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How personal task management differs across individuals ☆

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ABSTRACT

There has been a wealth of research on how individuals manage their tasks in general. However little to none has investigated whether, how, and why personal task management (PTM) behaviors differ across individuals. To fill this gap, we conducted two empirical studies: a focus group + contextual interviews with 19 participants, and an online survey with 178 respondents. Initially, based on the results of the first study, we were able to summarize the differences and similarities across the individuals by categorizing the participants into three categories: DIYers, make-doers, and adopters.

Then, we conducted a survey with a broader population to assess to what extent our previous results would generalize to a broader population. We found that many of the survey respondents did not fit neatly into one of the previous categories; rather, they demonstrated tendencies of varying strength toward adopting, make-doing, and DIYing for their PTM. This was reflected in how they recorded and remembered their tasks, and if/how they maintained task lists. Based on this, we recommend that PTM tools have the capacity to accommodate the varying strengths of those tendencies: they should be personalizable so that people with DIY desire can personalize their tool when they need to and should be relatively effortless to use and integrate well with other systems in use to satisfy make-do tendencies.

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1. Introduction

Many people are managing an ever-increasing number of tasks—loosely defined as "to-dos." Based on our own casual observations, we noticed a large variety of ways in which people manage their tasks and that many people still rely on general-purpose tools such as a text file for tracking their tasks. Such observations have formally been reported in Blandford and Green (2001); they highlighted that the majority adopt general-purpose tools such as paper scraps and mobile phones for remembering their to-dos. A plethora of electronic personal task management (e-PTM) systems have been developed since then, such as OmniFocus[1], Things[2], Remember The Milk[3], and Google Tasks[4], and people seem to have very different opinions as to which one is the best PTM application. Four different variations of the question "*what is the best task management application*?" in Quora[5] revealed 45 responses that collectively identified 33 different e-PTM applications[6]. As one of the respondents put it: "*The one thing that this thread illustrates is that there is no "best" task manager. There are hundreds if not thousands of options, but no clear market leader. All solutions have high abandonment rates, and ironically pen and paper is voted the best task manager on Lifehacker each year*".

Taken together—the large number and diversity of e-PTM applications, the fragmented e-PTM market, and the fact that many people seem to use general tools to manage their tasks—might suggest high diversity of PTM needs and behaviors across individuals. Although there has been previous research on how people manage their tasks (Bellotti et al., 2004, 2003), little to no research attention has been

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[1] https://www.omnigroup.com/omnifocus/
[2] https://culturedcode.com/things/
[3] https://www.rememberthemilk.com/
[4] https://www.gmail.com/mail/help/tasks/
[5] Quora.com (an online question and answer system)
[6] In February, 2014 we searched for "task management" in Quora and picked the existing top 4 questions related to "what is the best task management tool?" and looked at their 45 responses combined.

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paid to differences in PTM behaviors across individuals. Understanding such individual differences should provide valuable insight into the design of personalizable PTM tools. The ultimate goal is to design a PTM tool that better supports individual differences so that people can adapt the tool to their own way of managing tasks, instead of adapting themselves to the tool's approach, or worse, abandoning the tool altogether.

To understand differences across individuals' PTM behaviors, we ran two studies: Study One was a focus group + contextual interviews and Study Two was a survey study. For Study One we opted to focus on a relatively homogenous population, namely people in an academic setting. While this sample was chosen in part for convenience, it also helped to focus on sources of individual differences beyond the well-known sources of differences, namely task type and occupation. We were initially concerned that "academics" might be too homogeneous in their PTM behaviors, so we first conducted a focus group with 7 participants, which surprisingly revealed interesting variations in PTM behaviors. In close succession, we then conducted contextual interviews with 12 participants. About a year later, for Study Two, we broadened our sample by conducting an online survey with 178 people of diverse occupations to find out the extent to which the results of Study One generalize to a broader population. The focus of our studies is on the management aspect of PTM such as making lists—rather than activities related to *performing* tasks. In our studies—similar to previous PTM work (Bellotti et al., 2004; Czerwinski et al., 2004)—we loosely referred to tasks as "to-dos" or "things that need to be done".

Study One has already been published (Haraty et al., 2012). The current paper extends Study One, and only reports those findings from that study that are most relevant to the new survey study, namely Study Two. This paper makes the following new contributions:

1) Assesses generalizability of categorizing individuals based on their PTM behaviors into the three categories of DIYers, make-dosers, and adopters.
2) Extends the understanding of the above user categories by showing that the differences across individuals' PTM behaviors can be best explained by individuals demonstrating tendencies of varying strength toward adopting, make-doing, and DIYing for their PTM—instead of belonging exclusively to one category.
3) Offers implications for the design of personalizable[7] PTM tools, which can support differences in PTM behaviors across individuals.

2. Related work

In this section, we first review prior PTM studies related to tool use. We then discuss the relationship between PTM and personal information management (PIM) and review the PIM studies that have reported individual differences in PIM.

2.1. PTM studies

Task management has been studied from several perspectives. We categorize PTM studies into two groups: (1) studies of tool use and practices, i.e. what tools and practices people use to manage their tasks and how they use them, (2) studies of multitasking, task switching, and interruptions, i.e. how people *perform* their tasks which includes how people multi-task, switch tasks, handle interruptions, and resume an interrupted task. Our work belongs to the first group and adds to it by characterizing individual differences in PTM. Thus, we will review that group of work below.

PTM studies of tool use fall into two categories: studies investigating the use of a given tool such as calendar or email for PTM, and studies investigating how people manage their tasks in general.

Payne investigated the use of calendars and noted the mismatch between users' models of time management and the time management model imposed by calendars and diaries (Payne, 1993). He offered some design guidelines for e-calendars, many of which have been adopted in existing e-calendars such as Google Calendar. An example of such guidelines is supporting user orientation by making today or this week perceptually distinct. A large body of work has investigated the use of email for task management (Bellotti et al., 2003; Ducheneaut and Bellotti, 2001; Gwizdka and Chignell, 2004; Krämer, 2010; Mackay, 1988; Siu et al., 2006; Whittaker et al., 2006). These studies have identified a variety of problems of using email for PTM. As a result, several solutions such as TaskMaster (Bellotti et al., 2002), TeleNotes (Whittaker et al., 1997) and ContactMap (Whittaker et al., 2004) have been developed to enhance email support for managing tasks that involve other people (Whittaker, 2005). In a similar attempt, Google Inbox is designed as an email client centered on task management to the extent that the action of archiving has been replaced with the action of marking an email as "done". Although these systems have been successful in addressing the problems that they were targeting—except for Inbox for which there is no evidence yet on its success—individual differences were not taken into account in their design.

PTM studies have characterized different types of tasks that have given rise to some differences in individuals' PTM though. For example, studies of task management in email identified three types of tasks that people manage in their email (Bellotti et al., 2005): rapid-response tasks that take a few seconds to respond, extended-response tasks that take longer to complete, and interdependent tasks that depend on the actions of others to be completed. People have shown different strategies to manage tasks in each of the above. When discussing our findings, we reflect on how different types of tasks that have been identified in the literature explain some of the differences in PTM behaviors across individuals that we observed.

Compared to empirical studies on how people use a single tool such as email for PTM, relatively fewer studies have examined how individuals manage their tasks more generally; one example is Blandford and Green's study on how paper-based and electronic PTM tools are used together (2001). They concluded that there is no perfect PTM tool and instead of designing e-PTM tools that replace paper based tools, the weaknesses and strengths of different tools should be understood and seamless integration of the tools should be supported. Another example is Bellotti et al.'s study that investigated how busy professionals and managers manage their tasks (2004). The focus of

[7] There is no consistent terminology for personalizable/customizable tools in the literature. In this paper, we use the term "personalizable tools" to refer to ones that put users in control of tailoring the system to their needs by providing users with flexibility to make their own changes to the UI or functionality of the system (McGrenere et al., 2002).

their study was to discover the type of PTM activities that a PTM tool should support, with little emphasis on understanding how each PTM activity (e.g., recording tasks) might differ across individuals. Leshed and Sengers (2011) investigated the relationship between experience of busyness and the use of PTM tools. They found that people use a single productivity tool such as a calendar book for different purposes such as planning the upcoming week, logging activities, making to-do lists, as well as writing anything that comes to mind. They suggest personalization for the design of productivity tools, for example, by keeping the system open to multiple interpretations of how it can be used. However, the forms of personalization that should be provided in order to support appropriation for various purposes remain unclear.

