Agenda Benders: Modelling the Disruptions caused by Technology Failures in the Workplace

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ABSTRACT
There is a need to understand the impact of technology failures on work. In the studies reported here, subjects' plans at the start of each day were compared with their eventual accomplishments, and failures to carry out plans were investigated. A number of sources of disruption were identified; they included technology failures, which had a particular tendency to act as "agenda benders," preventing the completion of important activities.

KEYWORDS: Diary studies, productivity, usability, technology failures.

INTRODUCTION
Working life is full of unexpected events, and as computer systems become more complex and pervasive, unexpected system failures have a tendency to become more common. Little is known or published about the impact of these failures except in the catastrophic cases that come to public attention [1]. Minor failures occur too, and appear likely to cause a loss of productivity that is difficult to measure.

In an attempt to shed light on this issue we have conducted two diary studies, and these have enabled us to understand better how technology failures affect work. We report here on our initial findings, and in particular on our attempts to model those failures that cause "agenda benders", i.e., that prevent important plans from being carried out.

DIARY STUDIES
Our diary studies involved gathering detailed accounts of the work activities of subjects over a one-week period. At the start of each day, subjects filled out a list of the activities they *planned* on doing that day. For each activity, they estimated the duration and the importance of completion on that day (on a 1-to-5 scale). At the end of each day, we interviewed subjects to obtain a list of the activities they had *completed.* For each of these activities, we recorded the start time and duration. In addition, subjects were probed about why their "actual" days differed from their "planned" days, paying particular attention to their use of technology.

We have conducted two such diary studies, one in the engineering division of a product company (Produx Corp.), and the other in a large multinational financial organisation (the Commission). The first study involved 10 subjects, for a total of 50 days' data, while the second covered 25 subjects and 120 days' data.

ANALYSIS
Our analysis focused on the differences between planned and completed activities. We were interested in how people were able to accomplish a high proportion of their intentions, and what caused them occasionally to achieve relatively few.

During the interviews, subjects were questioned about their changes of plan. They were asked to explain, for example, why an unplanned activity was undertaken or why a planned activity was performed at an unplanned time. From their responses we learned about the surprise events that led to changes of plan. In the case shown in Figure 1a, Subject 1 described how he heard news of the problem with Project A at around 9 a.m. and immediately called a meeting for 11 a.m. This meeting did not resolve the problem, and so he then set up another meeting for 1:30 p.m. In the case of Subject 9 (Figure 1b), she described how she and a colleague decided to print out a file, only to discover that they did not have the requisite application on the workstation. After half an hour they agreed to spend some more time searching during the afternoon.

We attempted, on the basis of subjects' accounts, to reconstruct the evolution of their agendas throughout the day. This analysis, although involving some guesswork on our part, was useful in exposing the varying degree of success with which subjects were able to make new plans. We saw cases, such as Figure 1a, where subjects were successful in rearranging their agendas to accommodate one or more new high-priority tasks. We also saw cases, like Figure 1b, where an unexpected event appeared to throw a normally well-organized subject into an extended period of indecision, during which high-priority tasks were put on hold.

AGENDA BENDERS
Our analyses of the data have led us to distinguish between two types of unexpected event during the working day. Some events lead to immediate and simple changes in plans; time is found in the remainder of the day to handle

the unexpected over-run or fresh assignment. Other events create a period of uncertainty and indecision, during which any existing plans are suspended; replanning may become difficult if not impossible. The latter type of event can, at worst, cause the entire day's agenda to be abandoned, and at the very least, will leave it seriously bent out of shape. For this reason we call this category of event an *agenda bender*. It is characterised by failure to complete one or more high-priority activities that day.

When an agenda bender strikes, the time lost in dealing with the event is often compounded by damage done to the rest of the day's agenda, and sometimes there is a knock-on effect on other people's agendas. Thus when Subject 9's workstation crashes at the start of her day (Figure 1b), not only does she switch from doing high-priority tasks to filling in time with relative trivia, but she has no idea when her workstation will revive and must replan her day without adequate information. This uncertainty ultimately contributes to her inability to complete the "write specs" plan.

