

Daydar: framework for socially motivated productivity

ABSTRACT

Daydar is a framework to facilitate socially-motivated goal fulfillment. It uses to-do lists as the primary input, and a variety of physical and digital artifacts as output. These outputs may be abstract or focused, but they all use an awareness of your social circle's work habits in order to influence your own habits. We consider the influence of peers in self-reflection, and a balance between work and personal goals, in offering a flexible system that enables users to assemble a motivating environment that meets their individual needs.

Author Keywords

Social computing, social awareness, goal fulfillment, productivity, peer pressure, CSCW, ubiquitous computing.

ACM Classification Keywords

H.5.3. [Information interfaces and presentation]: Group and Organization Interfaces – theory and models, collaborative computing.

INTRODUCTION

Attempting to meet goals is a constant source of stress in people's lives. This may be caused by laziness, of course, but motivation is not enough to overcome all of the barriers to productivity and happiness, which include: setting unrealistic goals, feeling overwhelmed by large or long-term goals, pressure to keep up with peers, the lack of effective strategies to achieve individual tasks or to multitask efficiently, and setting a balance among the various needs in life.

One factor of technology that may be contributing to frustration is the increasing isolation in which tasks get done. The proliferation of email and telecommuting means that there are less of the informal and indirect interactions — from overhearing a negotiation on the phone to feeling the stress levels around the office — that provide useful learning experiences, rhythm and feedback to work. [1] But there is an opportunity to reintroduce some of the effects of the social office by connecting individuals with goal-oriented peers via the Internet.

We do not intend for the term “productivity” to restrict our focus to work activities. This opportunity is not exclusive to the

workplace. In fact, not only do individuals face similar challenges in their personal lives, the two environments are often intertwined in competing and cooperating ways. Many individuals develop systems for organizing their cluttered lives, from the day planner to the Getting Things Done methodology. [2] One time-honored, if messy, method is writing to-do lists.

We propose a framework that exposes the user's individual to-do list to a social group, in order to encourage members to:

- Learn from the working styles of others;
- Create an environment of healthy competition by being aware of peers' daily accomplishments;
- Reflect on one's own productivity strategies;
- Find a better balance between work and personal life.



Figure 1. A Daydar-connected alarm clock, which rings a bell each time someone in the user's group completes a task.

SOCIAL AWARENESS AND ACCESSIBILITY

We believe that feedback meant to create an awareness of others' activity can provide a context in which to gauge individual progress. [10] And beyond this, there is a growing trend in the Web 2.0 culture to measure everything about one's life and trying to glean meaning from it. This is illustrated by web applications such as Mycocosm [8] as well as consumer

products like the Nike+iPod workout tracking system. [12]

As Gordon Bell's research with MyLifeBits [9] demonstrates, the ease of creating data points has created a need for platforms that can handle organization and analysis of the informational deluge. We used the modern web application model of increased access — to APIs and to others' shared data — in following Dourish's cue to design a medium-oriented system that allows for user customization and creativity in constructing productivity tools. [11]

This framework illustrates a future ubiquitous computing application within which we are experimenting with various agents, both physical and digital, that help the user to monitor their own and others' productivity, get motivated, and document and visualize the process of whole projects. The rest of this paper is structured as follows. The next section describes the specifications and implementation of the Daydar system. Following that is a comparison to related work, and then the results of an initial evaluation. Finally, we present a scenario that outlines a number of interactions throughout the day that Daydar would enable.

SYSTEM DESCRIPTION

Daydar is both a conceptual framework to encourage goal fulfillment, and a software framework designed to support that purpose. The software framework uses existing web- and desktop-based software to provide to-do lists as input. It has a server component that aggregates this and abstracts it to protect privacy, and retrieves information for various output agents that can ask for generalized data, or if a context is provided, appropriate tasks from the user's own to-do lists.

In order to help users make sense of a large and diverse data set, the framework groups tasks into categories, either by having users tag their task lists [Fig. 2], or by matching untagged tasks with similar tagged tasks. We have selected five categories that we intend to speak to one of the frustrations mentioned in the introduction — setting a balance between the various demands in our lives. These categories, loosely based on Maslow's hierarchy of needs [3], are: Physical (health), Work, Social, Intellectual (learning), and Creativity (self-fulfillment).