We studied changes in PTM behaviors over time by asking people about changes in their PTM as well as the reasons behind those changes; we identified three types of changes based on whether the change is made to one's PTM strategy, to a an individual tool, or to one's tool-set by adding or removing a single tool to/from it (Haraty et al., 2015). We found that the reasons that people are not consistent with their PTM practices and make one of the above changes to their PTM is one or more of the following: changing needs, dissatisfaction by their unmet needs, and opportunities revealing unmet needs.

2.2. Individual differences in Personal Information Management

Personal Information Management (PIM) refers to the practices of locating, creating, storing, organizing, maintaining, retrieving, using, and distributing information for various everyday purposes such as later retrieval, reminding, and collecting that support our needs and tasks (Jones, 2007). PIM and PTM are related to each other in two different ways: (1) they have been considered as "the two sides of the same coin" (Jones, 2007) because people organize some of their information according to its anticipated use in their tasks/projects (Kwasnik, 1989); (2) PIM can be considered as a superset of PTM because a to-do/task such as "review paper by next Monday" is a form of information that needs to be stored, organized, and retrieved similar to other forms of information. Perhaps most relevant to PTM—among PIM studies—are studies of project management that have investigated how people organize information items related to their projects as part of their project management practices (e.g., (Bergman et al., 2006; Jones et al., 2006, 2005)). The focus of our studies differ from that of the project management studies in that we focus on the management part of PTM, such as making lists, as opposed to activities related to *performing* tasks, such as organization of information items needed for execution of a task/project. Below, we review the PIM studies that have reported differences in PIM across individuals and thus have a similar focus to that of our studies.

PIM studies have identified different groups of users with respect to their PIM behaviors. In a study of office workers, Malone identified two strategies of filing and piling in office management (Malone, 1983). This study was followed by MacKay's study of how office workers used email to manage their daily work, where she found that email provided a mechanism for task management activities: some delegated tasks (requesters), and some received their tasks via email (performers); performers kept working information in their inbox as a reminder of the tasks that needed to be done (Mackay, 1988). Whittaker and Sidner found three strategies in managing email: frequent filers, spring cleaners, and no-filers (1996). Similarly, inspired by Malone's filers and pilers, Van Kleek et al. found individual differences in use of a note-taking tool (List-it) (Van Kleek et al., 2011). By analyzing their participants' behaviors regarding note creation, edits, and deletion over time, they found four distinct usage patterns reflecting individual differences in using a note-taking tool. The four groups of users were minimalist, periodic sweepers, revisers, and packrats (a term used by some of the participants in Marshall et al.'s study, when referring to their behaviors in handling the encountered information while reading (Marshall and Bly, 2005)).

Jones et al. studied how people keep/organize web information for re-use and they found a great diversity across individuals' keeping methods: send email to self or others, print out the web page, save the web page as a file, paste URLs into a document, add a hyperlink to a personal web site, bookmark, write down notes on paper, copy to a "Links" toolbar, and create a note in Outlook (Jones et al., 2002). They explained the differences in keeping behavior between people by analyzing the functions that each keeping method provides: keeping methods differ in the functions they provide (portability of information, accessibility from different devices, persistence of information, preservation of information in its current state, currency of information, context, reminding, ease of integration, ease of maintenance, communication and information sharing) and people differ in the functions they need according to their job and tasks. Thus, the differences in keeping methods between people were attributed to the difference in people's jobs and tasks.

3. Study One

3.1. Methods

We investigated differences in PTM behaviors across individuals in an academic setting with a focus group and contextual interviews. In both the focus group and the contextual interviews, we used convenience sampling.

Of special note, we referred to tasks as "to-dos" or "things that we need to do" in both written and verbal communications with participants. We intentionally did not impose any particular meaning of task—other than the above—because people vary in how they distinguish tasks from projects or even from goals. This approach is not uncommon in prior PTM work. For example, Bellotti et al. used the term "to-do" to refer to task/project without distinguishing between the two (2004).

3.1.1. Focus group: participants and procedure

The purpose of the focus group was threefold: to ensure sufficient variation in PTM behaviors among individuals in our population, to broaden our understanding of PTM behaviors and practices, and to help refine our methods to be used in the contextual interviews. Five graduate students (1 female) and two post-docs—all from Computer Science Department at the University of British Columbia—attended the focus group which took place in February 2011. The goal was to allow the participants to talk about their task management practices without requiring them to answer specific questions. To seed the discussion, at the beginning of the session two broad questions were posed to the participants about their everyday task management: How do you manage your tasks? Do you consider yourself organized in regard to managing your everyday tasks? A few more specific questions were shown on a slide during the session to help the participants talk about their task management. These questions addressed the tools used for PTM and what were liked/disliked about those tools. Each

Table 1
Focus group participants (denoted by *) and contextual interview participants, the tools they used for PTM, and their identified user type—Participants' primary tools are in bold ($N=19$).

Participants	Tools used for PTM	Identified user type
P1	Paper planner	DIYer
P2	Pieces of paper, Notepad, iCal, email	DIYer
P3	**Paper**, email, alarm	DIYer
P4	**Word document**, Notebook, Google Calendar, cellphone, alarm	DIYer
P5	**OneNote,** Microsoft Outlook	DIYer
P6	Paper	DIYer
P7	**Word document**, Google Calendar	DIYer
P8	**Microsoft Excel, Word**, Google Calendar and Tasks, iPhone calendar	DIYer
*P9	**Paper**, calendars	DIYer
*P10	**Wiki**, Paper notebook, Mendeley	DIYer
*P11	**Word document**, Paper notebook, sticky notes	DIYer
P12	**AbstractSpoon**, Email (Gmail), Google Calendar, Smartphone (Calendar)	Adopter
*P13	**Things** (on Mac), Google Calendar	Adopter
*P14	**Google Tasks, Email,** Google Calendar, Whiteboard, wiki	Adopter
*P15	**OmniFocus** (on Mac & iPhone), Email for collaborative PTM	Adopter
P16	Paper notepad, iPod Touch (Calendar, Notepad, ListPro)	Make-doer
P17	Email, Google Calendar	Make-doer
P18	Calendar (Google, iphone), Post-it notes, notebook	Make-doer
*P19	Google Calendar, Firefox Tabs, text files	Make-doer

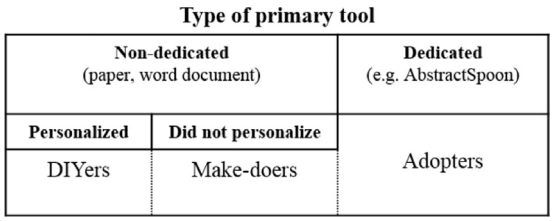

Fig. 1. Three types of users.

participant took a turn talking about how s/he managed her/his tasks, the tools used, and the challenges faced. The session was audio-recorded and transcribed. The substantial variations found in the participants' PTM behaviors gave us confidence to proceed to the contextual interviews with participants from the academic population, i.e. grad students, post-docs, and professors.

3.1.2. Contextual interviews: participants and procedure

Twelve volunteers (6 females), all from University of British Columbia, participated in our contextual interviews: 10 from Computer Science, one from Mechanical Engineering, and one from Medicine. All were graduate students except for one professor and a post-doc. Data were collected through semi-structured contextual interviews. These interviews were conducted in the place where participants typically engage in their PTM activities, such as their offices, or in most cases in an undisturbed space on campus (given that they had their PTM tools readily available, e.g. on their laptops). One participant was interviewed at his residence in the same city. The contextual interviews took place in March 2011 over a period of 2 weeks.

We first asked the participants about their education and work background, followed by more general questions about their organizational styles with regard to how they handled their day-to-day tasks. The goal was to find out how people felt about their PTM. Next, we asked participants to show us their PTM tools, to talk about how they used them, and to describe what and why they liked and/or disliked them. A *critical incident* technique (Flanagan, 1954) was employed to solicit stories about the tasks that they had recorded in their tools. We also asked them about their previous practices so as to capture the evolution of their PTM behaviors. Appendix A includes the interview script that was used to guide the semi-structured interview. Each interview lasted between 30 min and 1 h, depending on the number of tools the participant showed us, and his/her orientation to detail. All the interviews were audio-recorded and transcribed for data analysis.

