

Manufactured Serendipity: Facilitating Accidental Innovation
through a Web Application

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Introduction

Introduction

If Edison's assertion about the components of genius (one part inspiration, nine parts perspiration) is to be believed, one might well draw the conclusion that innovation is largely a matter of banging those rocks together as hard as one can, for as long as possible. But innovation in the contemporary business context--a topic directly linked to profit and thus the subject of much inquiry--has proven itself to be as multifaceted as it is elusive. What creates the spark that leads to a winning product or service?

Hansen and Birkinshaw's Innovation Value Chain (IVC) (Hansen & Birkinshaw, 2007) breaks innovation into three process components (idea generation, selection, diffusion) and makes clear that idea generation alone is not enough. Ideas must be selected appropriately and diffused within the company so as to be converted into actionable business objectives. Merely

churning out ideas is not an innovation strategy. In recognition of this, many businesses focus on IVC processes downstream of ideation. Yet does the quality of their ideation meet their expectation? Are they delivering the type of ideas that they need to support their business?

Employees in today's modern organizations are faced with an overwhelming amount of information, bureaucratic complexity, a rapid work pace, and communication barriers--factors that often prevent radical innovations from surfacing. Though some innovative ideas are discovered by accident within these haystacks of corporate complexity, obstacles remain that can challenge even the most progressive organizations from keeping pace with their competitors. New social software tools provide the promise of improved collaboration, but little work has been done to exploit the benefits of social software

in idea generation and innovation. In today's modern organization, is it possible that social software can increase the chances of serendipitous discovery?

smartSparq provides a platform where breakthrough ideas and "happy accidents" can happen more often. It relies on the premise that radical innovation occurs when ideas that seemed unrelated are connected in a creative way. Challenges are intelligently routed to employees who can bring a new perspective to them and who possess the capacity to make interesting connections between fields. smartSparq's algorithms leverage the creativity of the crowd by breaking down organizational barriers into smart and intrinsically fun challenges that will facilitate serendipitous discovery in large organizations.

The serendipity engine behind smartSparq leverages the

organization's existing information repositories, and uses machine learning, human computation, crowdsourcing, and game dynamics in an easy-to-use web application to increase the likelihood that innovative opportunities are uncovered in organizations. smartSparq is the result of user interviews, academic research, algorithm and interface development, and user experience testing, and is available as a prototype product.



**Project
Rationale**

Project Rationale

Idea generation has traditionally been the domain of an elite group. Some organizations have creative departments that are tasked with coming up with innovative ideas. Other companies hire innovation consultancies to facilitate out-of-the-box thinking. Finally, some organizations have Research and Development departments where innovation is supposed to happen. In general, ideas are generated in those small groups and the vast majority of employees do not usually contribute to the innovation process.

“I’m not a believer in innovation councils, or elderly wise men and women, who decide on [which ideas to move forward]. You have ten people in the jury, and five have no clue about the topic. They have never used it, they are not experts, they are opinionated...” - Business Software Company, Interview March 29, 2011

interview with Technology strategy team manager [11]¹

However, new social software tools allow all employees in the organization to participate in the idea generation process. Social software can empower employees to share knowledge more broadly, to access information sources more efficiently, and even to select ideas more transparently. The era of social software is exploding due to the convergence of web technologies and the need for companies to compete and innovate faster in a global marketplace. In fact, Forrester Research predicts that the exploding market for social enterprise tools,

¹ Each bracketed number refers to a specific interview that we conducted. Please see the corresponding number in the interview table in the appendix

software and services is expected to reach \$4.6 Billion worldwide by 2014².

Interestingly, little work has been done to exploit the benefits of social software in idea generation. When correctly used, social software has the potential to radically transform the way ideas are created in organizations. smartSparq is a social software web application that attempts to fill this void by providing a solution for idea generation. But instead of simply providing a repository for new ideas, smartSparq, through the algorithms of the underlying Serendipity Engine, fosters serendipitous connections by connecting ideas that didn’t seem connected before.

We consider smartSparq a system for manufacturing serendipity. By “manufacturing,” we mean that the

² Source: <http://www.informationweek.com/thebrainyard/aboutus/> accessed in April 2011

application creates opportunities for this type of serendipitous discovery to take place. Intelligent algorithms route challenges from those that need help with a specific innovation problem, to those that may have some insight to answer. But instead of creating a simple message board like Reddit or question-and-answer website like Stack Overflow, the Serendipity Machine behind smartSparq uses the information provided in the organization’s corpus to make these automatic connections between users and recommended topics.

In our effort to design this type of application, we started with the basic premise that few social software offerings focus on idea generation. Through our research, we find that indeed this is the case; organizations who focus on innovation tend to focus on only small, incremental product improvements.



Process

Process

In keeping with the interdisciplinary approach of the School of Information, we use a human-centered design process to take us through a cycle of research-tasks analysis-design-prototype-testing that explores the idea generation phase. First, we learned about radical innovation and how serendipity can occur in large organizations--what were the great moments of discovery and what precipitated them? Next, we spoke with a large number of people who deal with innovation issues everyday--product managers, internal innovation teams, even a Chief Technology Officer--in order to find out what their pain points are and how social software impacts their jobs. Then we sketched and designed prototypes, and returned to many of these same people to get their reactions. The result is smartSparq -- a web application prototype that helps create

“aha” moments in large organizations.[d]

Collaboration

A hallmark of our collaboration was a disciplined regimen regarding communication. Throughout the process we held in-person meetings once a week; this increased to twice or even three times a week when deliverables or other issues arose. To supplement our collaborative communications (as well as to capture the collaboration’s history), we used the following tools:

1. Google Docs
2. Yammer
3. Email
4. SMS
5. Mobile telephony
6. Subversion (for collaborative software development)

We agreed that dissent was a healthy and vital part of the process; to this end, we frequently used methods such

as Devil’s Advocate and Dialectic Inquiry to spur debate, improve decision making, and avoid common pitfalls (e.g., groupthink) that can occur in organizational contexts.

Discovery

Secondary Research

Serendipity alone would not drive our project; our intention was to inform the design as much as possible with a broad cross-cutting survey of secondary research to ensure that socio-technical gaps (Ackerman, 2000) would be minimized. Many, if not most, of the social dynamics that present themselves in any technological design exist here as well. We attempted to understand the most salient issues as the first stage of our discovery process.

Innovation

The path to innovation sources can be circuitous by nature or deliberately obscured (Von Hippel, 1976). To

understand how innovation develops, both within organizations as well as outside by affiliated individuals such as lead users, we surveyed research in business and product development sectors. This led to a design that attempts to tap more potential sources of innovation in a company than an anointed few (broadening the scope of the system and increasing the likelihood of facilitating serendipity).

Innovations can be incremental or radical. Incremental innovations refer to minor improvements or adjustments to current technology (Dewar & Dutton, 1986)—for example, a new version of a car, or a different flavor in a cereal bar. On the other hand, radical (also known as breakthrough) innovations are fundamental changes that represent revolutionary leaps in technology (Dewar & Dutton, 1986). Examples of radical innovations include the iPod and flash memory.

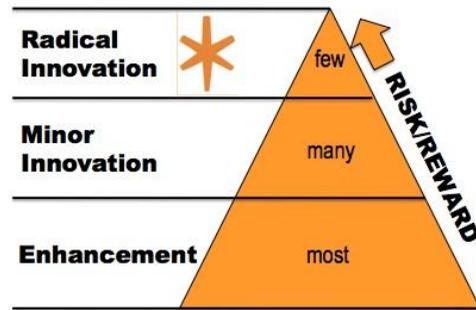


Figure 1. Idea Type Pyramid

(Christensen, 1997). Radical innovation has significant business value. Some authors argue that large companies lose out to smaller companies because they become extremely proficient at incremental innovation around their existing technologies but fail to pursue radical innovation (Christensen, 1997).

The Idea Type Pyramid

The types of ideas generated by organizations vary widely and draw heavily from organizational characteristics: phase of organizational lifecycle, innovation culture, attitudes toward risk, and more.

Organizational factors influence the type of ideas that move forward via selection and conversion; in general, the higher the risk (and potential reward), the lower the number of ideas. Based on the notion of radical innovation as distinguished from other innovation types, we envision an Idea Type Pyramid (see Figure 1) that

shows an inverse relationship between the type of idea (and concomitant level of risk), and quantity generated. Our work centers primarily on the highest-risk (and thus highest-reward) ideas: the radical innovations that can deliver new revenue streams, business models, and service paradigms. We argue that most organizations, regardless of the quantity of ideas they can deliver, generate very few of these profoundly innovative ideas³.

“Our product is used by 90% of the market. We may get hundreds of thousands of ideas [from the bottom of the pyramid], fewer strategic, and even fewer radical” - Director of Community Network [14]

³ In fact, our interviews revealed that some organizations find reasons--rooted in cultural norms, risk attitudes, and cost models--to deliberately veer from opportunities to generate them.

Intersection and creativity

Research on creativity has established that breakthrough innovation happens when ideas from different fields are associated in a new way. There are greater chances of finding remarkable ideas at the intersection of different fields, disciplines or cultures (Johansson, 2006). Similarly, other research demonstrates that additional ideas are generated when people are exposed to others who do not belong to their cohesive group (Fleming, Mingo, & Chen, 2007). Moreover, at least one study suggests that combining the results of individual brainstorming is more effective than the product of a single group brainstorming session (Taylor et al., 1958).

In the workplace, creativity sparks in serendipitous ways: during lunch conversations, from random discussions in the hallway, or impromptu meetings around the

water cooler. More often than not, a new idea is generated after someone overhears a conversation or sneaks a peek at someone else's screen. Later, the person connects her ideas to the ones that she just heard or saw and comes up with a new combination of ideas.

It is clear that organizations seeking to foster radical innovation should provide an environment where people from different backgrounds and experiences can interact and build on others' knowledge. However, as the next section will explain, most organizations do not work that way.

Homophily in social networks

Organizations tend to be organized by departments or functions, thus providing little opportunity for inter-unit interaction and collaboration (Weiss & Hughes, 2005). However, even in this traditional structure, people may be connected to

employees in other units by informal networks. Social settings such as the company-wide happy hour, the company-sponsored sport team, or the perennial favorite, the water cooler, may provide an opportunity for people in different departments can interact. Nevertheless, even in those cases, people tend to intermingle with people who work in similar departments, studied in the same school, or come from the same city. People are more likely to interact with those who are similar to them--based on dimensions such as education, background, ethnicity, etc.--than would be expected by chance (McPherson, Smith-Lovin, & Cook, 2001).

This tendency to interact with like-minded people hinders the ability of employees to come up with truly innovative ideas. Employees are not exposed to new perspectives or new points of view, thus reducing the

probability of finding new connections at the intersection of two fields. There are certainly cases where inter-unit collaboration occurs, but in general the opportunities for interaction with different fields are limited.

Motivation

Although issues of motivation in online collective action are by no means straightforward (Antin & Cheshire, 2010), incentives for participation remain a primary concern for designers of any cooperative tool. Our review centered on the use of games and disruption as methods both to cultivate motivation and to identify potential sticking points as well.

Game Dynamics and Mechanics

HCI research over the past 30 years has underscored the importance of fun in user interfaces (Von Ahn & Dabbish, 2008), and increasingly, making work enjoyable has been shown to contain verifiable benefits in

terms of motivation and productivity (2008). We examined Von Ahn's Games with a Purpose (GWAP) research and commercial applications of his principles to understand how play can drive up incentives to contribute time. This led to extensive review of game dynamics/mechanics in online applications, types of play (e.g., highly structured ludic play vs. freeform paidic play), types of players (how one plays a game in order to derive satisfaction), and the games themselves. Importantly, tool designers aspiring to benefit from GWAP principles must strive to "not simply slap a game-like interface onto work activities but to integrate the required activities into the game itself; there must be tight interplay between the game interaction and the work to be accomplished" (2008).

Disruption

We analyzed disruption as a potential factor in motivation as well as



Figure 2. Horace Walpole, who coined the term "serendipity"

innovation. At a “macro” level, innovations that alter the contextual landscape tend to be characterized as “disruptive,” to such a degree that the term has lost much of its impact. At the “micro” level, disruption takes on a different significance, referring more to an interruption in an individual’s effort at a given task. Both are used in a similar (and positive) context. We focused on targeted (“micro”) disruption as a way of breaking an individual out of her normal routine and encouraging out-of-the-box thinking. Inquiry into this hypothesis has generated mixed results: although greater amounts of multitasking--and thus increased disruption--can result in increased overload, it can also result in positive benefits as well (Lincoln, 2011).

Serendipity

Under which contexts do these radical-innovation opportunities occur? Whether reviewing historical

developments or interviewing contemporary developers, many of the same conditions present themselves: a chance encounter or fortuitous mistake, an insightful observation, and the curiosity and/or wisdom to pursue the insight further.

“What we are missing is, if you are a single developer or a sales guy or a sales manager, and you want to look into something that’s not related [to your product], you have a hard time finding support. If you have a manager that’s not supportive or no one to speak and snowball the idea, then you have a hard time.” -Technology Strategy Team manager [1]

In 1754, Horace Walpole coined the term “serendipity,” deriving it from the a fairy tale entitled The Three Princes of Serendip, the heroes of which “were always making discoveries, by accidents and sagacity, of things they were not in quest of”

(Weisenfeld, 2009). His discovery was certainly not the first of its kind: it is said that Archimedes arrived at a method for measuring the volume of irregular objects while stepping into his bath and observing the water's level rise (Wikipedia, 2011). (What sort of serendipity occurred as he jubilantly ran naked through the streets of Syracuse has been lost to history.) Vulcanized rubber, penicillin, and tooth whitening strips--all are products of serendipity as well.

Toward A Science of Serendipity?

A significant body of literature on serendipity exists, especially as it pertains to creativity, innovation, and discovery, and methods for trying to increase it. Serendipity--particularly the kinds of "happy accidents" detailed above--is becoming increasingly popular in sectors ranging from advertising to data mining, and it has more recently come into vogue in executive circles as a

way of unlocking the next killer application or must-have service model. We see elements of it in a growing number of web services such as Chatroulette, Pandora, StumbleUpon, Netflix, and Reddit. But serendipity has no fixed formula; it cannot be blindly "baked" into a product or service by following a recipe. What do we mean when we talk of serendipity?

Martello (1994) identifies some of the requisite components of serendipity.

