

# Visualization-Mediated Alleviation of the Planning Fallacy

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## ABSTRACT

The planning fallacy, i.e., people's tendency to underestimate the time required to complete a project despite past failures, is ubiquitous and resistant to coping strategies. We propose scenarios where visualizations may help alleviate this problem, motivated by previous research in psychology. We hope that with the help of visualizations, people will become more reliable in their judgments and work together in a way that is both more productive and more gratifying.

## Keywords

Planning fallacy, debiasing, information visualization, personal information management, social networks.

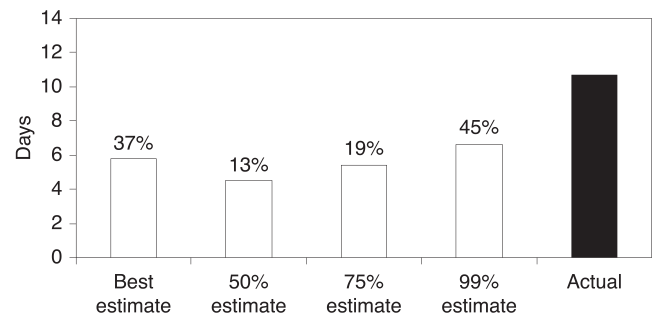
## 1. INTRODUCTION

The planning fallacy refers to people's tendency "*to underestimate the time required to complete a project, even when they have considerable experience of past failures to live up to planned schedules*" [7]. This cognitive bias has been documented for a number of tasks, both in the lab and outside the lab [3]. It has been regularly observed in many situations, including in large-scale industrial and public projects where the monetary cost can be extremely high [4].

The planning fallacy is present in our everyday lives, both private and professional, and has often negative individual and social consequences. For example, a PhD student may promise his supervisor to deliver a first draft of an article three weeks before a deadline, but will fail to do so. Or a supervisor may promise his students he will spend time on all articles, but will end up working on only one article. These poor judgments are counterproductive and can create a climate of frustration and distrust in collaborative teams.

The planning fallacy is present in virtually all medium to long-term projects, and is surprisingly resistant to coping strategies: step-by-step plans, team planning, task familiarity, motivation and incentives to finish on time usually ex-

acerbate rather than reduce the planning fallacy [3]. Deadlines do not eliminate the planning fallacy, as people often hope to finish well in advance [3] (see Figure 1). The dominant theory behind the planning fallacy [8] recommends to have people focus on their past experience, but even this technique often fails, as people typically tend to consider past mistakes as irrelevant [4]. Although there are individual differences, the planning fallacy bears little relationship with personality traits such as the tendency to procrastinate [2].