3.1.3. Data analysis

We used a variant of grounded theory for data analysis (Corbin and Strauss, 2008). A central tenet of this approach is that "all is data", which means whatever the source of the data is (e.g., informal interviews, conversation with friends), it should be included in the analysis. Therefore, all 19 participants from the focus group and the contextual interviews were included *together* in one comprehensive analysis. Three coders each independently coded two of the transcripts. The codes for the two transcripts were compared and discussed for establishing a consolidated list of codes. Using this list, a third transcript was coded by two of the coders, who then proceeded to code the remaining transcripts. The inter-coder reliability was calculated for the third transcript using Cohen's Kappa index. With the minimum kappa of 0.79, the two members continued coding and memoing (Corbin and Strauss, 2008) the rest of the transcripts, from which we proceeded through axial coding, which is the process of relating codes to each other, to establish themes and generalizations. After several rounds of axial coding and finding concepts that best describe the differences across participants, three types of users emerged, after which we went back to the data to check if we could describe all our participants based on those user types. This process of reanalyzing the data using the concepts emerged in the analysis is a variation of theoretical sampling in grounded theory given by Corbin and Strauss

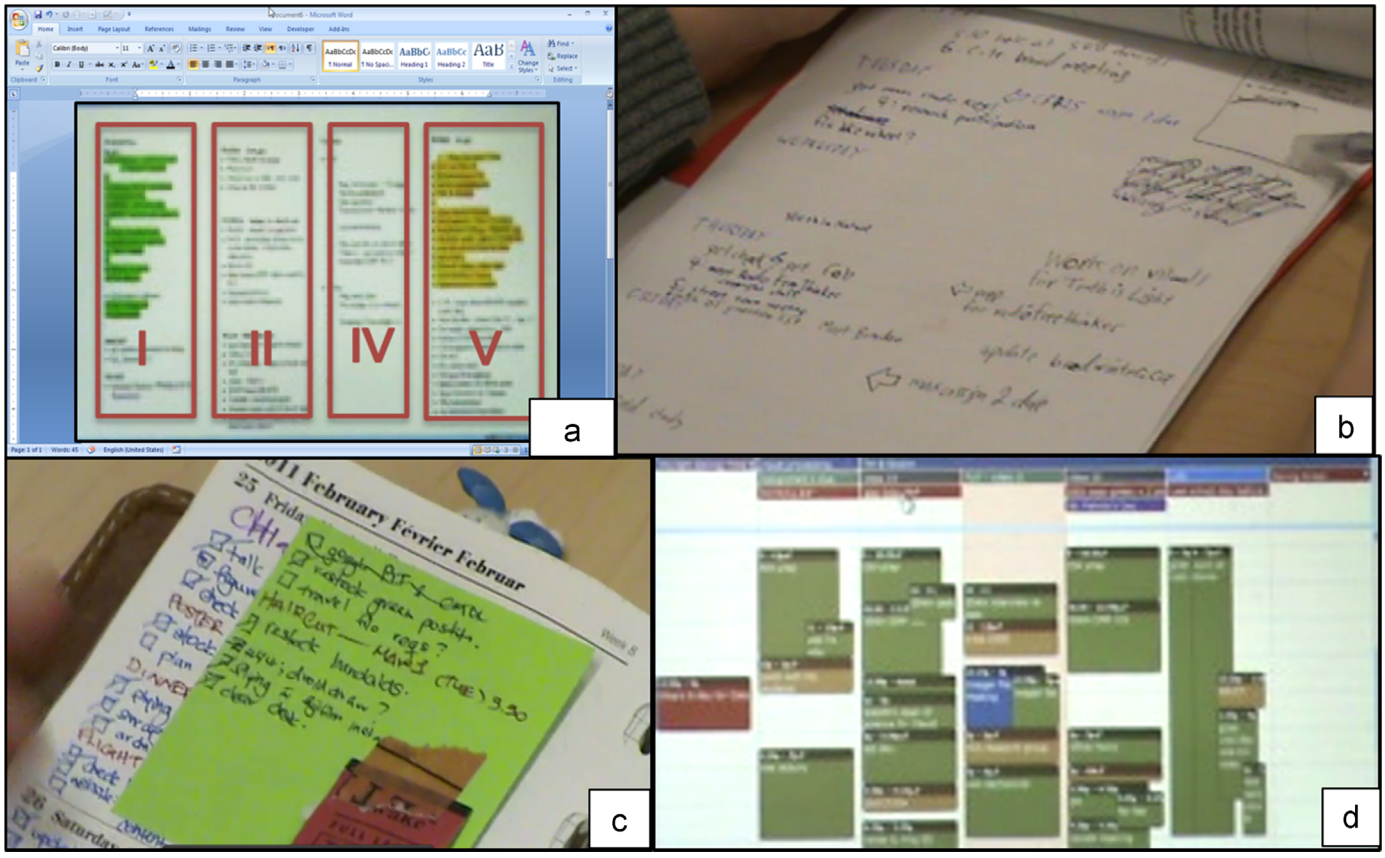

Fig. 2. Examples of how participants used and personalized tools such as a word document, paper, paper planner, and a calendar for their PTM: (a) P7's "Matrix To-do" list in a Word document comprised of 4 columns: (I) personal tasks, high priority ones highlighted in green, (V) work-related tasks, high priority ones in yellow, (II+IV) low-+medium priority work-related tasks, (b) P2's task list on a paper, (c) P1's paper planner, (d) Google Calendar.

(2008), although it does not involve interleaving of data gathering and analysis. Given the similarities and overlaps between different qualitative research methods, one could also label our approach thematic analysis (Braun and Clarke, 2006).

3.2. Findings

Here, we provide a brief overview of the findings of Study One: the three types of users and the PTM behaviors that differed across them.

3.2.1. Three types of users

We asked participants about what they used for managing their tasks and how they were used. Participants often used a tool-set—multiple tools in combination to satisfy their PTM needs (Table 1). The tools used for PTM ranged from highly general tools, both traditional (e.g. paper and pen) and electronic (e.g. Word document), to tools that provide some PTM support (e.g. email and calendar), to tools that are dedicated to PTM (e.g. OmniFocus, RTM). Among these tools, email and calendar were commonly used for PTM by most of our participants. Further, some participants used one or two primary tools, in which they did most of their PTM, while other participants did not identify any primary PTM tool. On a different dimension, we found that participants who were using general tools for PTM (e.g. paper and pen) differed from one another with respect to their investment in personalizing those tools. Designing a PTM tool using a general purpose tool such as a word document or a text file is what we refer to as personalization here. These tools were used in ways that were not specifically intended by their designers. As an example, P6 and P18 both use paper notepad/notebook for their PTM but to make a weekly/monthly list, P6 divides her paper into four columns and puts her tasks in one of those columns depending on the type of tasks; whereas P18 uses paper to simply jot down her tasks in a haphazard manner.

Given the similarities and differences we found among the participants, three mutually exclusive types of users emerged based on two criteria: (1) whether or not their primary PTM tool was a dedicated e-PTM tool, and (2) whether or not they personalized their primary non-dedicated tool. The three types of users, based on their primary tool, are:

- **Adopters**: who use a dedicated e-PTM tool.
- **Do-it-yourselfers (DIYers)**: who use and personalize a general tool.
- **Make-doers**: who use a general tool, but without personalizing it.

Participants cleanly belonged to only one of these categories, thus we were confident that these three mutually exclusive categories explain the data of Study One well. The majority of the participants were DIYers (11/19), with the remaining divided evenly between

adopters (4) and make-doers (4). Fig. 1 illustrates these three groups of users based on the two criteria and Table 1 shows the participants, their tools, and their types that we identified.

3.2.1.1. Adopters. The primary tools of adopters were dedicated e-PTM tools (e.g., OmniFocus), which were limited in terms of supporting personalization. Adopters differed with respect to the level of their investment in choosing their tools. While P12 chose his PTM tool by trying a number of different PTM applications in a single session, P14 on the other hand had tried approximately twenty PTM applications over a course of five years before finally deciding to use Google Tasks. When asked what he disliked about all these tools, he pointed out that they were not integrated with other tools that he had been using for PTM (e.g. email, calendar) and he disliked their inflexibility, which had forced him to adapt his PTM behavior to the way the tool required.