Chance--the absence of any preordained design--plays a central role in serendipity. Indeed, it is a necessary condition for it. We would hardly consider the surprise party thrown for us to be serendipitous. As a planned event that had come to pass, there would be no element of chance irrespective of our lack of knowledge about it: the party was to happen and so it did. An **Accident** or **Clue** (Weisenfeld, 2009) may serve as the

catalyzing event that occurs by chance. **Activity** is also vital. There must be a search--a quest for information, not of anything in particular, similar to the berry-picking model of information retrieval in which the information searcher moves peripatetically from one data point to the next (Bates, 1989). Martello relates an example of a subject who constructed a daily activity in an attempt to deliver serendipitous revelation:

[A] physician described to one researcher how he had 'reduced serendipity to a method by placing in a fishbowl large numbers of slips of paper, each inscribed with a physical fact. He regularly devotes some time to randomly drawing pairs of these facts from the fishbowl, looking for new and useful combinations. His procedure represents the operational embodiment' of serendipity (1994).

However, Martello rejects this as the very antithesis of serendipity, because the physician was specifically searching for something (and, presumably, because the good doctor had reduced the element of chance by seeding the fishbowl himself with data he himself compiled). Would it be reasonable to claim that an idea spawned from trolling one's own fishbowl was the product of serendipity? Decidedly not. At the same time, how would our assessment change if the fishbowl was placed in the waiting room, with no instructions, to be used by his patients?

This too might not be enough. A discovery made via happenstance by a questing individual would not qualify as serendipitous without the **Recognition** that a breakthrough has occurred. To return to the surprise party example, if someone attending the party meets two people who

uniquely complement each other either by interest, field of study, or personality--but does not remark upon it--this might qualify as a discovery that was not recognized. This quality of recognition manifests itself in superior powers of observation or representation (Martello, 1994), or, more generally, within an individual's **Sagacity** (Weisenfeld, 2009).

Lastly, a discovery might still lack serendipity if **Insight** is not available or utilized in order to "transform pure knowledge to applied knowledge" (Martello, 1994). Without it, a questing individual might not fully comprehend the significance of what s/he has just stumbled upon.

Bengston attributes this "serendipitous brilliance" (1982), tautologically, to **Genius**, a quality most of us lack: "[i]t sometimes takes genius to recognize brilliance" (1982). **Motivation** may play a role as well in

actualizing the discovery (Weisenfeld, 2009).

Identifying serendipity's composition, then, may help us recreate the conditions highly associated with serendipitous interactions. Methods for such replication include psychological tools (Mednick, 1962), social/organizational configurations (Weisenfeld, 2009), novel brainstorming techniques (Taylor, 1958), data mining (Ramakrishnan & Grama, 2002), data visualization techniques (Beale, 2007), and mobile social networking (Eagle, 2004). (But see Rigby and Corbett for a systematic organizational approach to innovation.)

Yet if chance is the cornerstone of serendipity, how does one reproduce it--artificially by nature--without fundamentally compromising the model? With the maturity of computational hardware and

techniques, data-based methods like the ones listed above show promise. However, just as it is a difficult problem to generate truly random numbers (most computational generators are considered pseudo-random number generators), it is equally difficult to generate true chance. And for all their power and wonder, even the best examples of this nascent computational "science of serendipity" occasionally fail miserably--and often by mere degrees, reminiscent of the "Goldilocks Zone" designation used in exoplanetary astronomy. An algorithm design yielding associations that are either too similar or too dissimilar will fail the serendipity test. Likewise, a user experience that feels either contrived or creepy--too clunky or too effective--will not meet the requirements. To create a system that feels "just right," then, in light of all the inherent challenges, would be the very embodiment of serendipity.

Zeitgeist

To capture a sense of zeitgeist on many of the above topics, we read and/or discussed a plethora of blog posts and mini-articles available on sites including (but not limited to) TechCrunch, Slashdot, and Reddit.

Needs Assessment

Interviews

We conducted 18 interviews with six different organizations over a four week period, seeking out interviewees in each company that had a job function related to new product development or innovation. Our goal was to find some common themes for how employees on the frontlines of new product development deal with the challenges of idea generation--the path from just before idea conception up until evaluation. We asked questions about how ideas come to life in their organizations--how they recognize good ideas from bad, how they choose ideas, how they measure

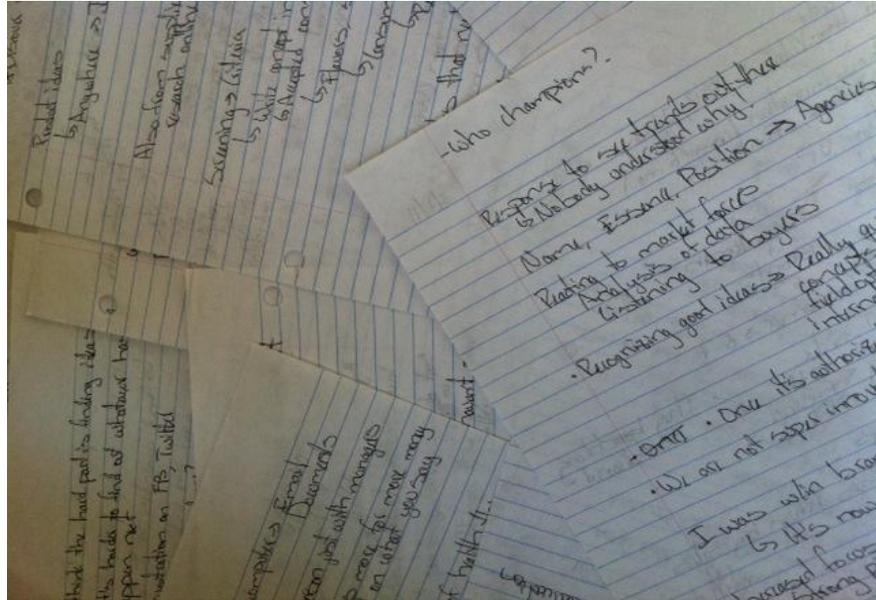


Figure 3. Interview notes and transcriptions

whether those ideas are successful, and whether there are differences between breakthrough ideas and those that are simply incremental improvements to products. Though these qualitative interviews didn't follow an exact script, we include a full list of initial questions in the appendix). Job titles of those we interviewed included Senior Product Manager, Research scientist, Director of Community Network, Ideas Network Lead, Manager--Employee Engagement Team, Technology Strategy Manager, Chief Technology Officer, Brand Manager, and Brand Marketing Manager--Corporate Innovation. The set of companies was diverse: consumer software, data networking, enterprise software, social networking, and consumer packaged goods (two). All companies had over 8,000 employees, with the lone exception numbering just over 300. Nearly every interviewee had some

team members that were geographically disparate.

Once we completed the interviews, we transcribed the recordings and coded for common themes among the companies. We then identified the major themes that could potentially be addressed using a web application, and used these findings to help inform our design. The major themes that we found were:

1. Risk tolerance
2. Ideation
3. Bringing remote people closer together
4. Motivation, including elements of fun and satisfaction
5. Reduce barriers to innovation
6. Selling, championing, and justifying ideas

Risk Tolerance

Almost universally with all of the companies we interviewed, risk tolerance was a major issue.

Interviewees recognized that playing it safe was the easy thing to do, and therefore the most usual path to new ideas and new products: “The appetite for risk was minimal and [the new product idea] got killed...we are a public company, and there are quarterly earnings you need to hit” (Brand Manager). [5] Others commented on the interplay between risk and benefit in large companies: “The spectacle of making a mistake makes you gun-shy...Finding a way to keep the balance of risk taking, but having everybody understand the impact of those risks is a very hard thing for a company of our size and scale.” (Product Manager) [9]. And many of the interviewees talked about the impact that top-down management had on innovation

Ideation - Finding the Needle in the Haystack

One consistent theme across all of our interviews underscored that coming

up with a large number of ideas is not considered a problem. Each company had stacks of ideas to sort, rank, and filter through. One manager summed up the quantity vs. quality problem: “...People love to talk about managing ideas and capturing ideas and ranking ideas and having idea funnels and so forth. But we all know that ideas themselves are not particularly valuable” (-grassroots innovation manager) [11]. Because of the volume and the size of the organization, obtaining intelligence from different parts of the organization in order to spark new ideas was difficult. Nevertheless, employees recognized the importance of this cross-pollination of ideas:

“The majority of innovation never makes it into the product. But you need many ideas to find good ideas. One learning from one lesson fits the experience for the next one. It might not be the right window, right opportunity, but two years

from now it might be.” - technology strategy team member [12]

“Did you ever see ‘Working Girl’?...She comes up with this idea...and at the end they ask ‘How did you come up with the idea?’ She said ‘I was reading this newspaper article, and I heard something on the radio, and I put the two together’. And that’s what we’re really trying to do...We’re not necessarily coming up with a brand new, new ‘it’ -- but if you can tie one thing and mix it with another thing, suddenly it’s something new. And that’s a great way to see the innovation.” -brand marketing manager [4]

“Radical innovation [happens when you] take two thoughts and scramble them together. Most of the times this is a failure, but some of them might be really good” - director of community network [14]

During interviews, we tried to ascertain whether or not “aha” moments constitute an actual occurrence within organizations:

“[Happy Accidents] certainly happen. More often than not, they happen with something we start off with one use case, and they end up complimenting another.” -product manager [2]

Another manager explained that there is a chance to make these connections in a mechanical, but nevertheless a potentially valuable way:

“There are lots of great ideas, and if you take one of them and evaluate it without looking at the other ideas that it could play off of, it may not be a great idea. All you have to do is make that one connection. This guy has one part, this gal has the other part, let’s get these two in touch and let them have a chance to recraft it with the combined ideas and then we’ll evaluate it...it’s making the initial connection [that’s currently a manual process]” - service innovation team manager [13]

Bringing Remote People Closer Together

As organizations grow, employees often become more distributed geographically. Employees still gather around the water cooler or share ideas over the lunch table. But for those employees that are not on-site, it can be difficult to involve them in the ideation process when their desk is not located in the same physical space. One CTO we interviewed commented on the difficulty of “riffing” on ideas together without people in the same room:

“Sometimes the conversations are impossible to have more remote. Sometimes free-wheeling speculative conversations, where people are reading each other, and knowing when to interject and when to continue their train of thought. For my meetings, where we talk about future [innovation], we never conference people in.” -CTO [10]

A consistent theme that continued to surface during interviews was the ability for those located in the same space to hear ideas in the hallway and to bounce ideas off one another in order to make serendipitous connections. As one brand manager mentioned:

“We all sit right next to each other so there have been so many times where I hear somebody talking over there and there having an issue and I know something about that....we eavesdrop basically just because you overhear stuff from other people that they’re working on. There’s a lot of informal stuff like that that goes on.” -brand manager [5]

Across the board, interviewees mentioned that importance of hallway conversations to enhance the innovation process and make connections with each other. Some pointed out that these conversations typically occur in a casual way:

“Sometimes [the conversations in-person that are meaningful are] the ones that happen outside the meeting room after the meeting is done” (product manager) [2]. Another interviewee remarked: “A lot of information happens informally, in the coffee corner--we have a coffee corner culture--or between the doors, and in official meetings just presented with a decision path and you are left out” (Technology strategy team manager) [12]. Others found it to be more explicit: “Our boss wants to have all researches in the same place to allow for these hallway conversations to happen” (research scientist). [1]

Some interviewees felt that remote team members had a large desire to get involved and contribute new product ideas, but they didn’t understand where to go or how to do it:

“The majority of the feedback I had went unheard, because I didn’t know where to go to be able to share those, or who to go to share those insights. For me at least, it was through hallways, 1:1 meetings, and maybe meeting with a product manager...and maybe share insights I have....One of the reasons this program was created was people didn’t know who to go to.” - collaboration software group manager [7]

Even when a deliberate effort is made to involve remote employees in the new product development process, it’s a rare individual that is able to contribute:

“We try and do a really good job of skyping them in so it feels like they are part of the team and part of the office. It takes really good, self assured confident people in order to do that. Not that many people can do an awesome job working alone....they know that they have to be a little more assertive to get their ideas

heard...If we work in enough shared spaces [e.g., skype, other collab tools], those things work. If we do it all in hallway conversations, those guys can feel left out." - product manager [9]

Though there are some people that have the ability to be an excellent contributor to new ideas and product innovation from afar, according to the people we interviewed, this is the exception rather than the rule:

"Ultimately it comes down to the individual. Some people thrive in isolation. This is our HQ, this is where [our main product] happens for the most part. This is where 85% of the team is...a lot of these engineers work really weird hours...There's a big difference to be able to walk down the hall and shoulder tap someone...Most people don't shine their very brightest when they are in a remote location, that's been my experience." - Product manager [2]

Motivation (Fun/Satisfaction)

Most of the people we interviewed were directly involved in the new product development process--either creating and building products themselves, or working with the builders to rank, sift, and sort the crush of ideas generated by their large organization. Individuals that worked in these roles had extrinsic motivation that was explicitly tied to incentives--most commonly in the form of higher pay. But for many, including those outside these roles, there were intrinsic motivators beyond promises of higher pay. Interviewees talked about having an emotional connection with the product, the chance to feel ownership, or the chance to make an impact for those outside the corporate walls:

"It has more to do with the emotional connection that you make and feel passionate about something and just want it for your company. I think that is more

encouragement than any reward." Service Innovation Team manager [13]

"...people have ideas and they want to do something new that will revolutionize something and they have a sense of ownership. You can't underestimate the power of that ownership connection." - head of grassroots innovation at erp company [11]

"Everyone is here out of passion....I know that the app I work on touches every single thing I can see [when I go to the bookstore in the computer section]. There's a lot of pride that comes with that, but also a lot of responsibility for keep making that what it is...It's in our core DNA to evolve, iterate, and push it...There's a certain responsibility that keeps being you at the top in your space...I don't want to be the guy that's sunk the ship." - product manager [2]

However, not all employees at the companies we talked with wanted to contribute based on these intrinsic

motivators. For many employees, a shot at recognition or a pay increase was just as powerful. Most of the companies we interviewed had tried running idea contests with prizes to encourage participation. And in the short-term, one company saw a huge bump in excitement about being a part of the innovation process:

"To be honest, there were 600 people that joined and there were 6000 comments. There's no way that the [iPad incentive] did that....They always thought that [our company] should do this or that. There was a pent up frustration that [employees] had never been heard from before. It was amazing how much they jumped on [the contest for new ideas]." - ideas network lead [3]

Though there often seemed to be a short-term boost that netted ideas from a variety of contributors, in the long-run, in order to get people to contribute regularly, something

beyond prizes motivated people to submit ideas and try to come up with the next breakthrough idea:

“Every quarter we offer cash prizes to join the network and share prizes. But there’s no incentive to continue to be active on the site. So the people that continue to be active are those that like to....Their motivation is more ego-centric....they want to become well known. There are different levels of motivation.” -ideas network lead [3]

And in the end, many interviewees simply wanted an outlet where they could be heard if they chose to weigh in:

“In an ideal world we’d like to reward some of these selected ideas...The benefit of people submitting ideas is a couple different factors. One, is the exposure. You get your name out there and presence to the executives. Two, we found that employees really want to become more connected to the organization, and there

was this gap: ‘I have these really great ideas but I don’t know where to share them or how to share them.’ So it gives them an outlet to being heard.” - collaboration software group manager [7]

Reduce Barriers to Innovation

The mantra that “good ideas can come from anywhere” was something all of the people we interviewed said that the organizations strive towards, but the reality is that most fall short. Not a single company had a frictionless process for ideation, though some had more friction than others. Some companies experimented with tools that allowed for new idea competitions or provided an online discussion space. However, many of these tools, if known at all, were used by only a small portion of the company. Considered even worse by some people we interviewed were the negative impacts of a gate-keeping process or special “idea councils” that at best caused a delay from integrating

new ideas into existing products, and at worst ended up blocking innovative ideas completely:

“With idea management, which I find a pretty frustrating experience, I put it in, and it goes to the person who’s an expert, who’s responsible for implementing, and they already have an opinion, and they shoot it down. Not because I’m an idiot, but because they’ve thought about it...With innovation, you need people who don’t necessarily come from [the same] area...I’m not a believer in innovation councils, or elderly wise men and women, who decide on [which ideas move forward]. You have 10 people in the jury, and five have no clue about the topic. They have never used it, they are not experts, they are opinionated...”