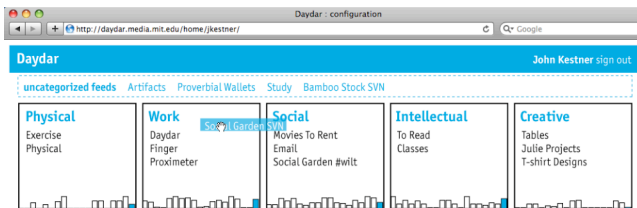


Figure 2. Drag-and drop interface for grouping to-do lists and other feeds into five defined categories.

We have specified principles within Daydar that these interactions may use to encourage goal fulfillment:

1. **Externalization** – making goals explicit. Giving tasks a form of embodiment makes it possible to prioritize, break down and otherwise manipulate them. This is a key feature of all to-do lists. Yet without continued self-reflection, lists are forgotten and fail to increase productivity. Daydar enlists Peer Influence to keep the user's focus on this process.
2. **Task Chunking** – reducing large problems into small ones. Humans are poor with perspective; abstract and complex tasks often overwhelm people. The user should be encouraged to

break large tasks into achievable subtasks in order to progress steadily. [2]

3. **Peer Influence** – tapping into the dynamics of communities. Guilt is a powerful motivator, as anyone with a mother knows. Comparing oneself to others can be a source of stress, but it can also provide comfort in knowing that others are struggling along with oneself, an avenue for sharing learning experiences, or a mutual goal. Eavesdropping can produce empathy. [1]
4. **Game Behavior** – nurturing the competitive spirit of the user by creating, as *Rules of Play* defines a game, “an artificial conflict, defined by rules, that results in a quantifiable outcome.” [13] Good game design understands how to engage players. This can be used in concert with Peer Influence to engage users.
5. **Timeliness** – getting the right information at the right time. Many systems do not take context into account when they constantly and dumbly alert the user when the user is not in an effective position to react. Just-in-time information retrieval agents [4] could notify the user of a location-specific task only when near that location and there is time in his or her schedule to complete that task, for instance.

RELATED WORK

Daydar is focused on metrics that can be gathered from various objects and tools that people already use. Unlike typical workgroup productivity solutions, it is not targeted at users working on projects together, although those are not excluded. Rather, it is aimed at loose social groups of friends and peers, regardless of whether they are working in the same room or remotely, and regardless of whether their tasks are personal or work-related. The goal is to help each person achieve his or her individual goals through awareness and comparison of a selected peer group's achievements.

Consequently, Daydar does not intersect with many CSCW applications, which are targeted to workgroups focused on common work projects. Erickson and Kellogg's concept of social translucence [14], which is built upon properties of visibility, awareness and accountability, does correlate with Daydar's underlying principles.

Among the features of the ambientROOM physical interface was an ambient display that made the user aware of activity in the surrounding workspace, in the form of abstract patches of light projected onto a wall of the user's office. [5] Daydar is intended to enable such ambient displays in a wider range of situations.

Remember The Milk (also referred to as RTM) [6] is an example of modern task management software. Because it's web-based and has an open API, it has a range of potential interfaces to meet users' needs in different contexts. It has a limited social feature set, allowing a user to send a to-do to another user.

WattzOn [7] deals in awareness of energy consumption rather than of productivity. But it has a similar model to Daydar in that it provides APIs for aggregating data from various sources and enabling social interactions, visualizations and a new breed of information appliances.

EVALUATION

An initial study was done to test the effects of real-time social productivity feedback with a small group in a common workspace using a prototype Daydar system over two months. Remember the Milk to-do items were used as input into the Daydar aggregator, which was implemented as a web-based application. The aggregated data was then fed into DoingDoing, a custom-made alarm clock with seven addressable bells which serve as embodiment of peer activity. [Fig. 1] Every time a tester checked off an item, a bell would ring that anyone in the vicinity could hear. In this fashion, people in the workspace could get audio feedback when they or someone else had completed a task.

The six users were a balanced mix of male and female, undergraduate and graduate students. Some had previously used task-management software, and others had only used paper lists or their memories. After a six-week period of using the system, the users were asked to fill out a questionnaire intended to gauge quantitative and qualitative changes in behavior before, during, and after the testing period. We don't believe that the results of this first study are significant enough to detail quantitatively, but patterns did emerge that are worth noting, many of which reinforced the principles we outline above.