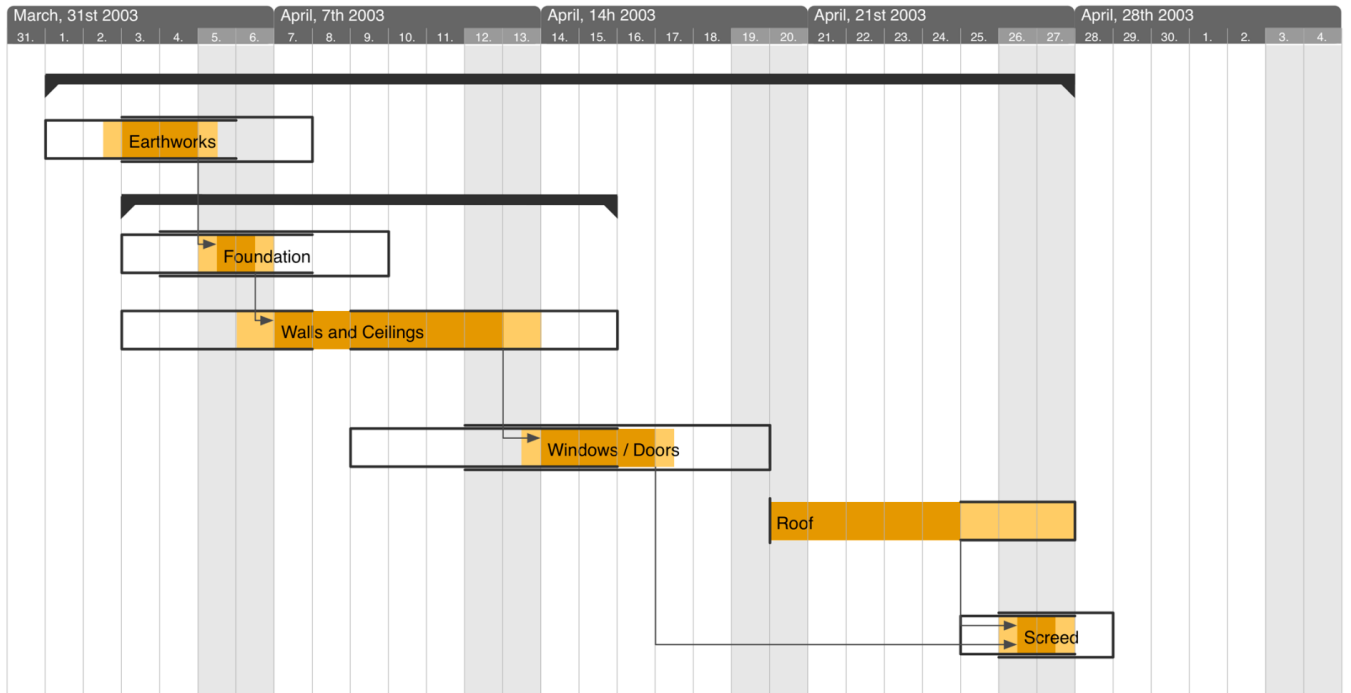
**Figure 1:** In a study by Buehler et al. [5], participants were asked to estimate for different levels of confidence when they would finish some academic projects. The numbers above the bars indicate how many projects were actually finished in time. Figure reproduced from Buehler et al. [3].

In this paper we propose that visualizations can help alleviate the planning fallacy. We suggest several possible approaches motivated by previous empirical studies on the planning fallacy. A few of these studies have achieved some success, but their experimental manipulations are difficult to implement in real-life situations. We hope that with the help of visualizations, people will become more reliable in their judgments and work together in a way that is both more productive and more gratifying.

## 2. HOW VISUALIZATION CAN HELP

### 2.1 Increasing Awareness of Obstacles

The dominant theory behind the planning fallacy is the *inside/outside account* [8, 9, 4]: people focus on scenarios of how the task will be completed (the “inside” perspective) rather than on how similar tasks have been carried out in the past (the “outside” perspective). An inside perspective tends to focus on best-case scenarios, ignoring the many ways the project may go wrong, and downplaying past failures. One



**Figure 2:** Screenshot of PlanningLines [1], a technique for visualizing plannings with temporal uncertainties. A task is represented by a rectangle. On each rectangle, the left black cap encodes the interval between the earliest and the latest starting times, while the right black cap captures the range of possible finishing times. The bright yellow rectangle conveys maximum duration and the dark yellow rectangle encodes minimum duration. Task dependencies are shown with arrows, as in Gantt charts.

intriguing consequence is that the more people plan for the future, the more wrong they will be in their time estimates.

Studies have however shown that not all planning styles are detrimental. Specifically, “unpacking” a project into smaller components has been shown to reduce the planning fallacy, because it forces people to become aware of tasks that were not obvious before [9]. Similarly, helping people to consider potential obstacles can be useful to some extent [3].

These findings have important consequences for the design of personal information management tools (PIMs), such as computer calendars and todo-list managers. Tools that take a naive approach to planning may actually aggravate the planning fallacy. PIM tools should support fine-grained task decomposition, both in terms of input and visualization. Users might also benefit from being able to set and visualize confidence intervals for completion times, as well as specify alternative plans in case things go wrong. Although such tools have been studied for large-scale project management [6] (see Figure 2), they need to be adapted to a larger audience. The temporal data structures involved are much more complex than typically supported by PIM tools, so designing such tools is a challenge. It is important that the visualizations are easy to understand, navigate and update on-the-fly. Only then will the tool encourage people to adopt a better planning style, and help them become more aware of hidden tasks and potential obstacles.