-Technology strategy team manager [11]

“It’s not just about a suggestion box. Companies left and right have a suggestion box, whether it’s anonymous or not. We don’t want to be just a

suggestion box. Because in a large corporation from an employee engagement perspective, if it’s just a suggestion box, 99% of those just fall into a black hole and demotivate employees. Because while you’re accepting my comments, my voice isn’t being heard....Just as important as the actual platform to submit the ideas, is the second half--the governance, the auditing, and the vetting of ideas.” - collaboration software group manager [7]

Bureaucracy and idea councils were not the only impediments to innovation. The companies we interviewed were challenged to come up with a system where someone with a good idea could spend time working on it. Most often, those with good ideas had to try and fit it into their already full schedule dedicated to their “regular” job duties.

“What we don’t have is a way to incubate....we have no incubation team. I don’t think we have successfully found a

great idea that does not belong to a business unit....Idea screens are great, but they're not enough. We believe that we should have an entrepreneur mindset, build-learn-prove...it's hard to do if you don't have the resources to do it and it has been a big struggle for us." -brand marketing manager [4]

"We're pretty lean, so it has an element of that entrepreneurial stuff, particularly within the innovation team. I just had a meeting with my director and he said 'What can we do? Screw the rules, screw the process, let's just go figure it out.'" - brand manager [5]

Cultural support for innovation was another common theme. Many of the employees we talked with thought that it was important for an innovative culture to be led not only by those at the top, but just as importantly, by those at the bottom: "Environment [is the most important thing 100%]. If you haven't got the environment, it

doesn't matter. The thing that I call culture is hard to create. It really has to come from grassroots as well as from the top-down....you have to have both" (ideas network lead). Another employee complained griped:

"We need to convince a manager that [having employees contribute ideas] is not a threat to their control over people and that people aren't wasting their time and are doing something useful" (-technology strategy team member). [3]

One assessment was even bleaker. An interviewee recounted his experience at his previous employer, another large technology company:

"It was cultural [at other big tech company]. There was a sense of ownership and proprietorship where people felt threatened by new ideas. There was a culture of building empires, owning stuff, instead of letting things ride. There was also a culture of top down instead of bottom up. There was no outlet for

innovation. There was a lot of innovation but no light at the end of the tunnel." - product manager [10]

But beyond mere cultural support, it was important for some interviewees to recognize that the company had to be willing to provide employees with time to work on projects outside their usual job scope (such as Google's vaunted 20% time):

"We have seen that everybody wants to apply [creative thinking techniques and methodology and tools] but it's just that everyday work doesn't really give them room to [innovate]. They are very focused on what they are working on at that point and breaking away is hard." -Service Innovation Team Manager [13]

Nevertheless, frustrations remain in these large organizations:

"Next thing I know [person who submitted an idea] posts on Facebook or Twitter his frustration, I think this is a big

fat warning signal. He wants to be loyal, he wants to add value, he tried to, but [his idea was turned down]. Next thing he hears is that a completely other team is working on that same idea...that is a big fat warning signal. We cannot afford to lose those young ambitious employees or the passion." - service innovation team manager [13]

Idea Selling/Championing/Justifying

One of the more surprising themes that surfaced during our interviews was the extent to which ideas required promotion and evangelization in larger organizations. Employees told us that a potentially disruptive idea was insufficient on its own; employees needed to present and share it frequently in order to obtain buy-in from other members of the organization:

"There is a little bit of this PR aspect that is important. Making sure that you have the right advocates. That's why I think



Figure 4. Coding and clustering user interviews

the show and tells are important because people can see that we're doing work. Because the first thing people say is that... 'You are in this ivory tower' -- that is the worst thing people can think...' - brand marketing manager [4]

One person commented about actually going around the office to show off what they've done: "[Our group] literally does a science fair every year" [to show new technology]." -product manager [2]

Translating User Needs into smartSparq Product Features

Much of our user needs research focused broadly on how innovation takes place in larger organizations. However, not all the common innovation themes that came up during the interviews proved addressable with and adaptable to a web tool. With that in mind, we continued to check back with the findings from our user interviews and secondary research in order to ensure

that smartSparq incorporated the most significant needs of our target users.

After the interviews, we identified a number of user needs across the entire Innovation Value Chain (IVC). We then performed an extensive coding and clustering process where we found about a dozen themes that reflected how each organization approached the innovation process. From there, we grouped these themes into each of the three steps of the IVC.

Our prototype focuses primarily on idea generation, and specifically radical or breakthrough ideas. Thus, we prioritized only the themes that are encompassed in the first stage in the Innovation Value Chain: idea generation. This was based on the user interviews as well as the comparative analysis. Based on this prioritization, we identified the following needs and corresponding design elements:

1. Risk tolerance
2. Ideation
3. Bringing remote people closer together
4. Motivation, including elements of fun and satisfaction
5. Selling, championing, and justifying ideas

In order to understand this process in relationship to other processes in the organization, our interviews were intentionally broad. As a result, we uncovered some user needs that fell outside of the scope of our application (idea generation) but are nevertheless important for effective idea implementation. For example, we found barriers to innovation, such as bureaucracy and overzealous “idea gatekeepers,” at nearly every company we interviewed. We exclude this from our design considerations in smartSparq, but we also propose some activities (see Future Work) to facilitate actual implementation of the

ideas generated via smartSparq and enable their conversion into business results.

Target Audience

We defined our target audience using a faceted approach. Based on our interviews and literature, all are 300+ person organizations. Our primary focus consisted of two segments: 1) workers with new product development roles tasked with idea generation, idea selection, or idea funding, and 2) those individuals who typically lack involvement in the innovation or product development process but might want to contribute. Virtual team members are considered to be included in both the primary and secondary target audiences.

Personas Development

Following our in-person interviews, clustering process and target audience definition, we developed a set of personas representing each target segment to guide us through the

design process. In addition, we crafted sample challenges based on these personas to provide some illustrative examples of the types of tasks we wanted smartSparq to perform. We have provided both the personas and the example tasks in the appendix.

Comparative Analysis

Before diving into a comparative analysis specifically of in-market social software solutions, we wanted to frame our product space more broadly. Over the past few years, many companies have begun to fuse some combination of collaborative filtering and sophisticated algorithms in order to create a variety of compelling products and services that have a baked-in element of “serendipitous” discovery. In fact, at a macro level, there is a larger shift away from simple social sharing towards more personalized, relevant

content⁴. Netflix is a recent example that uses this type of combination to recommend movies to its users. Quora is another—it uses computational intelligence in conjunction with a continuously evolving collection of questions and answers created, organized, and edited by users. To start the analysis of our space, we mapped a number of these types of services on a 2x2 matrix; the x-axis consisting of a continuum between “general” and “personalized”, and a y-axis from human-filtered to computer-filtered content. Figure 6 displays the results: a wide range of services that provide varying levels of serendipitous discovery based on how personalized and algorithmically curated they are.

⁴ For an analysis of the trend in the popular press, see <http://techcrunch.com/2011/03/03/the-age-of-relevance/> March 3, 2011



Figure 5. Competitors and the Innovation Value Chain

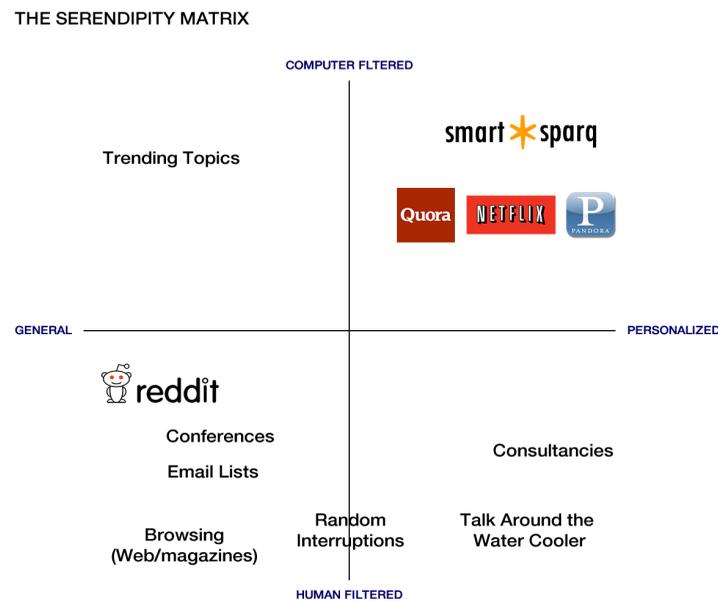


Figure 6. The Serendipity Matrix

In addition to carving out our product space, we analyzed specific innovation software solutions currently in-market to explore opportunities. Companies have taken small steps in terms of using social software for innovation. They have used social media tools to empower employees to submit ideas, collaborate on ideas, and vote on ideas. Much social software relies on the employees of the organization (“the crowd”) to comment on others’ ideas, vote for their favorite ideas (BrightIdea, Spigit, Imaginatik, Goldfire), and have ideas shared with the organization (MindQuilt). Although many software products attempt to facilitate innovation in organizations by providing social tools for employees, little has been done to leverage social technology in the first element of the innovation value chain: idea generation. Instead, they are mostly centered on idea conversion and diffusion processes (see Figure 5). Please see the appendix for details.

However, none of the current in-market offerings focuses on sparking creativity for idea generation at a large scale. smartSparq focuses not only on the idea generation phase, but automates the process of connecting different people in the organization in order to spark creativity among different fields and disciplines. One product—Illumin8—does provide features to facilitate idea generation, but unlike smartSparq, it does not contain any social features to allow multiple people to participate in the idea generation effort.

Based on this analysis, there seems to be a gap in the innovation process; current software does not harness the collective power of the organization to generate more radical ideas. However, social software like smartSparq has the potential to radically transform the way ideas are created in organizations.



Design

Design

Our final design is a web application that uses machine learning, crowdsourcing, and some simple time-tested gamification techniques in order to facilitate connections between individuals and improve the chances of serendipitous discovery in large organizations. We designed a system that goes beyond simply plugging in the latest social software phenomenon (e.g., “Farmville”) into the enterprise setting to create something like “Enterpriseville”. Instead, we took cues from the social sciences to design an approach based on observed human behavior and insight in the context of a large organization. smartSparq is the result of this focused approach.

Assumptions

There were a number of assumptions we made about the project when constructing the design. First, we recognize that there are a wide variety

of cultures and structures found in large organizations, but assume that smartSparq can be tailored to fit the needs of most organizations. For example, incentives, information available for the crunching by the Serendipity Machine, leaderboards, etc., are all assumed to be customizable to some degree, even if this customization is not available in the current prototype.

We assume that smartSparq works best in large organizations--those in excess of 300, and ideally those of 1,000 or greater with at least some employees that work away from headquarters. Anecdotally, we found that there is an inflection point around the 300-person mark where additional process, bureaucracy, and breakdowns in communication start to occur⁵.

⁵ For a visual analysis of the relationship of patent generation and organization size,

One of the initial pieces of feedback about smartSparq was how the ideas generated transition to product roadmaps or product plans. We deliberately do not deal with the other steps of the Innovation Value Chain framework (Idea Conversion and Idea Diffusion), instead focusing primarily on the Idea Generation phase. The design assumes that once smartSparq is implemented in an organization, it would simply integrate into a more general project management tool, where the last two phases of the Innovation Value Chain framework would be applied.

In addition, the smartSparq platform does not operate in a vacuum; it is built on the premise that there needs to be a corpus of information available that provides the Serendipity Machine enough information to work

see <http://vis.berkeley.edu/courses/cs294-10-sp11/wiki/index.php/A2->

effectively. The larger the corpus of information provided by the organization to the platform, the greater chance that serendipitous discovery can take place.

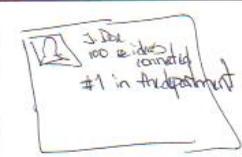
Finally, we consider smartSparq to be a platform based on the Serendipity Machine (which powers the algorithmic portion of the product) since an organization could customize it to their specific needs. For example, the type of information available, the types of challenges provided, the gamification options (like leaderboard design or incentives), or even development of an API, could all allow the system to be tailored to the organization.

Name

Title **Idea Tracker**

Description
A profile or achievement system that pushes you to generate more ideas

What are its features & attributes? (adjectives)
Quantitative
Social



*Use guilt to get more participation
"80% of your department has more ideas than you"
*But also small achievements

Name

Title **Dark Idea**

Description
A system that challenges assumption about how things are done
Minus your data and presents you with contradictions?
What are its features & attributes? (adjectives)
Provocative
Negative

How would a detergent without packaging look like?



