stowe Boyd describes himself as a web anthropologist, futurist, and analyst. His focus is the future of work and the tectonic forces pushing business into an unclear and accelerating future. Boyd has worked as an analyst for Gigaom Research for several years and as the curator in the social and future of work area since fall 2012. Boyd has been tracking the social revolution online since 1999, when he coined the term “social tools” and starting blogging. He was president of Corante, a blogging pioneer, in the mid-2000s and has been widely recognized as a theorist and influencer in the social web. He coined the term “hashtag” in '07 during an online conversation with Chris Messina, the originator of the convention.

He is at work on a book, *Fast-and-Loose: The New Form Factor For Work*. Boyd has participated in numerous conferences and events worldwide, including Web 2.0, Enterprise 2.0, Gigaom Net:Work, Reboot, Next, Mesh, Shift, Lift, SIBOS, Defrag, SXSW, and several TEDx events.

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