## 2.2 Selflogging of Durations and Predictions

The information visualization (infovis) community is more and more interested in the collection of personal data for personal purposes, an emerging movement that has been popularized under different names such as *selflogging* [14] or *the quantified self* [17]. One of the promises of selflogging is to empower people by letting them discover patterns in their own life for personal reflection and improvement [14].

There are several ways personal data logging and visualization tools could help alleviate the planning fallacy. For example, one can imagine that personal information on actual project completion times and previous estimates is recorded for later use by tools such as PIM tools (discussed above). At any point in time, users could visualize the bias and variability in their judgments. They could then use this information to better estimate the future, e.g., by applying a “corrective” factor derived from previous planning estimates.

One argument for such an approach is the *memory bias account* of the planning fallacy, which suggests that people are optimistic in their planning not because they do not use past experiences, but because they tend to underestimate the time it took them to accomplish similar tasks [12]. According to Roy et al., “it may prove useful to keep records of beginning and ending times for the task [...]. If this process is repeated, then mean duration and variability can be computed from which more precise predictions can be made.” [12]. However, it is still unclear which theory (the memory bias

account or the classic inside/outside account) is correct [3]. Nonetheless, we propose that recording *both* actual completion times *and* predictions could help people make better predictions, irrespective of what causes the planning fallacy.

One difficulty with this approach is that people tend to ignore past information even when it is available [3]. For example, software project managers often keep detailed records about past projects, but rarely use them because they feel that each new project is unique [3]. Even when people are aware that they have been regularly late in the past, they tend to consider that the future will be different, and they create narratives to explain past mistakes [4].

We believe that data aggregation and information visualization can mitigate this issue by hiding irrelevant contextual information about the past. Consistent with this, several studies suggest that neutral external observers are not subject to the planning fallacy: they do not have access to information on which to build narratives (i.e., explanations of past failures and detailed best-case scenarios for the future), and instead rely on objective sources of information such as past performances [3]. Computers could, therefore, act as *neutral external observers* that are more available and much more reliable in information gathering than humans.

### 2.3 Tools for Supporting Group Predictions

Another intriguing result from past research on the planning fallacy is that groups are often worse at predicting task completion times than individuals [3]. Group discussion has been shown to increase focus on positive scenarios and decrease focus on obstacles, but no detrimental effect was found for the process of agreeing on a particular forecast. Therefore, teams should perhaps “*collect and aggregate individual forecasts, instead of engaging in group discussion*” [3].

These findings have important implications for the design of groupware tools. Tools that facilitate informal exchanges (e.g., chat, email or videoconferencing tools) may exacerbate the planning fallacy [3]. On the other hand, a number of groupware tools (e.g., shared calendars or planning tools such as Doodle) tend to replace free information exchange by more systematic, “colder” procedures. These apparent limitations might actually turn out to be benefits for forecasting purposes. The idea that limiting exchange of information can improve group decision making has been also supported by research on the *wisdom of the crowds* [10].

Thus new groupware tools could be created that focus on collecting, aggregating and visualizing anonymous predictions when project completion times need to be estimated. Such tools could also take into account the multidisciplinary nature of teams, and collect and visualize a range of predictions on subtasks for which people are experts. However, since both performing a familiar task and occupying a position of power [3] tend to worsen the planning fallacy, the system should perhaps give more weight to people who are good estimators rather than experts. Such a system could use personal logging data about previous performances (as discussed previously), and compute weighted estimations while ensuring privacy.

Based on findings that people not involved in a project are better estimators, tools could also be designed that take input from independent observers, such as other teams, anonymous crowdsource workers, or online communities [15]. For example, PhD students could maintain a Web site that visualizes the many steps necessary to complete a thesis. Such a visualization could aggregate personal data collected from selflogging, or from the advanced PIM tools discussed before, such as the “hidden” tasks necessary to complete a thesis or the regularly experienced obstacles. Such online community visualizations could in turn help users input more reliable planning data to PIM tools. For example, they could apply a “correction factor” for time estimates based on data from multiple people instead of their own (necessarily limited) experience.