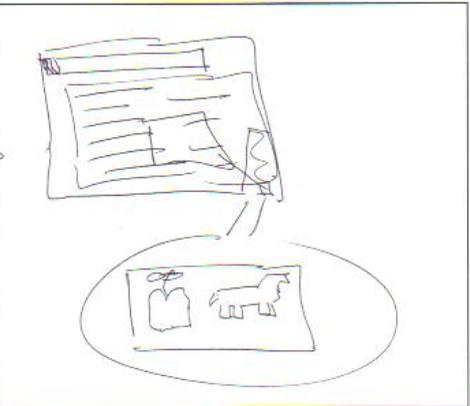
Or deliberately black out a portion of an idea to create thought:
"A document might system that does ~~XXX~~ with collab. filtering."

Name

Title **Metaphor Maker**

Description
A system that mines your documents and finds adjectives
↳ It later presents images of metaphors that meet these adjectives

What are its features & attributes? (adjectives)
Visual
Informed



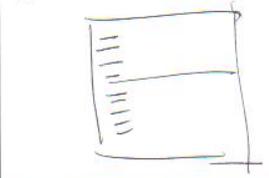
Name **Daily bomb**

Title

Description
Provides a personalized digest of trends in the industry and what others are doing

What are its features & attributes? (adjectives)
Organized
Expected
Frequent

Aggregates data from SMM
Compares to a profile
Aggregates data from public internal channels



Alternatively → a dashboard

Figure 7. A selection of early smartSparg concepts. Over 60 concepts were created before the final smartSparg design.

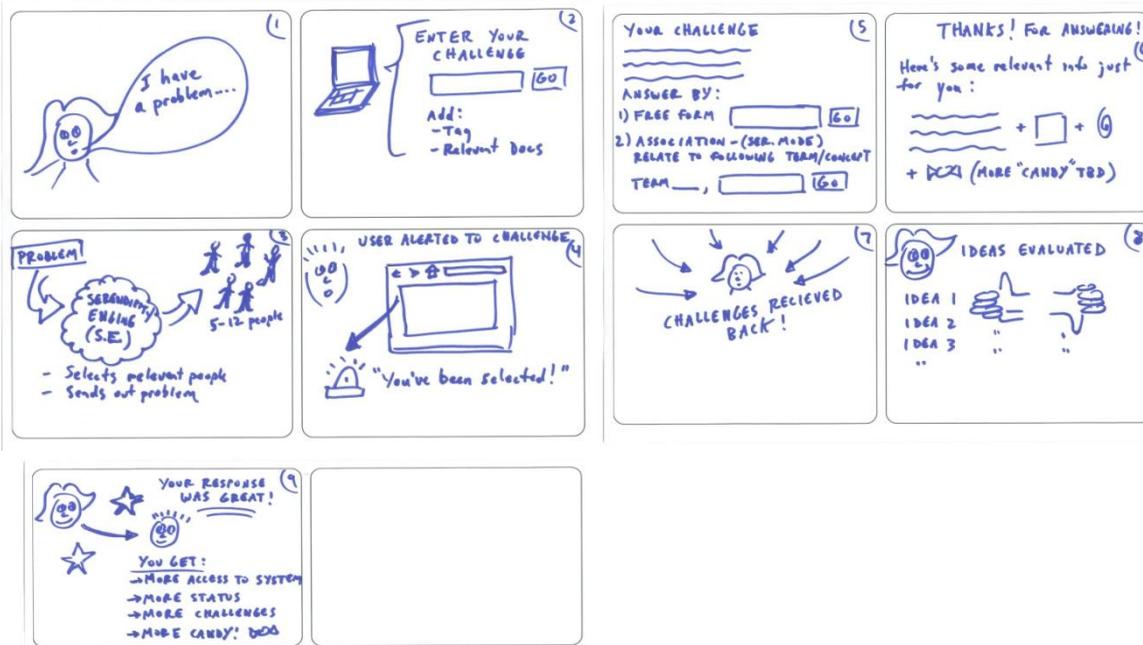


Figure 8. Initial smartSparq storyboards

Concept Generation Phase

When we were reviewing literature early in the process, we continued to come across the idea that many ideas in organizations were sparked when people were able to connect ideas. This original “thought bomb” approach, backed up by initial in-person interviews, was a key insight on what would develop into our smartSparq prototype. With the needs assessment and literature review as a guide, we did a number of group brainstorming and individual concepting sessions to generate possible solutions for a “thought bomb” application. Over 60 initial concepts were created, which included a sketch, brief title and description, and a listing of features and attributes (Figure 7). After these initial concepts, we continued to build on each of them over the next few weeks through additional research and group design sessions.

Visual Design: Storyboards, Wireframes, and Visual Systems

We used three main techniques for developing the smartSparq user interface: storyboarding, wireframing, and an interactive click-through prototype. Each of these artifacts provided a blueprint for the development of the web application.

Storyboards

Following the concept generation phase, we developed pen-and-paper storyboards in order to ensure that our concepts and use cases were well-connected. Rather than spending many hours revising higher fidelity wireframes or visual mockups, we found the presentation of storyboards to be a very valuable and time-saving step. Storyboards presented high level illustrations of the main smartSparq components and allowed us to work through multi-step processes, like submitting and contributing

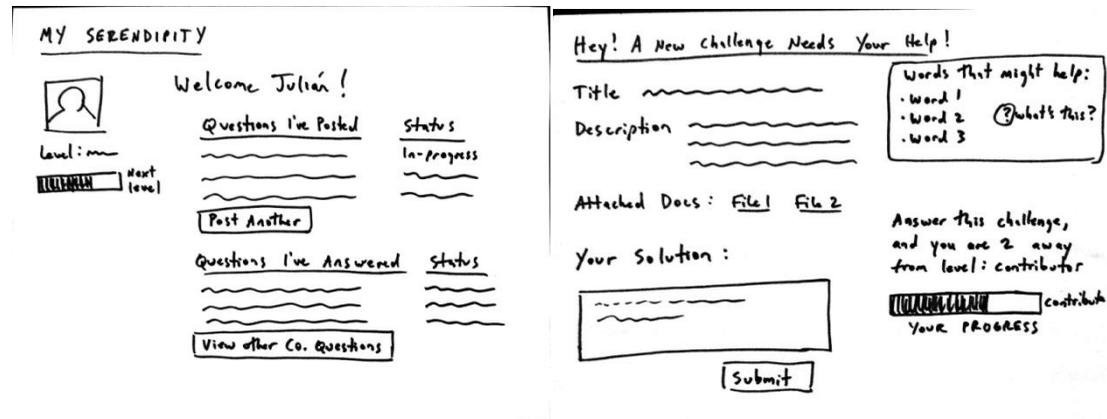


Figure 9. Early homepage (left) and challenge page (right)

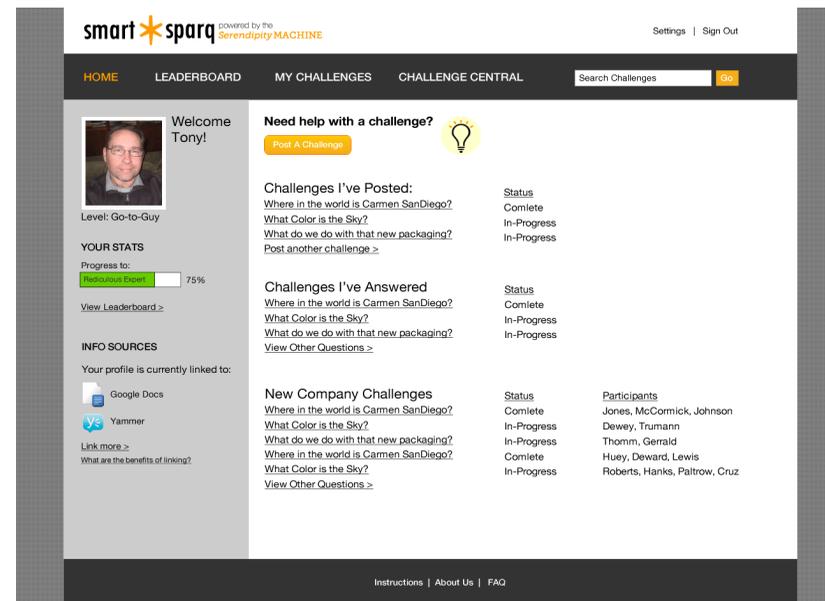


Figure 10. smartSparq web application visual design

challenges. Storyboards were also discussed with later-stage interviewees in order to get their first impressions of the system (Figure 8).

Low and Hi-Fi Wireframes

After working through a number of storyboards, we developed sketches of each component of the web application. Again, sketching allowed us to not only receive honest, initial feedback from our interviewees, but provided a way to quickly iterate on our design without having to rework more detailed wireframes (Figure 9). Once we had discussed and revised our sketches, we created higher fidelity wireframes for the web application, including challenge functionality for both posting and receiving challenges, a central dashboard, challenge notifications, and a page to evaluate challenge solutions. Wireframes were used to ensure that the backend capability of

smartSparq matched the front-end user interface.

Interactive Prototype

After creating high-fidelity wireframes, click-through interactivity was added to further solidify design decisions and to use as an interactive prototype for usability testing. Interactivity was added to the major tasks of the application, as well as application agnostic functionality like signing in and account options. The prototype was posted to the web to simulate web application behavior. It was built using Adobe Fireworks.

Take the click-through prototype for a test-drive:
<http://smartsparq.com/prototype/0.1%20Sign%20In.htm>

Visual Design

The last step in the design process was to establish a visual design template to help guide smartSparq css development. We set a goal of



Figure 11. smartSparq usability testing

creating a clean, easy-to-use design that would be kept fairly simple to speed implementation. We created a few different visual designs and chose a final candidate for implementation (Figure 10).

Testing and Iteration

We returned to two of the companies from our original user needs research and conducted on-site usability interviews, using the interactive prototype (see Figure 11). We intended to obtain additional feedback about how to refine the user interface prior to the implementation of the functioning smartSparq prototype. Specifically, the testing had the following goals:

- Understand whether a target persona is motivated to use smartSparq as a tool to improve innovation within large organizations

- Determine if a persona is able to use the smartSparq web application interface effectively for the following tasks (in priority order):
 1. posting a task
 2. responding to a challenge
 3. evaluating a challenge answer
 4. viewing leader board information
 5. signing into an account
 6. changing account settings
- Discover the main stumbling blocks preventing or hindering use of the smartSparq application
- Understand which tasks need further explanation or documentation

For each session, scenarios were presented and each tester was asked to work with the interactive prototype and make commentary in a modified think aloud format. Following the completion of the set of tasks, users

were asked for their feedback about what they liked and didn't like about the application and potential areas for improvement. The full usability protocol is available in the appendix.

User testing provided the opportunity to make final decisions about some functionality that would later impact the technical implementation. Specifically, the user testing resulted in the following findings and changes to the final smartSparq, pre-production prototype:

- Users can view challenges that were not routed to them, and may search for related challenges that are completed. *Key insight:* Users should be able to view all challenges as a source of knowledge sharing. Searching provides a user experience enhancement.
- Users that want to get involved with challenges not

initially assigned to them can contact the challenge creator. *Key insight:* Certain users may have key insights that could help solve a challenge.

However, to avoid building a communications platform, the challenge poster is kept anonymous until deciding to reach out to the user. In addition, challenge creators and responders remain anonymous to avoid politicizing challenges and prevent influence from the organizational hierarchy.

- The information presented to a responder after they complete a challenge is related specifically to the challenge and not the person. *Key insight:* Since a person may answer multiple challenges over a period of days or weeks, information relevant only to that person would quickly

become stale. In addition, presenting relevant challenge information may lead to further serendipitous ideas.

- A counter is provided that tracks the cumulative number of people that have participated in the challenge presented to the user. *Key insight:* Improving the game mechanics and competitive information will help fuel system participation.

A number of additional changes were made based on user testing, including added additional help information and "what's this" tooltips, making the "share challenge with a friend" link more prominent, and some miscellaneous messaging.

Technical Approach and Implementation

We designed our technical architecture (see Figure 13) with the following principles in mind:

- **Flexibility:** Because we used an Agile software development approach, frequent iteration formed a key part of moving our design forward. This meant that our code and platform had to remain flexible as requirements changed.
- **Portability:** In part due to the requirements above, and in part to prepare for changing user needs and volume, we needed to ensure that the code was easily migrated from one location--or even platform--to another.
- **Scalability:** To prepare for increases in volume, we chose a platform and code that would obviate any scaling

	acquisition (t ₁)	agreement	...	steam	temperature	wii	zoo (t _n)
Document 1	0.34	0.10		0.00	0.10	0.00	0.00
Document 2	0.05	0.00		0.00	0.30	0.40	0.30
...							

Table 1. A representation of the Vector Space Model

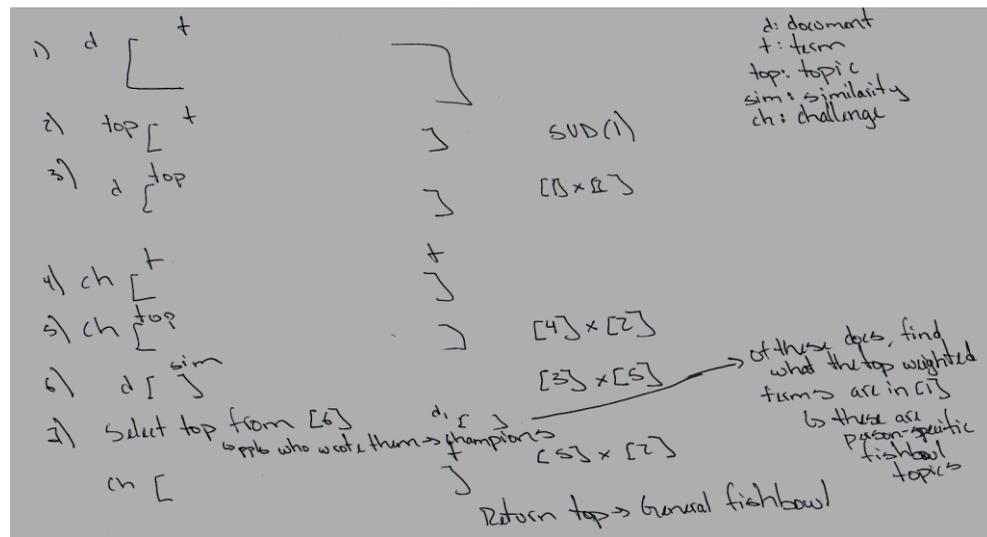


Figure 12. Early concept of the Serendipity Machine

issues up to an extremely high threshold.