Unsurprisingly, all users but the heaviest RTM users increased to-do item *writing* during the evaluation period, but those same users also reported little to no drop-off after the study ended. Number of to-do items *completed* also followed a similar pattern, although the users generally said that the tasks completed dropped in comparison to tasks written, which indicates that DoingDoing provided some motivation.

Indeed, the users did have positive responses to the ringing bells, though with different reactions. Three reported that they found the audio feedback "satisfying." One of these said further, "When I heard it ring for someone else, I felt like I should be getting things done, and sometimes re-evaluated whether what I was doing was really the most productive." In this case, Peer Influence and Externalization prompted the user to reflect on her work strategy. One of the heavy RTM users, who otherwise reported little change in behavior, noted that when she "heard someone checking off a string of things... for the sake of also generating a string of rings, [she] checked off the items that [she] had meant to check off that day," which reflects the competitive Game Behavior principle. Another user who had previously been only using a calendar to note major deadlines found that the public audio feedback for each task completed spurred him to Task Chunk using to-do lists, with the result that he became "more organized or at least less stressed out about unknown deadlines."

Users did request features that could be implemented in future studies, which were outside the scope of this one. Among these were remote feedback mechanisms for telecommuters, and more context about the kind of tasks that had been checked off — "Was it a big task? How long did it take the person to do it? How often was it postponed?" — which could be addressed with different forms of audio feedback or other appliances. (The alarm clock would ring multiple bells if high-priority items were checked off.) Overall we believe that this medium-term pilot study successfully demonstrated that Daydar can positively impact work behavior, and look forward to building on this.

In the next section, we use a narrative to describe the various inputs and outputs into the Daydar framework and how it enables new interactions that encourage the principles we've highlighted.

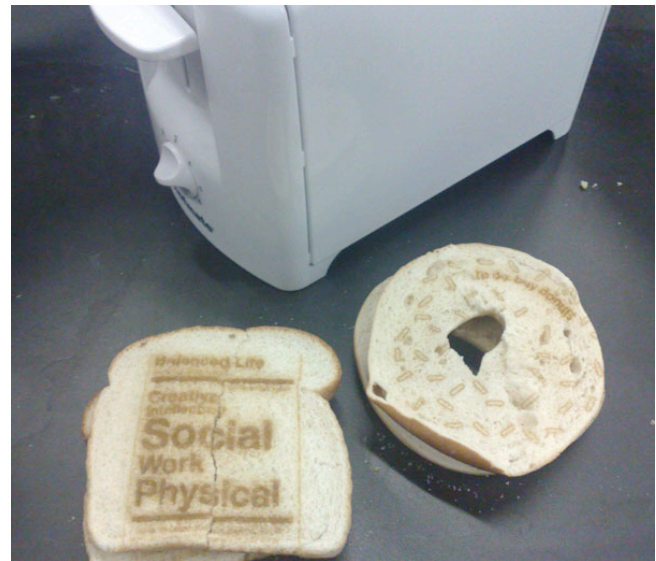


Figure 3. Life-balanced breakfast.

SCENARIO

At Home

In Boston, Julie's alarm clock goes off at 6:30 a.m. — as usual, she was optimistic about getting an early start. Reflexively she hits the snooze. But instead of the alarm going off again in another 5 minutes, it begins to sporadically 'ping' as Susie and Natasha in Berlin are already up and checking off to-do items. It takes several of these gentle prods before Julie gives in and gets out of bed. She hits her alarm clock a little harder than she needs to, hoping to make some other sleeper suffer for it.

She gets her breakfast from the toaster and glances at the information printed on it. [Fig. 3] One slice shows her the balance of needs met recently — the words 'Social' and 'Physical' are large, and she can see that Intellectual needs in particular are being neglected. The other slice shows her something off her Intellectual to-do list that she can do before she leaves for work — take a book that she's been meaning to finish, to read on the train.

At Work

When Julie gets to her desk, she logs in and glances at the background on her computer desktop [Fig. 4] and sees from the size of different arcs sweeping around a clock that much of her social workgroup has already started checking off items on work-related to-do lists, not just in Europe but in the US. She jumps in, calling people in order to quickly get "on the radar" of her social group.