Three adopters reported that they had tried e-PTM tools based on an approach to task management called GTD (Getting Things Done)[8] (Allen, 2001), however, only one continued to use OmniFocus, a GTD-based tool.

3.2.1.2. Do-it-yourselfers (DIYers). The primary tools of DIYers were general-purpose tools either paper-based such as traditional pen & paper and paper planners, or electronic such as Word and Notepad documents. They designed their own PTM system by personalizing these tools based on their own personal rules for recording and remembering their tasks as well as maintaining and organizing their task list. Some of the factors that had led them to design their own system instead of adopting an existing dedicated PTM tool included: lack of a clear market leader among the PTM systems, and thus the time required to find a good PTM system, the mismatch between their needs and existing PTM systems known to them, and PTM systems' steep learning curve. Five out of eleven DIYers settled as DIYers after trying to adopt a number of dedicated PTM applications. For example, P7 said about her PTM system, which was a Word document illustrated in Fig. 2-a:*"this is the best system that I've had to-date, after trying a number of different systems [including Palm Desktop, and something based on Stephen Covey's book][…] it works for me"*. Similarly, P1 who used a paper planner said: *"[…] on my phone, I tried a whole bunch of to-do list apps, there was like … Wunderlist: that one has a desktop app too so I tried both of them. But, I dunno …'cause there was a whole bunch of to-do list apps, and none of them is quite what I need. And it's kind of confusing to have to relearn stuff, so I was just like "forget it!" Paper is so easy! 'cause I can just configure it to however I want to do it"*.

DIYers were more likely to cherry pick strategies from methodologies such as GTD for their PTM instead of adopting them as a whole. P9 described his experience with GTD:*"I am using some of the strategies in GTD. But I am not committed to this methodology, since it's too much overhead for me […] GTD was so cool and I tried to do the same and be so organized but it didn't work for me. It was over-organizing everything […]*". Being aware of their characteristics and PTM needs, DIYers designed their own system in such a way that it met their needs. P1, a DIYer, reflected: *"I actually am not a very organized person by nature, so I need like all this massive complicated stuff [referring to her system] to remember"*.

P1 designed her own PTM system using a paper planner and Post-it notes (Fig. 2-c). She essentially personalized her paper planner. For example, due to the limited space in her paper planner for each day, she added Post-it notes to relevant days for additional tasks that did not fit in the space provided by the planner. To overcome the added effort of manually entering recurring tasks every week or month, she put these tasks on a Post-it note so that they could be easily moved to another week or month. Also, since paper planners naturally enforce every task to be associated with a date, she used Post-it notes for time-independent tasks, so that she could also easily move them around without having to rewrite them.

3.2.1.3. Make-doers. Make-doers did not use any dedicated PTM tools. The tools they did use were similar to DIYers'; they used email, calendar, and other general tools such as paper and pen and text files. However, unlike DIYers, they used such tools without personalizing or making any changes to them. They only utilized the minimal support of general-purpose tools for PTM without adapting/personalizing them. This explains the small variation among the make-doers' PTM behaviors we observed as compared with relatively large variation among the DIYers'. For example, when using electronic calendars, which provide a reminding mechanism, none of the make-doers had even changed the default settings of the reminders for any of their tasks. Despite this, two out of four complained that the default reminder was set to *only* ten minutes ahead of a scheduled task.

Thus, while both DIYers and make-doers adapt general-purpose tools (such as paper) for their PTM behaviors such as making to-do lists, only DIYers personalize those tools to the extent that they themselves consider their devised tool as their PTM tool.

3.2.2. PTM behaviors

We observed a set of common PTM behaviors among our participants, which we categorized into *three* groups: (1) recording tasks, (2) remembering tasks, and (3) maintaining and organizing task lists. In this section, we provide a summary of the aforementioned PTM behaviors which are discussed in greater detail in (Haraty et al., 2012). Here, we mostly focus on recording tasks since we rely on that in Study Two to identify different types of users.

3.2.2.1. Recording tasks. Participants reported a variety of task categories that they recorded in their tools: administrative, project deliverables, scheduled events, things to read, shopping lists, "things, events, people to research at a later date", random notes to see when looking at the task list (not associated with any task), packing list, agendas for meetings, and phone calls.

We found a great variety of methods for recording tasks: making lists, keeping web pages or documents open, taking pictures, flagging email messages or making them unread, and writing post-its. These behaviors were influenced by the environment/tool in which the task was created. We summarize the behaviors relevant to recording tasks into two groups of making task lists and distributing tasks across multiple tools, and we discuss their variation among individuals.

[8] A number of personal task/time management approaches as described in Stephen Covey's "The seven habits of highly effective people" (Covey and Emmerling, 1991), David Allen's "Getting things done" (GTD) (Allen, 2001), and Mark Foster's "Do it tomorrow and other secrets of time management" (Forster, 2006) have provided people with strategies to manage their time and tasks. As mentioned in the Introduction, a number of PTM tools are available on the market, some of which are designed based on the aforementioned methodologies. Such tools often require their users to adapt their behaviors to the method supported by them.

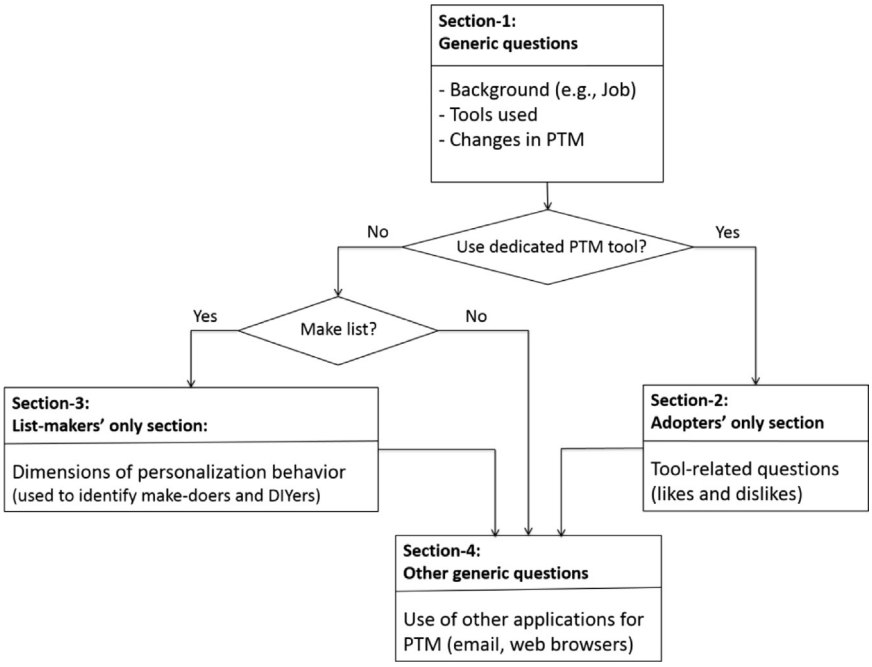

Fig. 3. The survey structure; participants were directed to different sections of the survey based on their responses to the two question of whether they use a dedicated PTM tool and whether they make lists.

Table 2
Participants' occupations in Study Two. Others represent occupations held by 1 or 2 respondents only: editor, publisher, financial analyst, designer, accountant, engineer, church minister, community organizer, communications professional, medical doctor, technology coordinator, rehabilitation specialist, and user support specialist.

Occupation	Survey
Grad students	68
University Professor/post-doc	20
Nurse	20
Teacher	18
Administrative staff	8
Manager	7
Lawyer	5
Software developer	4
Consultant	3
Others	25
Total	178

Making task lists: Making task lists was a prevalent PTM behavior among adopters and DIYers. Dedicated PTM tools imposed the format of adopters' task lists, giving them limited formatting flexibility. However, whenever their tools (e.g., a piece of blank paper or a plain Word document) allowed, DIYers exhibited a variety of uses of space when making their task lists. Two common examples were dividing a list into multiple columns, each representing a different category of tasks, and placing high priority items at the top and low priority ones at the bottom. Although making task lists was not a dominant behavior among make-doers, they would choose the most readily available tool, likely paper, digital document, or email, if they happened to do so. There would also be little or no rules as to where and in what order tasks were placed in their lists. We observed different uses of color in making lists, with the most common use for differentiating between types or importance of tasks. Some individual characteristics such as small handwriting increased the need to use color for facilitating visual search: *"it's much easier to differentiate my tasks with color because my handwriting is small"* (P1). Others used different colors simply for the sake of adding variety to their lists (P5, P1, P6).