- **Bodacity:** As we envisioned it, the design had to be a state-of-the-art platform, worthy of the team who conceived it, the advisor who molded it, and the school that inspired it. Quite simply, there was no option other than to deliver an architecture unparalleled in its awesomeness.

SmartSparq’s core engine is powered by the top-secret Serendipity Machine algorithm (see Figure 12). The Machine runs atop the computationally mighty Apache Hadoop platform that powers many of the clusters deployed by the major search engines to deliver automagic type-ahead search completion.

At a high level, the Serendipity Machine consists of indexing, discovery, and retrieval methods. The

indexing process first implements a typical Vector Space Model (VSM) (Manning, Raghavan, & Schütze, 2008). It parses a collection of documents (a corpus) and generates normalized term frequency/inverse document frequency (tf/idf) vectors. This process creates a representation of each document in the collection with a tf/idf value for every term in the corpus. See Table 1.

The discovery process is in charge of finding serendipitous connections between topics. This process determines what topics might be related even if a person would not realize that right away. The Serendipity Machine uses a Singular Value Decomposition (SVD) algorithm to reduce the dimensionality of the document-term matrix and project it to a lower number of dimensions. This process mathematically determines what terms tend to appear together and clusters them in what is called a

“topic space”. SVD decomposition was first used in a technique called Latent Semantic Indexing (LSI) to improve the effectiveness of retrieval systems (Deerwester, Dumais, Furnas, Landauer, & Harshman, 1990). Nevertheless, it has been found to retrieve documents that are somehow related to the query, but are not necessarily what the information seeker was looking for (Soboroff and Nicholas, 2002). For the purposes of our project, however, Singular Value Decomposition is exactly what we need. We intentionally want to find new connections between topics that seem unrelated at first. The curse of the fuzziness of SVD turns out to be a blessing for serendipity. Instead of using SVD to produce accurate result sets, we employ it to produce intentionally semi-related result sets.

The result of executing SVD on the document-term vector results on a term-topic matrix that associates every

term to a number of dimensions. For the purposes of our testing, we reduced the Vector Space to less than 100 dimensions, as Deerwester shows that this number works well to generate new relationships between terms (Deerwester et al., 1990). Later, we use the values in the term-topic matrix to generate a document-topic matrix that represents all documents in the new space.

Both the indexing and discovery process should be executed semi-frequently when new documents are added to the collection. We believe that daily or weekly re-indexing should be enough to keep the Serendipity Machine up to date.

Finally, the retrieval method is executed when new challenges are posted. It receives challenges from the RESTful API and represents them as vectors in the space of the corpus. The Serendipity Machine then transform

those challenge vectors using the term-topic matrix to obtain a challenge-topic matrix. This matrix is multiplied by the document-topic matrix to obtain a similarity value for each document in the corpus. The Serendipity Machine determines which documents in the collection have the most “relevance” (i.e., the highest probability of serendipitous connections) to the challenge. Then, it selects the authors of the most relevant documents and the most highly ranked terms used in those documents. By this process, the engine determines the people to whom the challenge must be sent (based on their previous documents about semi-related terms) and at the same time determines terms that can prime the challenge responder to think differently about the challenge. We call these terms “sparqs” – these sparqs are concepts not directly comprising the challenge itself, but that the engine found might be

related. Both the persons and the sparqs are returned to the service that made the call (the Serendipity Middleware).

The discovery algorithms require a large corpus to find new and interesting connections between terms. Our current implementation assumes an existing corpus. For testing purposes, we used the Enron email corpus made available by the University of Maryland⁶ because it provides a real-world collection of communications that happen in an organization. Future versions of the Serendipity Machine may also include crawling methods to collect documents generated by the users of smartSparq as they connect their profile to information repositories.

The Serendipity Machine uses a modified version of Apache Mahout to

⁶ The dataset was obtained from <http://www-2.cs.cmu.edu/~enron/>

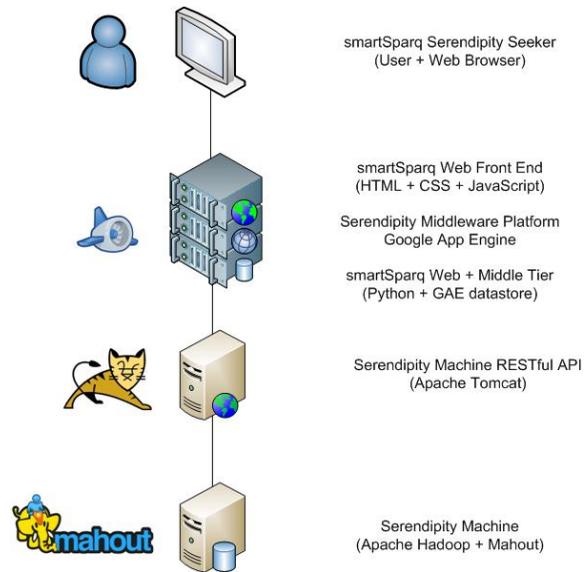


Figure 13. Architecture diagram

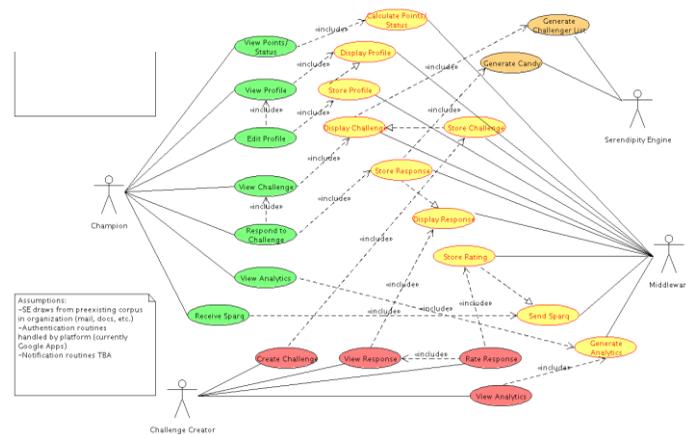


Figure 14. smartSparq use case diagram

parse text from documents, generate document vectors and execute dimensionality reduction. The indexes are stored in Apache Mahout format and a custom application that sits on top of Mahout accesses them when the Serendipity Middleware requests champions and topics. The Serendipity Machine exposes its methods via a RESTful API delivered via the Apache Tomcat application server.

The Serendipity Middleware acts as the glue between the Engine and the application itself. It runs on Google AppEngine, a free Platform as a Service (PaaS) that provides a complete MVC framework and replicated datastore. The Middleware code is written in Python and uses GQL to interact with the GAE datastore.

The SmartSparq front end is composed of HTML, CSS, and

JavaScript. It also runs on GAE alongside the Middleware code.

The code was developed using the Subversion source code version control system.

Final Design

We used a user-centered approach to design smartSparq--that is, we first gathered information about how innovation happens in a variety of large organizations, addressed these needs through initial storyboards and prototypes, and then obtained additional data by observing real end-users to determine the validity of our design. Throughout the process, we strived to keep a few high-level goals in mind:

1. Focus on the “serendipitous” aspects of innovation
2. Ensure that the system includes proper hooks to motivate action

3.

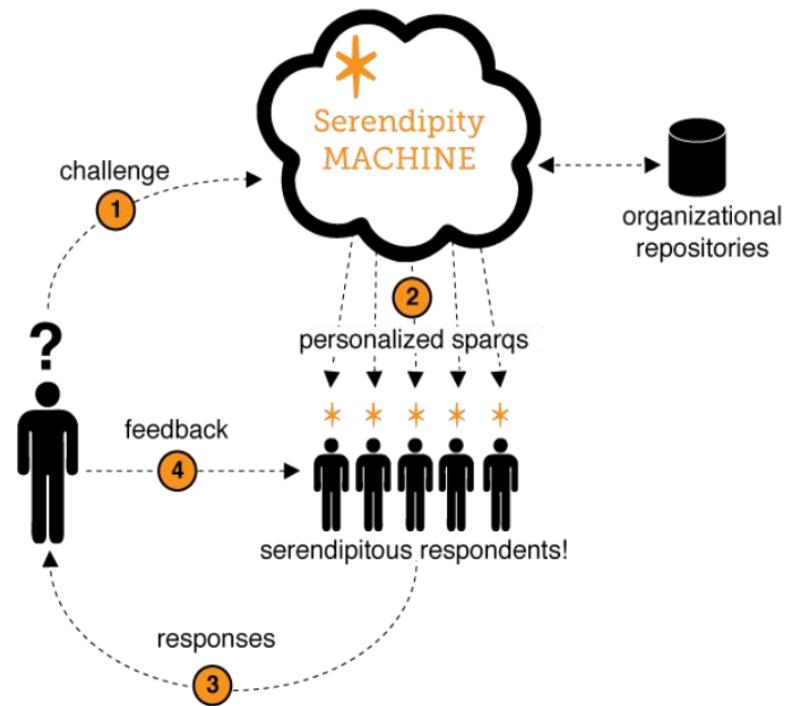


Figure 15. Functional diagram

Use a mix of human computation and automatic computation to achieve the best of both worlds: relevancy and personalization

4. Leverage existing research and an analysis of in-market solutions to guide design decisions

Focus on the Serendipitous aspects of innovation

We placed great emphasis on teasing apart the serendipitous aspects of innovation--how "sparq'ing" these connections between individuals can result in a greater chance for breakthrough innovations. We wanted to unravel how to virtually recreate the types of information exchanged in hallway conversations, lunch discussions, or eavesdropping--many of which were uncovered in our user interviews. Additionally, we aimed our sights at breakthrough innovations -- not simply incremental

improvements to an existing product line. Based on academic research, our interviews, and the comparative analysis, we determined that there is significant opportunity to create a computer curated, personalized solution that could help facilitate these types of transformational solutions. During an interview, one product manager commented that "[happy accidents] certainly happen. More often than not, they happen with something we start off with one use case, and they end up complimenting another." We wanted to create a system that would help encourage these types of complementary connections.

The elements of the design that incorporate these serendipitous aspects:

- The system selects between five and 12 individuals to send challenges to. The literature

- come se!

Hey! You've been specially selected to help with a new challenge!

Three others have responded so far. Be next to submit a great answer.

! Successfully complete just 2 more challenges and improve your rank to: "Contributor" level

To get started, please review steps 1 and 2:

1. Look at the following words as they might help you better answer the challenge:

Mobility

Independence

Handwriting

Energy

? what's this?

Settings

Notification Options

Email Notifications:

On

Off

Web Notifications:

On

Off

Notifications allowed per week:

1

Notifications allowed per day:

1

Show alerts only on:

Monday

Tuesday

Wednesday

Thursday

Friday

Saturday

Sunday

Figure 16. Sparqs displayed to the challenge responder

support on this considers this number to be optimal for electronic brainstorming sessions (Gallupe et al., 1992), specially when more creative answers are expected.

- Sparqs (the priming words), are used to unleash the creative juices in a challenge receiver's mind. Scientific inquiry shows that priming the subject ahead of time may help created connections and moments of serendipity (Johansson, 2006). The "sparq" words are algorithmically generated based on the relatedness to the challenge and drawn from the information corpus (see Figure 16 for an example).
- The system can route intelligently based on one's current field of work, previous activity, or an inferred relationship between one's expertise and the challenge.

The system finds "related" or "fresh" views to the challenge, not necessarily the most traditionally "appropriate" users. This fosters out-of-the-box thinking and provides the opportunity for intersectional ideas instead of incremental ones.

- A customizable notification system so that users can choose how often and which medium they want to see alerts -- email, or in-browser alerts (see Figure 17).

Motivation

Much of the smartSparq product is built around the idea of motivating users to action. In a system that depends upon contribution, what's the best way to encourage participation? We use some light game mechanics to assist with extrinsic motivation. However, our philosophy was not to just attach game mechanics on top of

Figure 17. Notification settings

Thanks for taking the time to help your colleagues and the organization!

By answering challenges, you are helping the system benefit everyone. Based on your answers, the SerendipityMachine has found some information that you might find relevant and helpful:



Interested in boosting your level? Consider posting your own challenge. Plus, the more you answer, the more relevant documents can find you.



Want to get in touch with the challenger? Send them a Serendipity Machine Mail.

[Send SE-Mail Now >](#)

RELATED INFORMATION TO THIS CHALLENGE

[Why am I getting this stuff?](#)

PEOPLE:



Goldilocks Powell
Product Manager

[✉ goldl@acme.com](mailto:goldl@acme.com)
[☎ \(123\) 123-1234](tel:(123)123-1234)



Bear Withme
Accountant

[✉ bear@acme.com](mailto:bear@acme.com)
[☎ \(123\) 123-1234](tel:(123)123-1234)



Wolf Johnson
Chief Scientist

[✉ wolf@acme.com](mailto:wolf@acme.com)
[☎ \(123\) 123-1234](tel:(123)123-1234)

DOCUMENTS:

From the Acme Wiki:

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From the Acme Yammer Feed:



Goldilocks

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Bear Withme

Figure 18. smartSparq presents the user with useful information after they complete a challenge

You've received new answers!



By rating the answers, you increase your score and have the potential to advance to the next level.

The Challenge

Title: This is the title of the challenge

Description:

This is the description of the challenge with corresponding text to respond to. It can go on and on for a few lines anyway here depending on how many lines were filled out.

Supporting Files:

[Download File 1 \(4 MB\)](#)

[Download File 2 \(375 K\)](#)

Challenge Answer



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Figure 19. smartSparq allows users to rate responses

Leaderboard

Here's your current company rank:

Sultan of Serendipity (2 person)
Genius (5 people)
Expert (35 people)
Discoverer (109 people)
Contributor (You and 276 other people)
Novice (298) people)
Starter (39 people people)

Here's your current department rank:

Ken: Expert
Jim: Contributor
You: Contributor

Figure 20. Contextual leaderboards

the web application, but think about ways through simple messaging, social cues, and basic levels and leaderboards, create a game with a purpose instead of a purpose with a game. One interviewee commented that game mechanics can apply to a whole variety of tasks: "...You could think of when you have a blog post, how do you evaluate that? Ratings are game mechanics. Views are game mechanics. Comments are game mechanics. This is feedback that you have."