Then she glances at a small whiteboard-like display on the wall that shows her the top priority right now, "Edit research paper," and two alternate tasks. [Fig. 4] These are chosen from her to-do lists by context (she's logged into the system from a network address at work), self-weighted priority and due date entered from Remember the Milk, matching estimated time against schedule to help ensure that she'll have enough uninterrupted time to "get in the groove" and finish the task. After half an hour of reading source material to possibly reference for her paper, Julie's mind starts to wander, but the whiteboard is there to remind her of her goals. She does one of the short alternate tasks as a break, then goes back to the main task and gets satisfaction from wiping it off her digital whiteboard with a gesture when she's done.

It's 45 minutes to lunch, and after getting a big task done Julie is tempted to idle for a while. But a challenge from Jay in New York pops up on her whiteboard, with a reward of a shared virtual lunch break. She sets the timer to 45 minutes and agrees by tapping on the whiteboard. Her whiteboard turns into a game clock and gives her both quick tasks and more involved tasks that count for more. Her strategy is to fire off as many email-related tasks as she can to intimidate Jay upfront, then see if she can fit in the sketches for a website layout for a big finish. She gets 5 emails sent, but doesn't quite finish the sketches to her satisfaction. But she got a good start on it that she'll finish after lunch, and she still beat Jay. With a feeling of accomplishment, she feels she's earned an IM lunch chat with her friend.

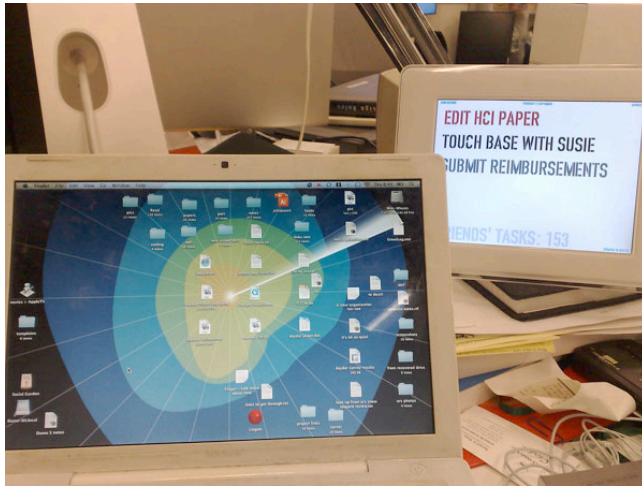


Figure 4. Ambient desktop radar and “do it now” taskboard.

After Work

It's after 5:00 p.m., and Julie can see the work arc on her desktop radar tapering off as the others leave to go home or get drinks. She works a little longer since she's in a groove on her project, and cognizant that she can skip the gym and socializing for a change. Around 6:00 p.m. she logs off her computer and heads to the train station. When she pulls out her phone to idly text and listen to some music, the phone notes that she is no longer near her desk and suggests that she do some thinking about one of the items on her creativity to-do list, picking a home improvement project to tackle for the summer.

When Julie gets home, she gets on her computer to organize her thoughts about the kitchen retiling she's decided to do. She adds "Kitchen retiling" to her projects list in her task manager, which then encourages her to break down what seems like a big task into manageable chunks by entering the primary subtasks involved, and then repeating the process with each of those, until she's fleshed out enough tasks with short time estimates that she can start tackling now.

CONCLUSION AND FUTURE WORK

With the Daydar platform we have identified key principles to improve a task-based, goal-oriented situation, may that be at the workplace or at home. These principles, synthesized as a conceptual framework, are only tangentially related to current systems for workgroup productivity. Instead of focusing on tools for collaboration, we concentrated on individual task management,

and how it can be improved and influenced by means of a social process. By defining the main interactions for this process — Peer Influence, Externalization, Game Behavior, Task Chunking and Timeliness — we set the foundation for the broader platform to be developed.

In our medium-term evaluation we have observed that an ambient awareness of other people's work behavior can have a positive effect on people's own task management. Taking this as a starting point, we see much potential for additional digital and physical systems to approach the other identified aspects of socially-motivated goal fulfillment.

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