Distributing tasks across multiple tools: Participants were found to distribute some of their to-do items to tools such as email, calendars, and web browsers. This is similar to Bellotti et al.'s finding that to-dos are stored in different resources (2004). However, while they found that people only kept a minority of their to-dos in their to-do lists, we found considerable diversity across our participants with respect to the proportion of their tasks in lists and the spread across other tools.

3.2.2.2. Remembering tasks. Five categories of remembering strategies emerged from the data analysis. They were either chosen by participants or imposed by their tool or situation: notification-based strategy (setting reminders), polling-based strategy (checking a task list frequently), association-based strategy (associating an object or a time to a task), social-distribution strategy (relying on another person to remind), and rehearsal or trying to remember. The differences in remembering strategies were in part influenced by the type of tasks and the differences in tools used for recording tasks. For example, a social-distribution remembering strategy was used for tasks that involved other collocated people, and a notification-based strategy was used more for tasks with strict deadlines. Polling-based remembering

strategy was dominant among individuals who used general tools like paper and Word documents; whereas notification-based strategy was dominant among people who used a tool that offered a reminding functionality.

3.2.2.3. Organizing and maintaining task lists. Organizing or maintaining task lists, exhibited by both DIYers and adopters, was the third group of PTM behaviors, and it involved adding or changing details of a task, or reorganizing tasks. When done with the tasks on their task list, DIYers and adopters employed various post-completion strategies such as crossing, checking, archiving, or deleting the tasks. Similar to adoption of remembering strategies, adoption of each of these strategies was in part influenced by the affordances of the tool used to record tasks and by the type of tasks. For example, crossing off items was more common when using paper than digital lists since not all digital lists supported this action and tasks written on paper cannot be easily deleted. Tasks received by or related to email would typically be archived, or simply just left alone, as were Google Calendar items. Tasks on digital lists such as Google Tasks or documents were normally deleted to avoid cluttering the screen.

4. Study Two

To assess the viability of grouping people based on the two criteria described in Study One (type of the primary tool and personalization), we conducted an online survey in February 2012 with a more heterogeneous population and asked the respondents about the tools they used as well as their personalization behaviors. The goal was to extend our understanding of the three types of users identified in Study One by assessing the extent to which they generalize to a broader population.

4.1. Methods

Here, we describe the survey design, the respondents, and the data analysis methods.

4.1.1. Survey design

The results of Study One were used to guide the design of the survey that comprised 4 sections (see Fig. 3). Appendix B includes all the survey questions. The first and the last sections of the survey included generic questions that were answered by all the respondents. The first section asked all respondents about individual characteristics (e.g., job and busyness), and the tools they used for PTM. Depending on their responses to the first section, respondents were directed to different survey sections: respondents who had reported using a dedicated tool in the first section were directed to the second section whereas those who had indicated that they made a task list were routed to the third section—see the flowchart in Fig. 3. In the last section of the survey, all the respondents were asked about their use of other tools such as email and web browsers for PTM.

4.1.2. Respondents

Survey respondents were recruited by a series of invitation emails to various departments at the University of British Columbia as well as to the authors' friends and colleagues. The goal was to distribute the survey to people with diverse occupations. A total of 182 people responded to the survey. To limit the participation to people who have experience with task management, the first question of the survey asked respondents whether they have ever used any tool such as a calendar, paper planner, or a piece of paper to manage their tasks. Four respondents had never used any of these tools and were thanked for their participation after responding to this question; the remaining 178 respondents completed the survey. The majority of respondents (134/178, 75%) were female with 42 male respondents (24%), and two participants did not disclose their gender. Despite our goal of broadening our sample beyond academics, we still attracted many professors and graduate students to our study (88/178, 49%). The non-academics (51%) included nurses, teachers, administrative staff, software developers, lawyers, and consultants among others (see Table 2).

4.1.3. Data analysis

We analyzed the data of 164/178 (92%) respondents for the purpose of identifying their types, namely DIYer, Make-doers, and Adopter. The remaining 14/178 (8%) respondents filled out the survey incorrectly and were excluded from the analysis[9]. Below, we describe how we identified the three types of users among the survey respondents.

4.1.3.1. Analysis method for identifying the three types of users. To identify adopters, we used a simple question of whether or not respondents use a dedicated PTM tool. However, to distinguish DIYers from make-doers, we used a combination of methods. First, we asked non-adopters if they maintained some form of a task list, which we defined in the survey as "*a physical or digital page/note on which they write/type/enter their tasks*". This was to distinguish the ones who did not make any task list (those categorized as make-doers in Study One) from the ones who made task lists and could be either make-doers or DIYers depending on their personalization behavior. Second, to distinguish DIYers from make-doers among the list-makers we used two distinct methods, namely clustering and manual classification, both based on responses to six questions related to personalization when *making lists*. We specifically focused on making lists because the most distinguishing characteristics of DIYers were that—unlike make-doers who barely kept to-do lists and managed their tasks in an adhoc way—they maintained task lists and personalized them by using color, symbols, and sketching; and they had a systematic approach to PTM. Moreover, DIYers were more likely to come up with their own layout for their task list rather than to use a default layout, and they would use different parts of their task lists. Based on these, we used the following six questions related to personalization when making lists:

1. U*se of color:* whether or not the respondent uses color when making list (Q23 or Q37 in Appendix B).
2. *Use of symbols:* whether or not the respondent uses any symbol (e.g., star, arrow, etc.) when making a list (Q23 or Q37 in Appendix B).

[9] These participants were directed to the adopters-only section of the survey (Fig. 3), even though they did not actually use any dedicated PTM tool. When asked for their dedicated PTM tool, if they have used any, they provided the name of a non-dedicated PTM tool (e.g., wiki, calendar, etc.) instead.

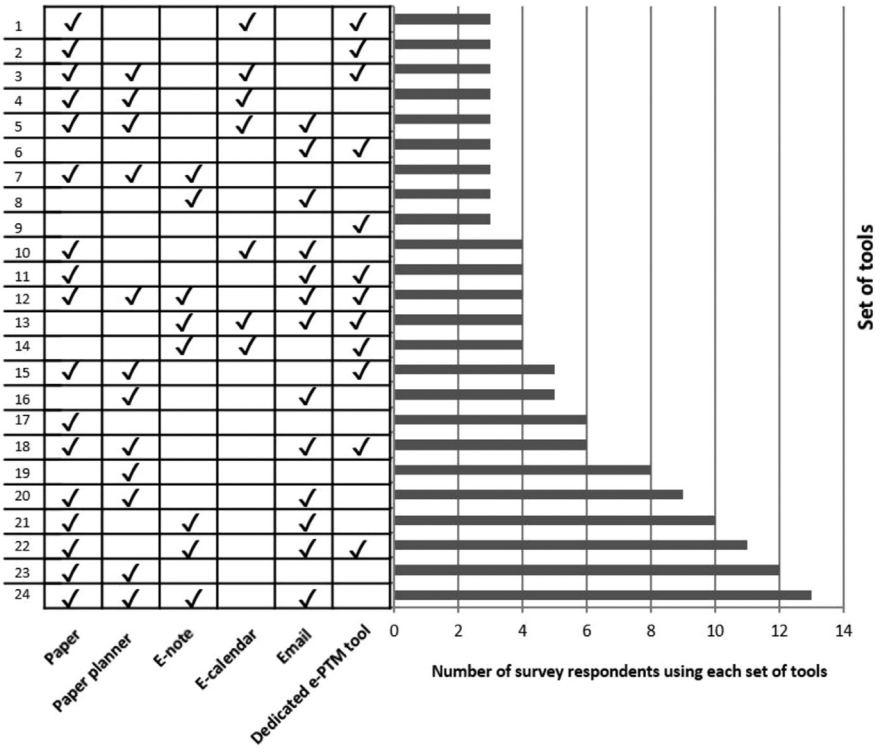

Fig. 4. The table on the left shows 24 different combinations of tools that were each used by at least 3 respondents—32 other combinations (not shown) were used by less than 3 respondents. Each row represents a unique combination and each column represents a single tool. For example, row #24 shows the combination of paper, paper planner, e-note, and email that were used by 13 respondents.