### 2.4 Social Networking Tools

So far we mostly covered how computer tools and visualizations could help individual people and groups. We now turn to social networks. Social networking tools are particular in that they support the sharing of data with a relatively stable set of privileged individuals — the person’s *connections* — instead of temporary teams or the whole Internet. By allowing to share and visualize potentially sensitive information and by supporting trust building, such tools offer extremely rich possibilities.

People usually care about trust when there is the possibility of deception. Deception has been shown to be occasionally associated with optimistic planning. For example, it can be useful for political purposes to make overly optimistic predictions for the completion of large-scale public or industrial projects [2]. More generally, people in a group can have conflicting interests, and some may be better served by an overly optimistic planning than others. In this context, it could make sense not to take all predictions at their face value, and ask for guarantees. Such guarantees could be provided by add-ons to professional social networking tools, where professionals or institutions could advertise and visualize their history of accurate predictions to potential partners. Individuals could advertise similar information to their friends (e.g., being generally on time for meetings with friends), provided of course that they have incentives to do so. Bilateral sharing agreements could provide such incentives.

It is safe to assume that overly optimistic plannings are generally the result of a genuine planning fallacy rather than a deliberate attempt to deceive. Even in that case, people may still benefit from accessing, sharing and visualizing personal histories of past forecasting performances. Many people are honest about the fact that they are rarely on time, be it for meetings or completing projects. Such information is likely to facilitate collaboration and mitigate both obstacles to success and personal frustrations. Social networks and visualization tools can greatly facilitate such information sharing. Whether there is deception or not, sharing such information may provide incentives for people to make more realistic predictions, by the way of social pressure.

## 3. CONCLUSION

The planning fallacy is present in our everyday lives, both private and professional, and has often negative individual and social consequences. Among other things, it makes col-

laborations – e.g., coauthoring a workshop article – a less rewarding experience. It is robust and resistant to coping strategies, and the many experimental manipulations used in empirical research only yielded limited successes [13, 11].

We believe that computers can help alleviate the planning fallacy due to their ability to collect, process, dispatch and visualize data. But existing information management and communication tools need to be redesigned and new tools should be developed based on lessons from the psychology of the planning fallacy. We discussed several approaches, including personal information management tools that encourage the externalization of hidden tasks and obstacles, logging tools for self-awareness, groupware tools for aggregating and visualizing people’s predictions and performances, and finally social networking tools to support social awareness of the planning fallacy and encourage behavior change. We also suggested how each of these tools could benefit from more emphasis on information visualization.

We contrasted deceptive optimistic planning with genuine planning fallacy. It remains the intriguing possibility of most systematic optimistic predictions being a complex mix of both. This is our personal position. The extreme resistance of the planning fallacy to deliberate attempts of self-improvement supports this: if people know they were wrong in the past, how can they possibly keep being wrong over and over again? This suggests that overly optimistic predictions may somehow benefit people who makes them. An isolated but important study seems to confirm this [11]: when people are asked to make verbal predictions, they exhibit the planning fallacy, but the fallacy is eliminated if they make anonymous predictions. The authors thus conclude that the planning fallacy may be caused by a desire to present a favorable impression to others. This again provides support for the design of computer tools that depersonalizes communication for the purposes of accurate planning.

Pezzo et al. do not discuss whether the desire to present a favorable impression is conscious or unconscious, nor do they discuss why people ignore the unfavorable impression that a later failure will likely give. A recent article on self-deception may shed some light on these questions [16]. The authors postulate that self-deception evolved to gain advantages from others while preventing deception from being detected, and minimizing punishment if the deception is discovered. Although they do not address the planning fallacy, in the commentaries Thomas Suddendorf proposes that “*in order to elicit cooperation on a project, one may benefit from exaggerating the likelihood and positive consequences of success (or negative consequences of failure)*” [16]. Thus, the planning fallacy may be the result of an unconscious mechanism that has evolved to foster other people’s cooperation. This conjecture is consistent with the finding that people in position of power exhibit more planning fallacy [3]. If this turns out to be true, then the planning fallacy may be hard or impossible to overcome, and we should perhaps focus on designing social networking and visualization tools that promote accountability and social awareness rather than tools that support planning and self-awareness for individuals.

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