The elements of the design that incorporate motivational features and functionality:

- Prominent, but simple messaging and tips encouraging people to improve their rank. For example, "By rating the answers, you increase your chances of advancing to the next level."

In addition, making people feel special or exclusive based on messaging. For example, "You've been specially selected to help..."(see Figure 16)

- Messaging indicating what others have done: how many other answers were submitted, (see Figure 16)
- Providing information and connections to others in the organization that the user might find helpful as a thank-you for completing challenges (see Figure 18).
- Leaderboards that present the user with their rank relative not only to others in the organization, but also current department, so that they have direct indication of how they are performing (see Figure 20).
- We avoided the idea of a reward "catalog" because we concluded that over time the excitement and participation

Identified Need	smartSparq Design Element
Risk tolerance	Challenge alerts (sparqs) provide a low-risk, easy-to-achieve way for people to participate in innovation activities in a more active way, even if it's not a core part of their job function. By getting employees into the habit of thinking about innovation, smartSparq increases the likelihood of serendipitous connections.
Ideation	smartSparq connects ideas using intelligent routing in order to maximize the chances that connections can be made. Priming participants with semi-related topics that they can use in their responses to sparqs provide a new perspective.
Bringing remote people closer together	A web-based system allows any employee, whether they are remote or not, to participate in innovation activities without missing out in as many "water cooler moments." By mining documents, smartSparq levels the playing field for remote employees and increases participation of all employees regardless of location.
Motivation, including elements of fun and satisfaction	The system addresses both intrinsic and extrinsic motivators by utilizing game mechanics and principles of social psychology in order to encourage participation from a wide variety of individuals from across the organization.
Selling, championing, and justifying ideas	Through leaderboards, system analytics, and company visibility, organization members (including remote employees) that want to champion their ideas have an easier time gaining support for their ideas

Table 2. Identified needs and design elements

wear off. Instead, we aimed to foster intrinsic motivation where possible. Nevertheless, we planned to create a system with some variability so that we could address users purely after extrinsic rewards as well.

- Encouraged people to increase the chances that the system would be helpful to them by adding messaging encouraging them to link their profile to additional sources of information

Create a system that incorporates a mix of human and computer computation

We designed a system that takes the information from a wide variety of sources, incorporating data mining techniques with some serendipitous randomness thrown in, as well as human judgment, to increase the "hit" rate for successful innovation. We tried to incorporate ethics and privacy

sensitivity into our design through increased user control via account settings. A Manager of Grassroots Innovation at one organization echoed the importance of information in surfacing better content: "The main challenge is getting enough fertilizer on the bottom there to get these ideas going and to try stuff out." [11]

The functional design elements that incorporate some these systems:

- Present the user with useful and relevant information based on a challenge in which they have participated (see Figure 18).
- Build a Serendipity Machine that mines information repositories to discover new connections between topics
- Create a system smart enough to route information intelligently to users. The number of challenges routed to

users is done based on the serendipitous connections inferred by the Serendipity Machine but also with frequency in mind.

- Allow administrators of the system to increase the amount of data in the corpus, while providing end-users with some control over which information the system can sample. However, we wanted to create a system that made it clear that the more information they provided to the Serendipity Machine, the greater the likelihood that they would benefit from the system.
- Provide the ability for people, and not just algorithms, to rate and provide feedback for each response. smartSparq uses a simple binary ratings system for users to show their support for an answer. Future smartSparq versions might

include a more granular rating system (see Figure 19).

Design Elements based on User Needs

Many of our final design decisions were based on key insights derived directly from the user needs assessment. Those design elements are detailed in Table 2.



**Future Work
and
Implications**

Future work and Implications

We identified a number of design and functionality improvements to add to smartSparq. We have listed a few of these areas in more detail.

Collaborative filtering

Our current approach in the Serendipity Machine uses Singular Value Decomposition to automatically reduce the dimensionality of the term space and find new connections. Soboroff and Nicholas (2002) proposed the usage of collaborative filtering to improve those connections between topics. We believe that a future version of the Serendipity Machine may benefit from introducing collaborative filtering in the indexing process. In typical collaborative filtering, users have preference value for certain items. The recommender system uses these preference values to infer a preference for the items that have not been rated. In our case, we

could use authorship or membership information to construct a user-item preference matrix. When the Serendipity Machine crawls information repositories, it could generate a user-document matrix and assign preference values. For example, if a user is the author of a document, the preference might be 3; if the user has “Liked” the document (this value could be obtained from message feeds such as Yammer or SharePoint), the preference might be 2. Finally the system could assign preference values of 1 to the documents that have been read by the user. A collaborative filtering technique could then be used to infer preference values to those documents that the user is not aware of. This would leverage information about similar users’ preferences (or about similar documents’ preferences) to provide recommendations about other documents the user may be interested in.

The generated user-document preference matrix could then be multiplied by a document-term matrix to generate user-term profiles based on collaborative filtering. Since document-term matrices tend to be very sparse, this approach could fill in inferred values for terms the user is not an expert on, based on latent connections between users, documents, and terms.

Project ownership

Some of our interviewees mentioned that the feeling of ownership is critical to the development of radical ideas. We envision that smartSparq may streamline this process by associating the name of the person who solved a challenge to the idea itself. In this way, employees may have a strong motivation to submit ideas that are likely to succeed, might advocate for them in future stages of the process (idea selection and development), and may even contribute to the project as it

evolves. Future versions of smartSparq may provide tools or reports to help build teams based on interest and their participation in the smartSparq system.

Project follow-up

One other recurrent theme in the interviews was the need to track of ideas as they move through the Innovation Value Chain. Employees want to be able to see where their ideas end up. Visibility of the whole innovation process increases credibility in the system and motivates people to keep participating. We envision that smartSparq may be integrated with other idea management or project management tools to (1) transfer the ideas generated in smartSparq to the idea funnel and (2) provide feedback and updates to the participants that contributed to an idea. For example, smartSparq could have interfaces to some of the tools that were mentioned in the

“Competitive Analysis” section to push ideas and retrieve project status. Employees could then keep track of their contributions and take pride when they end up in successful developments.

Reporting and integration

An avenue of future work might be the development of reports both for management and users. Executives might find value on discovering who the most active contributors are, the kinds of topics that get more traction, and the serendipitous ideas that have been unveiled in smartSparq. Managers could use those reports in performance reviews to reward employees who contribute innovative ideas or to highlight them in internal newsletters and meetings. By knowing that management keeps track of the contributions to smartSparq, employees might be more motivated to participate.

Additionally, smartSparq might send frequent reports to users that give them more information about themselves. As the Serendipity Machine learns more about the users with their participation, they might become interested in knowing more about themselves (just as people who fill out the Myers-Briggs questionnaire are interested in getting the results). For example, a report that highlights the topics that they have responded challenges about, or the departments that they have helped, might motivate employees who consider themselves experts in certain fields (achievers) or those who want to increase their reach by helping multiple departments (explorers). For a more detailed description of different gaming types, see Bartle (1996).

Implications for leadership

smartSparq should not be implemented in isolation. Innovation is part of a larger process that requires

a large number of elements in place. Companies embracing social software for idea generation will require a shift in management style. The old command-and-control model would not work effectively in an environment where radical innovation can come (and is expected) from all employees. Leaders will require a much more open, transparent and collaborative style if they truly want to reap the benefits of social idea generation.

Organizations that implement the techniques here suggested should expect a dramatic shift in the innovation mix. Employees who use social software to facilitate serendipitous connections are more likely to come up with new, radical ideas instead of the incremental innovations of the past. However, customers expect companies to excel in both incremental and radical innovation. Current customers will

still need small improvements to existing services so that they can build trust in the company. Thus, managers need to make sure that, although radical innovation may now be more likely and look more exciting, a certain number of incremental ideas are pursued to keep current customers happy. In the early stages of a product or service, managers may implement various incremental innovations until the market is established. Once the product is stable, managers need to move forward only those incremental innovations that represent a differentiation opportunity (Moore, 2007). This embodies a fundamental change in the way ideas are selected, converted, and diffused. Fewer incremental ideas will see the light, but more radical ideas will be explored.

Companies that implement social idea generation will also expect an increase in the pace of innovation. More ideas

than ever before will be generated. The innovation pipeline will be much larger and managers will need to deal with many ideas at the time. In the past, the idea funnel was evaluated using sales forecasts or business cases. These techniques may work well for incremental innovation. However, breakthrough ideas cannot be measured by standard metrics. By their very nature, radical ideas have not been implemented before—financial models do not exist for them, customers in focus groups will not show purchasing intention, and market analysts will not have measured their impact. The only way in which radical ideas can be evaluated is by actually pursuing them and testing them.

The results of radical innovations are uncertain and therefore management will need to deal with uncertainty as well. Organizations that adopt social idea generation will need to run

experiments to quickly test new ideas and evaluate their potential. Managers should cede some of their authority and control to employees—allowing them to take ownership of their ideas. The role of leadership in this paradigm is to provide the means to allow employees to experiment cheaply and quickly. When exploring new radical ideas, companies will fail more often because they will experiment more. But at the same time, they need to make sure that they fail sooner as well to avoid overspending. Management needs to give employees quick buy-in to run small prototypes and test them. Concurrently, management needs to measure the process closely in order to both detect growth opportunities and kill prospects where the tests do not show results. Management also should communicate that failure is expected in an environment where experimentation is encouraged. Employees should not be

disappointed if their first attempts do not succeed. It is very likely that most of their attempts will fail, but by experimenting more it is also more likely that they will discover new opportunities for the organization.

Implications for employees

Employees who belong to organizations that implement smartSparq will also require a shift in the way they get their job done. Social idea generation represents an increased sense of responsibility for every employee. Innovation is no longer limited to a select group—it is now expected from everyone.

An employee who generates a new idea by combining two concepts that had not been combined before will take pride of her contributions. Moreover, if the organization allows the employee to pursue her idea and move it forward, the employee will take ownership of the project and will

do her best to make sure the idea is exploited. This could have positive effects for the employee (by increasing her sense of belonging) and for the company (by increasing loyalty and motivation).

There are however, certain risks that should be taken into account. When more information is shared among several people in the organization, the risk of losing confidentiality is increased. Employees will need to understand better what information can be shared outside of the organization and what information should remain confidential. In this new paradigm where the boundaries between public and private spaces are blurring, employees will need to be very careful about their communications. Although transparency within the organization will be embraced, communications with outside parties need to protect

privacy and ensure that no confidential information is revealed.

Finally, the increased flow of information to the individual may also result in some undesirable consequences. Employees may suffer from information overload if they are only connected to others via online channels. They may find it difficult to identify the needle in the haystack of information available. Similarly, their attention span may be reduced if they are constantly exposed to new people and new topics. Although this may be beneficial in terms of idea generation, some jobs may require long-term relationships with others in the organization and a specialized area of expertise. Internal coaching may be provided to help employees determine the level of interaction that they need with both people in their unit and people outside their unit. Similarly, coaching could be provided to help employees deal with larger amounts

of information and reduced attention spans.



Conclusion

Conclusion

smartSparq and the Serendipity Machine incorporate nearly every aspect of our collective School of Information coursework, including information retrieval, computer mediated communication, user experience research and usability, user interface design, web architecture and application development, and analysis of information systems. Our goal was to not only understand what drives innovation, specifically idea generation, but to employ a user-centered design process to create a working prototype to “manufacture serendipity” in larger organizations. Social software by itself will not solve all of the problems and issues surrounding a company’s ability to innovate effectively. However, we believe that when new web technologies are matched effectively with an organization’s processes,

structure, and people, the chances to improve effective innovation, particularly idea generation, are improved dramatically.

Ironically, we could have used our own smartSparq application for our design process: our final product was itself the endpoint of a meandering journey of exploration filled with Godot-like moments of waiting for inspiration to emerge. Manufactured serendipity is not an oxymoron, but it is a paradox: one can only find the thing he wants when he stops looking for it. We were only able to move forward by acknowledging this fact in our design, which relies heavily on the “chance” generated by the synergistic interplay of human and non-human (i.e., computational) actors. Through the creation of this prototype, we hope to inspire both contemporary innovation and future insight by

helping organizations manufacture their own serendipitous discoveries.

About us

Anthony Lincoln is a MIMS candidate at the UC Berkeley School of Information. He has over 15 years of experience in information management for private-sector companies including Netscape Communications and public-sector institutions such as Lawrence Berkeley National Laboratory. His areas of interest include information in organizations, economic analyses of systems and networks, and information overload.

Julián Limón Núñez is a MIMS candidate and a Fulbright scholar at the UC Berkeley School of Information. He has a bachelor’s degree in computer science, as well as 5-year management consulting experiences. His main interest is the

usage of social media and information organization and retrieval techniques to foster collaboration and knowledge transfer in organizations.

David Rolnitzky is a MIMS candidate at the UC Berkeley School of Information, where he focuses on user experience design and usability. He has 10 years of industry experience shaping consumer technology as a designer, product manager, and marketer.

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Appendix

Appendix

Full List of Initial Questions for Interviews

Organizational and workplace environment:

Name and Role?

How many people are in charge of innovation/new product development? What is their typical background/role?

What's your work environment like? What percentage are you/people in your position in front of a computer? Connected via a smartphone? How critical are these to your success and product development/coming up with innovative ideas?

How much do you work with virtual teams?

Idea generation:

How do you come up with new product ideas in your organization?

How do you recognize good/innovative ideas? How are they surfaced?

Where do most ideas come from? (customers, suppliers, outsiders, people in your group, people in other groups)?

What's the current process for developing these new products ideas?

What methods have you found that work/don't work? What tools (if any) do you use for this process?

What do you need (tools, organizational support, etc.) in order to come up with innovative ideas?

What specific tools do you employ to drive innovation? What do you like/dislike about them?

How often does your invention process/new product development process happen due to "accidental" circumstances (by chance)?

Can you give us an example of a successful idea that was generated in the organization? How was that idea generated?

What motivates innovative ideas at the organization?

If you work with virtual teams, how is your innovation process different?

Innovation Process:

How do you determine which ideas to move forward?

What's the creative process like at the organization/group? How much time do you dedicate to this?