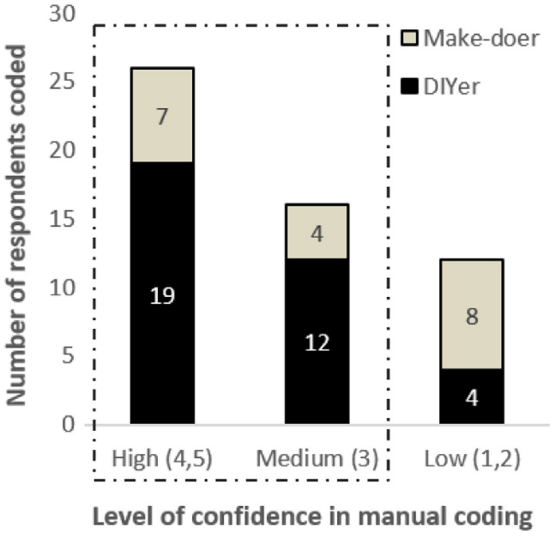

Fig. 5. User types identified in manual coding with high, medium, and low confidence. The result of the clustering of the respondents who were manually labeled with high or medium confidence matched their manual classification ($N=54$).

3. *Use of sketching:* whether or not the respondent uses any sketching in her list (Q23 or Q37 in Appendix B).
4. *Use of space:* the degree to which the respondent uses different parts of the task list (Q30 or Q44 in Appendix B).
5. *Adhoc management:* the degree to which the respondent manages her tasks in an adhoc way, i.e. no systematic way of managing tasks (Q29 or Q43 in Appendix B).
6. *Layout of tasks page:* how the respondent chooses the layout of her tasks page (using the default/built-in layout vs. coming up with a layout by themselves) (Q26 or Q40 in Appendix B).

For the manual classification method, one coder manually assigned respondents into the two groups (DIYers and make-doers) based on their responses to the above questions. Since the coder's confidence in this categorization varied across the respondents, she also assigned her level of confidence in classifying each non-adopter on a scale of 1 (not confident at all) to 5 (being very confident). We posited that one coder would be sufficient if the result of manual classification matched that of the automatic clustering. However, if the results of the two methods did not match, further investigation on the reliability of both methods would be deemed necessary.

Table 3
Summary of the survey results confirming and extending the results of Study One.

What did the survey confirm?
1. Similar to the DIYers in Study One, the 31 survey respondents classified as DIYers with medium-high confidence reported three or all four of the following: • Had a systematic approach to their PTM • Used color/symbol/sketching when making a list • Used different parts of their task list • Came up with their own layout for their task list
2. Similar to the make-doers who made lists in Study One, the 11 survey respondents classified as make-doers with medium-high confidence reported three or all four of the following: • Had an adhoc approach to their PTM • Did not use color/symbol/sketching when making a list • Did not use different parts of their task list • Used a default layout for their task list
3. Similar to the make-doers who did not make lists in Study One, the 35 survey respondents classified as make-doers did not maintain any form of task list.
4. Similar to the adopters in Study One, the 75 survey respondents classified as adopters reported using a dedicated PTM tool.
How did the survey extend our understanding?
5. Unlike the adopters in Study One who used their dedicated tool as their primary tool, 2 of the survey respondents classified as adopters reported using their dedicated tool only minimally compared to their other tools.
6. Unlike the adopters in Study One who actively chose their dedicated PTM tool, 40/75 of the survey respondents classified as adopters used their dedicated tools because they were pre-installed and handy to use (as will be described in Section 4.2.5). These respondents shared attributes with: • Adopters because they used a dedicated PTM tool • Make-doers in that they used their dedicated PTM tool because of its handiness.
7. Unlike DIYers and make-doers in Study One who were clearly different in the extent to which they personalized their tools, 12 of the survey respondents classified as either DIYers or make-doers with low confidence shared attributes with: • DIYers because they exhibited one or two of the behaviors in Row#1 above. • Make-doers because they exhibited one or two of the behaviors in Row#2 above.

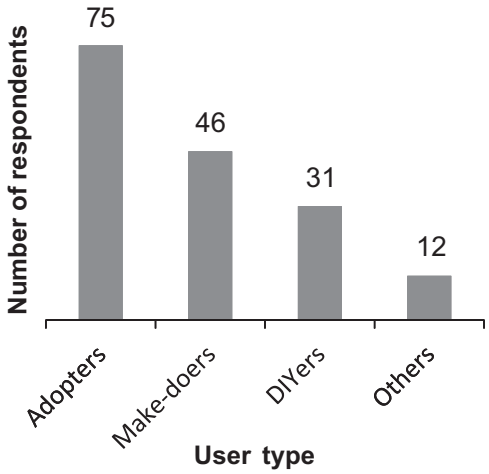

Fig. 6. Summary of user types identified among the survey respondents. Others are the respondents whose type were identified only with low confidence ($N=164$).

To validate the manual classification method, we performed an automatic clustering analysis on the same respondents. We used two clustering algorithms for this purpose: hierarchical clustering and fuzzy clustering. The analysis was done in R, using the cluster package. To compute the dissimilarities between participants, we used the daisy method with Gower as it's metric. Gower's dissimilarity coefficient was used because we had three types of variables—nominal, ordinal, and binary. With Gower, each variable is standardized by dividing each entry by the range of the corresponding variable after subtracting the minimum value; the rescaled variable has range [0, 1]. To select the best number of clusters, we used the average silhouette width, which measures how well each object belongs to its cluster. We ran PAM algorithm for several number of clusters ($k=2,3,\ldots,9$) and compared the resulting silhouette plots: the largest silhouette width for all the above groups was found for $k=2$; in other words, the data was best described by 2 clusters. We compare the results of the two methods in Section 4.2.3.

4.1.3.2. Analysis method for assessing associations between user types and individual characteristics. To investigate how user type is related to the individual characteristics (gender, level of busyness, satisfaction with one's PTM, interest in PTM, reliance on memory for

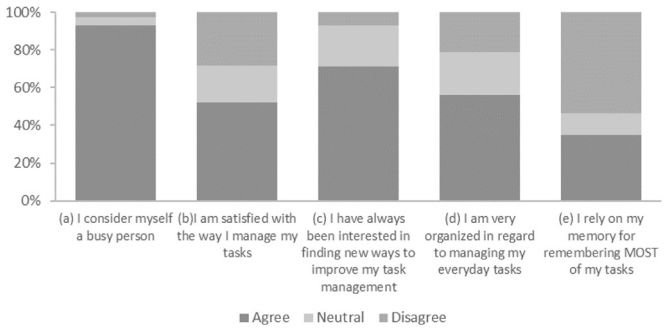

Fig. 7. Survey responses to 6 questions that were chosen based on Study One: each column illustrates the responses to one question. Questions were 5-point Likert scale that were binned in 3 groups of agree, neutral, and disagree ($N=178$).

Table 4
Dedicated PTM tools used by the adopters ($N=75$), the number of adopters using each, and how adopters found out about their tools.

Dedicated tools used	**# of adopters using the tool ($N=75$)**	**How adopters found out about their tools**		
		Pre-installed on computer	*Integrated with other apps used*	*Searching the Internet and word of mouth*
Outlook	41	31/41	9/41	0
Google Tasks	12	NA	8/12	4/12
Others (19 different dedicated PTM tools)*	22	0	0	22/22

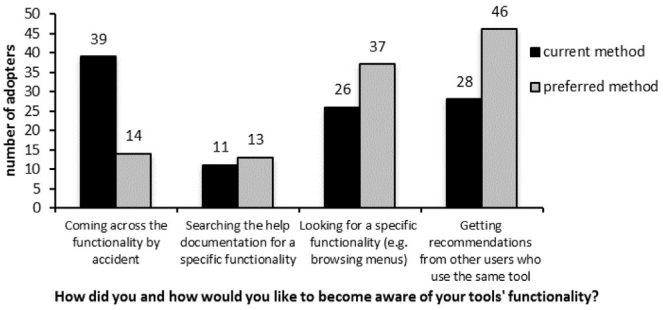

Fig. 8. Current and preferred methods of becoming aware of tools' functionality among adopters. Coming across the functionality by accident (accidental discovery) was the most used method for becoming aware of tool functionality and getting recommendations from other users was the most preferred method ($N=75$).

remembering tasks, and occupation), we used multinomial logistic regression analysis. The aforementioned variables were chosen because Study One suggested they might vary with users' PTM behaviors (Haraty et al., 2012). We will discuss the results of this analysis in Section 4.2.4.