Agenda benders appear to arise through a loss or breakdown of essential resources, for a period of significant but unpredictable length. Sometimes the missing resource is a person, e.g., a colleague who cannot be found for a vital meeting. More often, in the cases we studied, the vital resource is a supporting technology: a missing file, a recalcitrant document formatter, a networked file system, a crashed workstation. Of the eight cases of serious agenda benders that we found in the data from our two studies, six could be traced to technology failures.

DISCUSSION

Our understanding of agenda benders is based on only two studies and is far from complete. We are still engaged in developing reliable methods for capturing and analysing data on how people manage their daily agendas in the face of these and other unexpected events. However, our initial impressions are that unreliable technology can, by causing agenda benders, have a significant impact on the work that gets done during the day. We believe that reliable, predictable support may prove to be an important factor in determining a system's ability to support the day's work.. Agenda-bender avoidance could, on these grounds, be regarded as an aspect of a system's usability.

We have seen, in our two studies, some differences in the frequency with which agenda benders arise. In the Produx study we saw 5 cases in 50 working days, while in the Commission we saw only 3 in 120 days. Clearly a number of factors contribute to the occurrence of agenda benders, including the reliability of the technology and the prior training of users. Work patterns may also be an important factor. In Produx Corp., people scheduled many meetings each day; at the Commission, the work consisted mainly of solo authoring and relatively few impromptu meetings, which allowed some freedom in dealing with unexpected events. The Commission also used relatively conservative technology and provided its users with relatively thorough training. Such an organisation may be inherently less susceptible to the productivity losses that agenda benders can cause.

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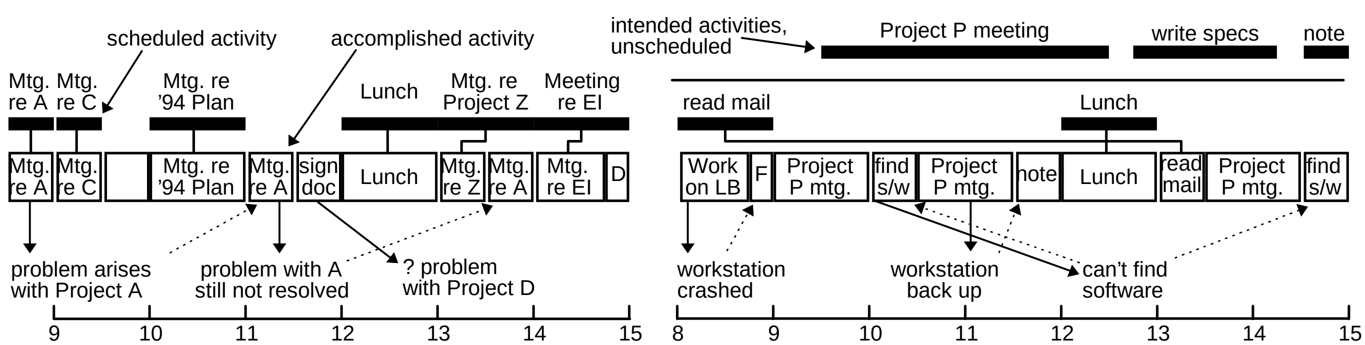

(a) Subject 1, Day 3

(b) Subject 9, Day 4

Figure 1. Two seven hour periods from the diary-study data. The lower row of boxes shows actual activities performed, the upper dark boxes are intentions for the day, both unscheduled (above the broken line) and scheduled. Time is shown on a scale along the bottom of each chart. Above the time scale are shown the occurrence of unexpected events (shown with solid arrows), and the resultant replanning (shown with dashed arrows). Subject 1 has three unexpected events, all of which are handled by cutting short other activities or using slack time. Subject 9 also has three such events, with the result that one intention (write specs) is postponed and another (read mail) is cut short.