How do you try to foster creativity? Do you do that every day, every time you have a new project, etc.?

What's an example of an idea that you/others thought that was good that was never developed? Why was it never developed?

Do ideas come when you're trying to innovate or when you're doing something else?

Which are more important (if any) in the process? Systems, processes, tools, people?

Challenges:

What are your organizational challenges to innovation?

Do you think that getting more information/interacting with more people fosters innovation? How so?

[Alternatively]Does information overload hinder innovation or the new product development process? How so?

Success Measurement:

What do you consider a successful innovation?

How do you measure innovative results and outcomes?

User Needs Assessment List of Interviews

Reference Number	Interview Company	Person/position Interviewed	Date
1	Consumer Software Company	Research Scientist	2/22/11
2	Consumer Software Company	Sr. Product Manager	2/22/11
3	Consumer Packaged Goods Company	Ideas Network Lead	2/24/11
4	Consumer Packaged Goods Company	Brand Marketing Manager, Corporate Innovation Team	2/24/11
5	Consumer Packaged Goods Company #2	Associate Brand Manager, Innovation	3/1/11
6	Consumer Packaged Goods Company #2	Brand Manager, Innovation	3/2/11
7 (2 people together)	Networking Company	Manager, Collaboration Software Group Manager, Employee Engagement Team	3/4/11
8	Networking Company	Product Manager	3/4/2011
9	Social Networking Company	Product Manager	3/10/11
10 (2 people together)	Social Networking Company	CTO, Product Manager	3/10/11
11	Business Management Software Company	Manager, Grassroots Innovation, Innovation Center	3/29/11
12	Business Management Software Company	Manager, Technology Strategy Team	3/29/11
13 (3 people together)	Business Management Software Company	Managers, Service Innovation Team	3/29/11
14	Business Management Software Company	Director of Community Network	3/14/11
TOTAL: 18			

Personas

Developer/Engineer - Gary Jensen

Age: 34

Location: Omaha, Nebraska

Job Title: Developer - Internal Tools

Organization: 5,000 employee software company

Responsibilities: Develops internal company tools used for bug tracking

“Teleconferencing is always hard because there’s no way to include people all over the world without being really early or late for someone. There is a big difference between physical and virtually teams...Bringing people together is absolutely a need.”

- Gary Jensen

Gary is a 34 year old developer with over 12 years of experience developing software for large corporations. He’s lived in the Bay Area for most of his life. He lives with his wife of 10 years and their 3 year old daughter in Omaha. Gary has a bachelors degree in information technology. In his spare time he plays the guitar in a small blues band.

Gary moved to Nebraska a few years ago when his wife took a position as superintendent of the local school district. He’s always worked for large companies and enjoys the stability and reasonable hours they provide. Though he uses the latest technology to stay connected to people back at headquarters in San Jose, California--using wikis, email, video conferencing, etc. -- he still feel somewhat disconnected to the organization.

Behavior/Involvement with the Innovation Process

- Knows certain aspects of the products very well. He has been working on them for years and is very familiar with those in his small department
- Has ideas about how products and services can be improved, but generally does not participate in the decision making process
- Does not know (or is not concerned with) the general strategy for the products
- Has limited contacts in the organization beyond his department
- He loves when he gets to go to the headquarters. He feels a lot gets done when he is there and that his ideas are heard.

Information/Product Needs

- Would like to find a way to have his ideas heard and ultimately incorporate them into company products
- Wants to feel more connected to the organization, through exposure to ideas and discussions with co-workers
- Wants to get a sense of what other people in the organization are doing

Product Manager - Patrick Hodge

Age: 43

Location: San Francisco, CA

Job Title: Sr. Product Manager

Organization: 7,500 employee software company

Responsibilities: Responsible for P&L for a large consumer software product line

“You won’t find any clean whiteboards around here. I get tons of email, to the point where it’s really overwhelming. Some people use IM, but I can’t throw in another thing and start using it. I’m already reading a couple hundred of emails a day, and I can’t imagine adding instant messaging on top of that.”

- Patrick Hodge

Patrick is a 43 year old Senior Product Manager at a very large software company. He’s been employed in the high-tech industry for nearly twenty years, mostly in marketing or product management roles. He’s been with the company for five years and responsible for one of their larger product lines. He has an MBA from a top-20 school in business management. Patrick is married and lives with his wife in a suburb of San Francisco.

Patrick is almost always “on” -- connected to people within his organization nearly around the clock. He constantly is managing messages on his blackberry, taking phone calls in the car, and frequently works long hours at home after a day at the office. He manages a team of about 20 people that work on his product line. He feels a bit overwhelmed by the volume of communications that he must manage on a daily basis, whether for internal team members, others in the organization, or external press.

Behavior/Involvement with the Innovation Process

- Decides the long-term strategy for the product
- Talks to large customers and opinion leaders to gather needs and identify trends in the industry
- Defines the product road map
- Receives ideas from customers, partners, suppliers, and colleagues
- Prioritizes ideas and decides on what ideas to move forward

- Feels a great sense of pride in his work and the opportunity to positively impact millions of users

Information/Product Needs

- Needs a way to stay connected to his team often
- Needs to be able to synthesize information from a variety of sources, including members of his team, other teams in the organization, management, and outside constituents
- Needs to find a balance between incremental innovation and groundbreaking ideas that will represent a larger opportunity
- Needs to be able to “sell” his ideas, and those of his team to others in the organization and company leadership

Brand Marketing Manager, Innovation - Kathy Wang

Age: 32

Location: Cincinnati, Ohio

Job Title: Brand Marketing Manager, Innovation Team

Organization: 3000 employee consumer packaged goods company

Responsibilities: Tasked with figuring out consumer needs, technical feasibility, and size of market for potential new products.

What we don't have is a way to incubate ideas--we have no team dedicated to this. I don't think we have successfully found a great idea that does not belong to a business unit already. As a member of the Innovation Team, we believe that we should have an entrepreneur mindset, to build-learn-prove. But it's hard to do if you don't have the resources to do it and it has been a big struggle for us. As a result, we're really good at fast-following; which means we're often second to market."

- Kathy Wang

Kathy is a 32 year old Brand Marketing and Innovation member tasked with researching and reporting on potential new products as part of the Innovation Team. She has been in marketing and brand management in the packaged goods industry since receiving her MBA in marketing from a top 10 MBA school three years ago. She is single and lives in Cincinnati, Ohio.

Work-life balance is important to her, and she appreciates that most people in the organization feel that 8 hours is a full work day. However, the glacial pace of the organization makes her job a bit more frustrating when it comes to developing products and getting them to market. She feels the organization should be taking more risks, but understands that the reality that being a publicly traded company often means playing conservative and creating profits in the short-term over long-term bets.

Behavior/Involvement with the Innovation Process

- Talks to large current and potential customers to understand their needs
- Analyzes market sizes to identify opportunities for growth
- Creates business cases for new ideas/new products
- Works with the R&D and the sales channel team to identify opportunities
- Understands the importance of "Show and Tells" to push ideas forward

Information/Product Needs

- Keeping a pulse on the new processes and products that are being developed in the R&D group
- Understands the importance of “working the halls” to get an idea of what’s happening in the group and the organization
- Needs to make sure that her groups finds a “home” --meaning a division takes ownership of the ideas and products that the Innovation Team would like to move forward
- Come up with a sophisticated, consistent, and useful way to screen product ideas
- Needs more resources dedicated to incubating new ideas

Lab/R&D/product development/Engineer - Ravi Goyal

Age: 31

Location: Palo Alto, CA

Job Title: Product Research and Development Engineer

Organization: 1500 employee technology company

Responsibilities: Research and develop new technologies that could be used in-product

“Disruptive idea generation is often problematic because of organizational barriers, not because of the lack of ideas...The metrics--performance evaluations of the new research--influence how you balance between crazy, breakthrough innovation, and feature-like innovation--which is immediately relevant for the product and for your metrics. You need to keep a delicate balance between effective (immediate) development and out-of-the-box research.”

- Ravi Goyal

Ravi is a 31 year old researcher and product developer. Ravi has been coding since he was 15. He has a bachelor's degree in computer science from a large and well-respected state university. Ravi spends much of his day trying to invent new algorithms that might in the future be integrated into new company products. He also writes a number of research papers about his work that get published in major technology journals.

Ravi generally works solo in his office, but frequently pairs up with others in the group to flesh-out ideas. He likes the work he's doing, and finds that working on future-looking initiatives is more to his liking than previous roles working as a developer on existing products. He's frequently amazed at the ways in which users end up using technology he's developed--often in ways that he had never imagined or intended.

Behavior/Involvement with the Innovation Process

- Works up to a few months on an idea, and then if he doesn't get buy-in, he abandons the idea
- Ravi frequently pitches his ideas to the different product groups -- often informally over lunch or in more structured meetings.
- Has frequent, personal interactions with other researchers and product developers and gets advice on how to best solve problems he's working on

Information/Product Needs

- Because he used to work directly in the product groups as a developer, he happens to have good relationships with his old product team (unlike some of his peers), though he feels that he wants to feel more connected to other groups
- Has to have an opportunity to work without interruption on a daily basis
- Improved satisfaction by seeing more disruptive ideas getting used by the product team
- Fewer organizational barriers to prevent his ideas and research from integrated into existing, go-to-market products
- Has to have credibility to be able to do his job effectively

Innovation Manager - Maria Lopez

Age: 39

Location: Boston, MA

Job Title: Innovation Manager

Organization: 5,000 employee technology company

Responsibilities: Work on initiatives that help improve innovation and collaboration in the company

“It’ll be interesting to see how we can get back to the folks that have ideas that might not align with our product roadmap, but at the same time not putting a hamper on creativity. Because maybe out of 100 ideas that don’t align with the roadmap, one might be that very disruptive thing that becomes a breakthrough for the company...Employees really want to become more connected to the organization, and there was this gap before we started, where they’d say ‘I have these really great ideas but I don’t know where to share them or how to share them.’ So this gives them an outlet to being heard.”

- Maria Lopez

Maria is a 39 year old Innovation Manager at a large technology company in Boston, MA. She’s worked in a variety of positions, both in technology and in consumer goods throughout her career. She has a general business background, though considers herself pretty savvy with the latest technology. She is a first-adopter for consumer electronics in every sense of the word, and it’s not out of the question for her to wait in line for hours if that means she can get it.

Maria works with a small team on innovation initiatives at the company. Her team focuses on building tools and creating process that can help employees collaborate and come up with innovative ideas. She's been working on a recent initiative that will allow employees to submit new ideas to be considered by the product team. She feels that the current process is a bit broken in that many good ideas are not filtering through to the proper groups, or they lack visibility to turn into real products. She wants to change that.

Behavior/Involvement with the Innovation Process

- Works on a team to create collaboration and innovation tools
- Ran a contest to get employees to submit their new product ideas
- Monitors the internal idea tools and submissions and makes sure they are appropriately filtered to the right department
- "Socializes" ideas with that may be the most popular or ones with the most potential, to senior executives
- Often assists employees to build a business case for their idea

Information/Product Needs

- A way to filter and vet ideas without biasing them
- Finding a way to motivate employees to contribute to the system
- Needs to convince senior executives that these types of initiatives and contests are worth having
- Need to find a way to encourage more break-through/disruptive ideas instead of just incremental product features
- Making sure people know where to go with their ideas -- where they can submit them in order for them to be heard from

Example Tasks

Challenge 1

Challenge:

Ravi Goyal finds out that a researcher in UPenn has developed a new technology to cast light on 3D objects twice as fast as before. Ravi is interested in using this technology to improve certain aspects of the photo-editing software.

Challenge: Rendering lights and shadows on large three-dimensional images has usually taken 2 hours to complete. A researcher has found that it can take only an hour if the image is pre-processed. How can we integrate this in our current software?

Responses:

Gary Jensen. Fishbowl topics: “map-reduce”, “cloud computing”

“We can probably calculate the pre-processing in our new server farms and optimize the process even more. It may take only 5 minutes if we leverage map-reduce techniques”

Challenge 2

Challenge:

Brian O’Neill has recognized that designers are using more tablet computers than before

Challenge: What new capabilities can we offer for tablet devices that are mobile, have multi-touch technology and long battery life?

Responses:

Salesperson. Fishbowl topics: “mobility”, “independence”

“I think we can develop a new version of our software for free-lancers who are always on the go and do not have a high-powered computer. They might perform partial job on their tablets and then upload their designs to be rendered”

Challenge 3

Challenge:

Kathy Wang who works for a CPG company goes to a boutique store for pets and takes a picture of the organic food it’s sold there.

“How could we take advantage of the new trend in organic food for dogs? Specialty stores in high-end neighborhoods just introduced some products and they’re showcasing how beneficial to the environment they are. How do you think we could introduce something similar in our product line?”

Attaches picture

Responses:

James Hodge, Vegetables. Fishbowl topics: “Steam”, “Microwave”

“Dog food has traditionally been canned--organic food in a can may lose some of its properties. I believe we can introduce a new microwaveable product for organic food!”

Challenge 4

Challenge:

We've recently launched a new service to allow advertisers to put ads at the top of our search results. How can we increase their clickthrough?

Responses:

User engagement product manager. Fishbowl topics: "Trends", "Location"

"We have noticed that once a topic becomes hot or trending in one country, a lot of people run searches on it to find out about it. We could provide a new service to allow advertisers to pay for a spot in the 'trending topics' area in a particular location"

Challenge 5

Challenge:

A new technology that allows to do more computations in memory has been developed. Complex operations require less access to hard disk and can be performed much faster. How do you think we can monetize this?

Responses:

Maria Lopez, Sustainability. Fishbowl topics: "savings", "temperature"

"Some companies that want to reduce their carbon footprint would be very interesting on making sure that the software is as efficient as possible. I believe we could develop a new product that is solely based in the new in-memory technology and keeps track of the carbon savings".

Full Usability Protocol

Objectives of the test:

Understand whether our personas/target is motivated to use the Serendipity Machine as a tool to improve innovation within an organization (500+ people).

Determine if the personas/target is able to use the web application interface effectively for the main tasks (in priority order):

- posting a task
- responding to a challenge
- evaluating a challenge answer
- viewing leader board information
- signing into an account
- changing account settings
- Others?
- What are the main stumbling blocks?

- What are the best/worst features
- Which tasks need further explanation/documentation?