4.2. Findings

In this section, we report on the following findings: tools the survey respondents used, the results of assessing generalizability of identifying adopters, DIYers, and make-doers using our manual classification method and automatic clustering method, associations between user types and individual characteristics, and behaviors of adopters.

4.2.1. Tools used

Similar to the participants in Study One, the survey respondents were found to use a tool-set, rather than a single tool, for their PTM. Each reported tool fell into one of the following categories: paper planner; other forms of paper (e.g., a piece of paper, sticky note), electronic notes (e.g., text file, Word document, spreadsheets, note-taking applications such as Evernote), electronic calendars (e.g., iCal, Google Calendar), and dedicated PTM tools (e.g., Wunderlist). We found 24 unique combinations of these tools used by at least 3 respondents (Fig. 4). The five most frequent tool combinations (rows 20–24) include paper, which might suggest the inadequacy of electronic tools on their own. In addition, any individual tool was rarely used solely on its own, suggesting the inadequacy of any single PTM tool on its own: eight respondents relied solely on paper (row 19), six solely on paper planner (row 17), and only three solely on their dedicated tools (row 9).

Table 5
What adopters liked and disliked about their tools. *n* is the number of adopters ($N=75$) who liked or disliked each of the tool characteristic.

Likes	*n*	Dislikes	*n*
Ease of use	28	Lack of a needed functionality	16
		Examples of functionality:	
Reminders	24	• Prioritization of tasks • Location awareness • Integration with other tools	
Seeing others' availability	10		
Use across multiple devices	10		
Integration with other tools	8	Not being able to make changes to the tool.	15
User friendly and simple UI	5	Examples of changes:	
Features like crossing out tasks	3	• Location of UI elements • View of their task lists • The way the tool prints out task lists • Default reminders	
Adding details to tasks	2		
Drag and drop tasks	1	Not intuitive, visually appealing, or user friendly	8
Prioritization	1	Electronic device	6
Custom views of tasks	1	No access to list when not at computer	4

In the last section of the survey, respondents were asked about their use of email and web browsers for their PTM, since these were two interesting behaviors we observed in Study One. The majority of the respondents who made task lists and kept email messages as to-dos in their inbox preferred to have a feature to transfer their email messages to their task list (69%, 97/140). Keeping web pages open as tasks was not as common as keeping email messages in inbox among the survey respondents; 80/178 (45%) of the survey respondents kept some of their web-pages open as reminders of their tasks and the majority of them (71%, 57/80) would like to have the option of transferring their web-pages as to-dos to their task lists.

4.2.2. Identifying adopters

In Study One, all the participants who used a dedicated tool used it as their primary PTM tool while using other tools only occasionally. None of the non-adopters used a dedicated PTM tool in any capacity (i.e., even as a *non*-primary PTM tool). We therefore used the question of whether they currently use any dedicated PTM tool as a filter to identify adopters in our survey design. However, despite our observation in Study One, we found large variation in the way dedicated tools were combined with other tools based on the comments made by some survey respondents (Fig. 4): while some respondents reported using their dedicated tool only minimally compared to their other tools, others solely relied on their dedicated PTM tool to manage their tasks (Fig. 4, row 9). For example, a university professor who reported using the Wunderlist application commented: "*Though I admit it's probably been a month since I've logged in*" [SR137], and another university professor, who reported using Google Tasks said: "*It does offer all kinds of advanced functionality but I don't use it usually. To be honest I don't use this tool much compared to a flat email todo list and my calendar app*" [SR142]. Despite the variation in the extent to which the respondents used their dedicated tools as their primary PTM tool and the limitation of using a survey instrument to capture the actual usage of dedicated tools, we tentatively continued to label those who reported using a dedicated PTM tool as "adopters". 75/164 (46%) of the respondents were labeled as adopters.

4.2.3. Identifying make-doers and DIYers

The next step was to identify make-doers and DIYers among non-adopters—the respondents who reported not currently using any dedicated e-PTM tool (89/164, 54%). To do so, we performed the analyses described in Section 4.1.3.

35 out of 89 non-adopters (39%) reported not having any task list and thus were identified as make-doers. 54 out of 89 non-adopters (61%) made lists and thus we used the two methods of manual classification and clustering, described earlier, to identify their types. Fig. 5 shows the number of non-adopters manually classified as make-doers or DIYers with different levels of confidence. Respondents who were classified with only low confidence (scale of 1 or 2), had some similarities with both DIYers and make-doers (see Table 3, row 7)

Automatic clustering. When clustering was performed on a group of respondents that were manually classified with high confidence (48%, 26/54), its results completely matched that of the manual classification method. The same was true when automatic clustering was performed on the combined high and medium confidence group (78%, 42/54), Fig. 5. But discrepancies were found between the results of the two methods, when the low confidence group (22%, 12/54) was included in the automatic clustering. This is not surprising given that these respondents were originally manually classified with low confidence. Therefore, since the results of the manual classification and automatic clustering largely matched, we saw little benefit in adding a second coder to the manual classification as discussed earlier.

To summarize, of our 164 respondents, 75 (46%) were adopters, and 35 (21%) were immediately identified as make-doers because they reported neither using a dedicated PTM tool nor making task lists. 54 (33%) made task lists and therefore required further disambiguation. Out of these 54 list-makers, we were able to identify the user type of 42 respondents—31 DIYers (19%, 31/164) and 11 make-doers (7%, 11/164)—because the outcomes of our two methods for assessing the generalizability (manual classification and automatic clustering) were identical for these respondents. However, we would need more evidence to categorize the remaining 12/164 (7%) list-makers, whose types were only identified with low confidence (Figs. 5 and 6).

The survey study allowed us to reach a much larger population. Although the data lacked sufficient richness compared to that collected in Study One, it extended our understanding of PTM differences across individuals. Table 3 summarizes the survey results compared to those of Study One. The survey showed that some individuals shared attributes with multiple user types and that caused us to rethink the *distinct* user types we identified in Study One: instead of belonging exclusively to one of the categories of DIYers, make-doers, or adopters, individuals demonstrated coexisting *tendencies* toward DIYing, make-doing, and adopting. What varied across individuals though is the *relative* strength of these tendencies. We further reflect on this in the Discussion Section and from this point forward, we use DIYers,

make-doers, and adopters to refer to those participants whose tendency was strongest towards one of DIYing, make-doing, or adopting respectively.

4.2.4. Associations between the user types and individual characteristics

In this section, we first describe the survey respondents' individual characteristics, then we report the associations that we found between those characteristics and the user types.

4.2.4.1. Busyness. The great majority of the survey respondents (93%, 165/178) considered themselves to be busy (Fig. 7(a)). Six out of the ten respondents, who commented on their busyness, reported having multiple jobs and two pointed to the variability of their busyness: "*Highly variable given the deadline schedules*" [SR49], and "*busyness ebbs and flows*" [SR89].

4.2.4.2. Satisfaction with one's PTM. 90/178 (50%) respondents were satisfied or very satisfied with the way they managed their tasks, Fig. 7 (b). One of the dissatisfied respondents said: "*I feel the way I manage tasks is quite good in theory but it fails during stressful times (in that I ignore my system in order to focus on whatever is stressing me out)*" [SR158]. Failure of one's PTM system *"during stressful times"* was a common source of dissatisfaction among our respondents. Lack of a needed feature in their PTM tool and having tasks recorded across multiple tools were other sources of dissatisfaction reported.

4.2.4.3. Interest in improving one's PTM. Although only 49/178 (27%) were dissatisfied with their PTM, a majority of respondents (71%, 127/178) were interested in improving their PTM practices, Fig. 7(c). One of the respondents who was interested in improving her PTM said: "*I'm still looking for the best ways to have in one place all tasks related to different areas of my life (work, studying, private life)*" [SR163], and a disinterested respondent said: "*I have always resisted new ways*" [SR67]. Among respondents who were neither interested nor disinterested, SR167 said: "*I know how to improve my task management. I just don't make those choices*". These comments show that the differences in individuals' interest in PTM may be related to differences in their PTM needs, their resistance to new methods, and their self-determination in enhancing their PTM.