Scenarios and Tasks:

Scenario A)

You are involved in researching and coming up with new products for the organization. You've been working on a couple solutions to a problem and can't quite come up with something that works. You want to ask others for assistance using the SE machine.

[start user at SE home screen - after they have posted the challenge, take them to the alert that they have new answers]

Task 1: login to the SE

Task 2: Post and submit a new challenge

Task 3: Evaluate a challenge (after seeing an alert)

Scenario B)

You are working on project during the work day and you see a notification pop up in your browser (that you are familiar with)

Task 1: View the challenge

Task 2: Respond and submit the challenge

Scenario C)

You've heard about a new initiative the company has started to try and foster game-changing ideas to problems people in the organization are having. You are curious to see who's tried it out so far and what types of questions and answers have been submitted.

[start the user at the new login flow]

Task 1: Login to an account the first time

Task 2: Find more information about the SE

Task 3: Post a challenge

Scenario D)

You are working on project during the work day and you see a notification pop up in your browser that your idea has been evaluated (that you are familiar with)

[start at the "Congratulations" screen]

Task 1: View the leaderboard

Task 2: Learn more about how to take other challenges

Quantitative data scorecard -- how many users were able to:

- posting a task

- responding to a challenge
- evaluating a challenge answer
- viewing leader board information
- signing into an account
- changing account settings
- Others?

Exit Questions:

On a scale of 1-5, with 1 being very unlikely and 5 being very likely, how likely would you be to use the Serendipity Machine if it were rolled out to the organization?

1 2 3 4 5

Why/Why not?

On a scale of 1-5, with 1 being very unlikely and 5 being very likely, would you recommend using the Serendipity Machine to a colleague?

1 2 3 4 5

Why/Why not?

What did you like best about using the Serendipity Machine?

What did you like least about using the Serendipity Machine?

Do you think some people would have problems using the Serendipity Machine? What kinds of people? What kinds of problems?

Which features of the Serendipity Machine were confusing?

What is your impression about navigating through the application? Does it seem difficult? What makes it that way?

What else should be included in the Serendipity Machine application?

Would you like to make any other comments about the Serendipity Machine?

How would you feel about receiving the pop-up browser notifications? How many would be ok receiving in a given day? Week?

Would the Serendipity Machine help you with your work? Do you think it would help your colleagues? Your company?

Complete Comparative Analysis

BrightIdea

BrightIdea's Innovation Suite is comprised of three offerings: WebStorm, Switchboard and Pipeline. WebStorm focuses on the idea submission and selection process--what BrightIdea calls "social idea collection." It allows employees to submit ideas, have others comment on them and collaborate on ideas, while letting the community, which may be internal or external, rate them. Switchboard also focuses on the selection workflow. This tool allows companies to organize ideas, develop business proposals and identify business potential. Finally, Pipeline helps companies manage innovation projects. It tracks the progress and presents the information needed to evaluate the status.

Spigit

Spigit is a Pleasanton, CA-based company that develops idea management software. Its EnterpriseSpigit solution also focuses on idea submission and selection. It allows employees to post ideas, collaborate on ideas, and vote for ideas. It also features an analytics engine to help employees find ideas and relies on social features like social currency and social reputation to promote participation. Finally, it includes an idea trading market where employees can buy and sell ideas. SpigitFusion is another product from Spigit that provides idea management features. It allows companies to connect ideas with individuals who can evaluate them and can manage the decision-making process. Finally, it relies on the wisdom of the crowd by enabling prediction markets in its PredictionSpigit tool.

Mindquilt

Mindquilt provides question and answer software that allows people in organizations to post questions and have them routed to the most appropriate persons. It leverages the wisdom of the crowd by matchmaking within the organization's social graph. Although the routing mechanism does not facilitate idea generation *per se*, it may route ideas that are not yet ready to others who can build on them.

Invention Machine Goldfire

Invention Machine Goldfire is a software solution that provides tools for innovators to perform their tasks better. It is mostly targeted for engineers and researchers. It allows them to submit ideas, manage the testing and evaluation process, articulate needs, analyze market opportunities, foster incremental innovation on existing products, leverage their existing intellectual property, and mitigate risks.

It is not clear how “social” the offering is. It seems that it does not harness the collective power of the organization, but merely individual efforts. The application also does not provide particular tools to foster idea generation.

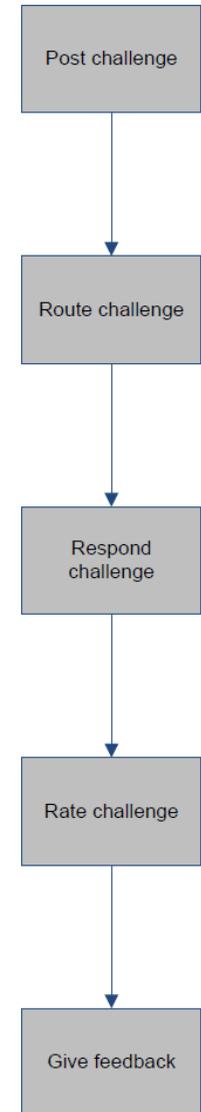
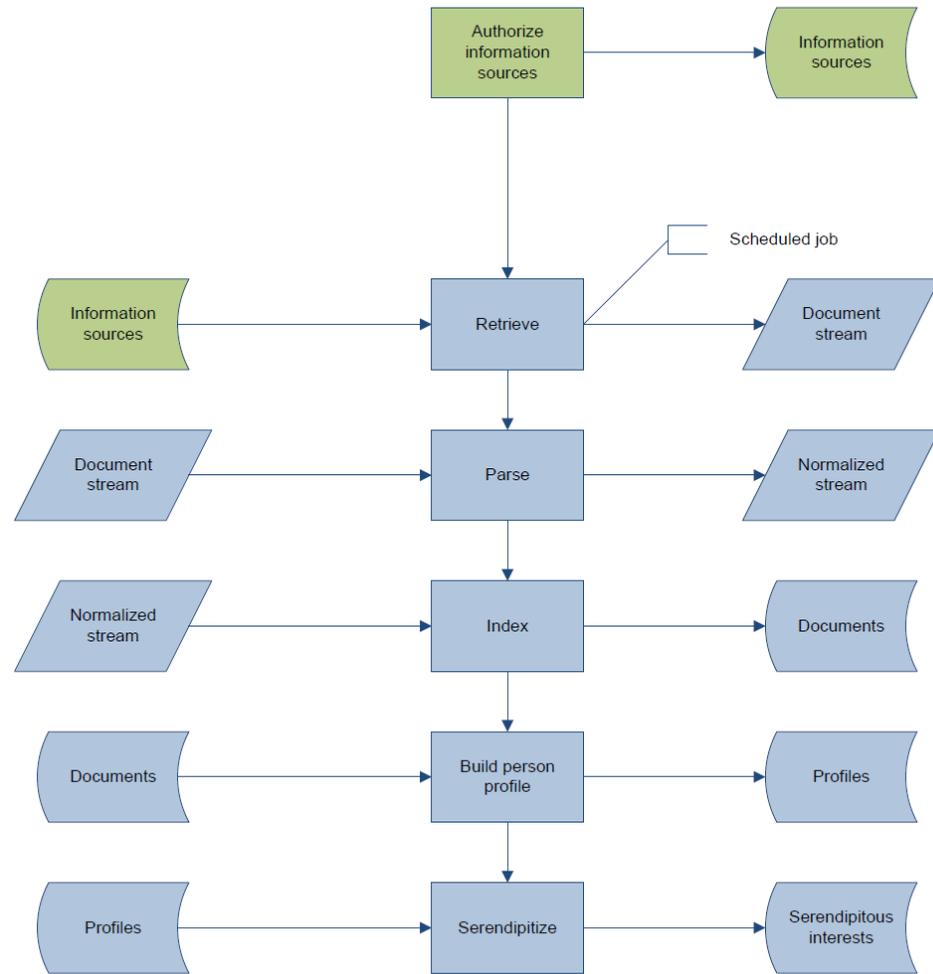
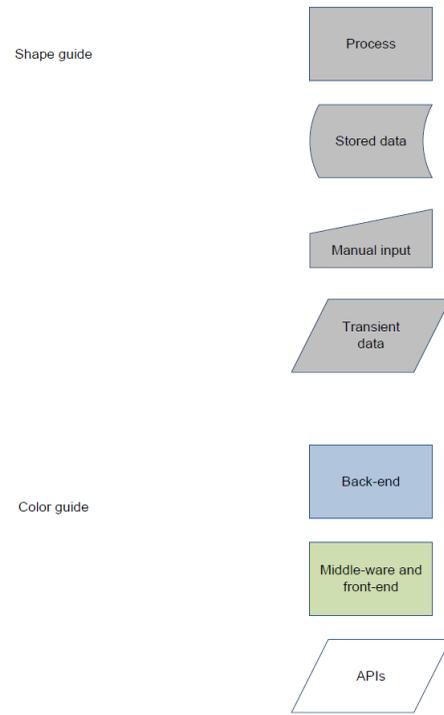
Illumin8

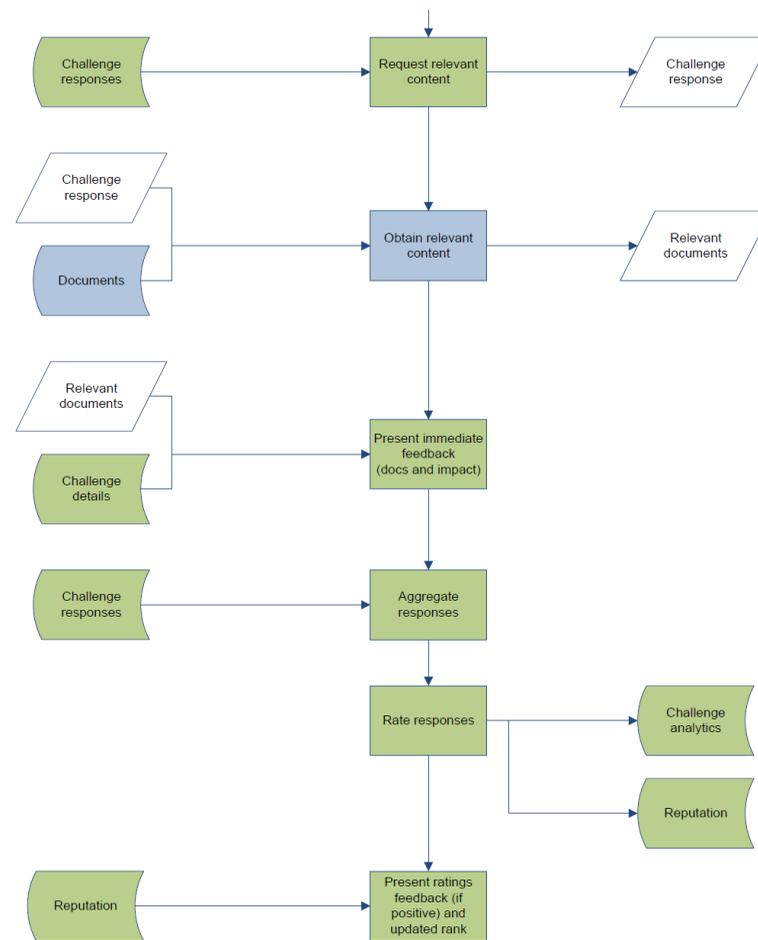
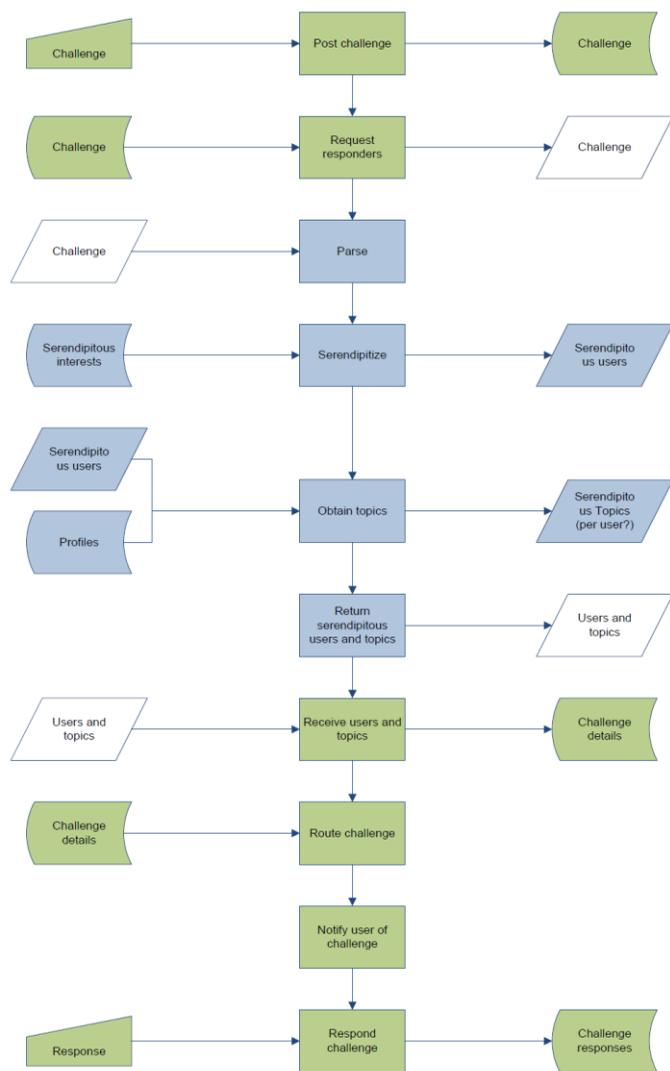
Illumin8 is a solution created by the Elsevier publishing house that provides innovation and R&D professionals with insights from scientific, patent, and news content. As a publisher, its strengths rely on the ability to analyze large text collections and present people with insights. Although the offering is focused on scientific publications, one could imagine that a similar approach could be used to analyze communications in organizations, providing insights on what people in the organization are doing. Finally, it also allows to compare two research topics (according to the volume of published records, related products and approaches, organizations, and people) to find connections between the two or to choose the best approach.

Imaginatik

Imaginatik started out as an idea management software company and has now branded itself as “innovation as a service”. Its flagship product, Idea Central, is a crowdsourcing platform for employees, business partners and customers. It allows participants to submit ideas, track ideas, and showcase ideas. It also provides with tools for informal idea evaluation and formal idea review. It also includes collaborative capabilities to streamline innovation

Information Flow Diagram





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