4.2.4.4. Being organized. 99/178 (56%) of the respondents considered themselves very organized, Fig. 7(d). Two provided evidence for why they were organized: "*trying to do everything on the schedule*" [SR28], and "*have to multitask and be open to changes*" [SR143].

4.2.4.5. Reliance on memory. Although almost all the respondents considered themselves to be busy, 62/178 (35%) respondents still relied on their memories for *most* of their tasks, Fig. 7(e).

4.2.4.6. Occupation. The distribution of the survey respondents across different occupations was shown in Table 2. Since Study One was conducted with grad students and professors, we wanted to detect any differences that might exist between that group and others in the survey. Thus, for the purpose of our regression analysis described below we considered occupation as a binary variable by grouping university professors and grad students as academics (49%) and the rest as non-academics (51%). While this is an imperfect grouping, our key goal was to distinguish other groups from the group we studied in Study One.

Based on a multinomial logistic regression analysis—described in Section 4.1.3—we found that occupation ($p=0.015$), reliance on memory for remembering things ($p=0.019$), and level of busyness ($p=0.045$) made a significant contribution to predicting the user type. Compared to non-academics, academics were 3.36 times more likely to be a DIYer as opposed to being an adopter. People who tended to rely on their memory for remembering tasks were 56% more likely to be an adopter as opposed to being a make-doer. People who reported lower levels of busyness were 1.7 times more likely to be an adopter as opposed to a make-doer. We found no significant association between individuals' approach to PTM and their satisfaction with their PTM, being organized, and being interested in improving one's PTM. We further reflect on these findings, which might seem counterintuitive, in the Discussion (Section 5.2).

4.2.5. Behaviors of adopters

The ultimate goal of this research was to inform the design of personalizable PTM tools that can better support individual differences. To achieve this, we investigated what may have caused adopters to use dedicated PTM tools and if their tools accommodate their needs sufficiently. Here, we present our findings about adopters' tool use including the tools used, adopters' awareness of their tool functionality, and their likes and dislikes.

4.2.5.1. Adopters' tool use. Although the 4 adopters in Study One used 4 *different* tools, Outlook appeared to dominate among the tools used by the adopters in the survey population. Table 4 summarizes dedicated PTM tools used by adopters. When asked how they found out about their tools (Q15 in Appendix B), it turned out that all of the Outlook users and most Google Tasks users found out about their tool because either it was pre-installed on their computers or it was integrated into their other applications they were using (e.g., Gmail). Starting to use a dedicated PTM tool because of its handiness, although we acknowledge that other reasons might have also played a role in such adoptions, can be due to the tendency of these adopters toward make-doing. We further reflect on this in the Discussion. Our finding that the majority of adopters use Outlook or Google Tasks needs to be interpreted with caution – together these applications appear to capture significant market share among our survey respondents, however, it is not clear whether this is because they accommodate the needs of a wide range of people. Rather, their relatively high use may be better explained by the fact that they typically come pre-installed on computers or are integrated with other applications such as calendar and email. Another reason for their high use could be the difficulty of discovering new tools.

4.2.5.2. Adopters' awareness of their tool functionality. To gain insight into how to make users aware of the personalization facilities in personalizable PTM tools, we asked adopters how they currently became aware of their tool's functionality and what their preferred methods would be (Q17 and Q18 in Appendix B). Participants were allowed to choose multiple methods for each of the above questions

(Fig. 8). Coming across functionality by accident (accidental discovery) was the most used method for becoming aware of tool functionality. However, that method was not their preferred method. When asked how they would like to find out about their tool functionality in the future, the two most preferred methods were intentional browsing (49%) and getting recommendations from other users (61%), which should be considered when designing personalizable tools for helping users become aware of personalization facilities.

4.2.5.3. Adopters' likes and dislikes. We asked adopters what they liked and disliked about their tools to better understand if and how their needs were accommodated by the existing dedicated PTM tools (Q19 and Q20 in Appendix B). Table 5 summarizes the tool characteristics and features that the 75 adopters liked and disliked.

5. Discussion

In both Study One and Two, individuals differed in the tools they used for their PTM and in how they used their tools. We reported a range of PTM behaviors that differed both across individuals and across different types of tasks for an individual: recording behaviors (e.g., recording in a central task list vs. distributing across tools), remembering strategies (e.g., polling-based, notification-based, association-based, social distribution), post-completion strategies (e.g., crossing off, deleting, archiving), and organizing strategies (regrouping tasks, moving tasks up and down the list). Here we compare our findings across our two studies, and discuss how Study Two extends our understanding of individual differences in PTM. We also discuss the factors that we found to be associated with such differences, reflect on the benefits of assessing generalizability of findings, and discuss the limitations of our studies.

5.1. How individual differences in PTM compared across Study One and Two

In Study One, we identified three types of users: DIYers, make-doers, and adopters, based on the tools participants used and the extent to which they personalized their tools. When we used these criteria to categorize the respondents from Study Two, we found some clear DIYers, make-doers, and adopters among them. But we also found that some respondents shared attributes with both DIYers and make-doers and some with both make-doers and adopters (Table 3). We categorized these respondents based on their strongest tendency. However, this result made us rethink our three types of users originally identified in Study One: instead of being mutually exclusive, we saw individuals demonstrate coexisting tendencies toward DIYing, make-doing, and adopting, and what differed across individuals was the relative strength of these tendencies. For every participant in Study One, the strength of one of the tendencies dominated the others leading us to clearly identify three distinct categories: DIYers personalized to a *great extent*, make-doers were *minimalistic* in terms of the effort they were willing to spend on using tools for their PTM, and adopters used their dedicated PTM tool as their *primary* PTM tool. This could indicate that our participants in Study One are perhaps prototypical examples of DIYers, make-doers, and adopters. Alternatively, perhaps we had insufficiently rich data for some of the Study Two participants to cleanly categorize them.

Our finding that some survey respondents shared attributes with multiple user types is similar to the findings of the past email work that tried to classify participants using the previously reported user profiles in managing email—no filers, frequent filers, and spring cleaners (Whittaker and Sidner, 1996). Boardman and Sasse (2004) were only able identify no-filers and frequent-filers but no spring cleaners; instead, they found that many of their participants did not fall into any of these profiles because they employed *multiple strategies.* Similarly, Fisher et al. (2006) found little evidence of distinct email handling strategies; most of their participants fell into a middle ground. In addition, Bellotti et al. (2005) found that some of their participants shared behaviors with both frequent filers and no-filers, and based on those participants, they considered classification of people into specific categories as an oversimplification of reality.

5.2. Factors associated with differences in PTM across individuals

Our results showed that occupation, level of busyness, and the extent of relying on memory for remembering tasks were significant predictors of individuals' behavioral tendencies (DIYing, make-doing, and adopting), i.e. the type of their PTM tools and the extent to which they personalized their tools.

5.2.1. Occupation

Academics, compared to non-academics, had a stronger tendency toward DIYing than adopting. This is consistent with the finding of Study One with academics that the majority of the participants were DIYers, and this may be due to the fact that academics generally have more autonomy over their tool choices than in other professions, or that the less structured nature of tasks in academia—a characteristic of academic tasks as described by some of our participants across our different studies—appeared to have invited more DIY solutions to managing tasks. Similar occupational differences have been found in email practices (Cecchinato et al., 2015). This suggests that personalizable PTM tools that provide flexibility to users might be more appropriate for people with certain jobs.

5.2.2. Reliance on memory

People whose tendency toward make-doing was strongest seemed to rely less on their memory for remembering tasks compared to people whose strongest tendency was adopting. We found this result counterintuitive. One explanation is that make-doers keep their tasks in the applications they use (e.g., starred email messages or open webpages) instead of keeping them in their memory. It could also mean that adopters simply have more tasks than make-doers; they record many in their tool but rely on their memory for others. Another possibility is that dedicated PTM tools do not support easy recording of tasks, so adopters don't bother to record every single one of their tasks and thus tend to rely on memory for some of their tasks.

5.2.3. Busyness

People whose tendency toward make-doing was strongest reported higher levels of busyness compared to people whose strongest tendency was adopting. We suspect that having adhoc methods for managing tasks—as people with strong tendency toward make-doing had—can get unwieldy, possibly overwhelming, and thus increase people's perceived level of their busyness.

Barriers to using dedicated PTM tools

Our data on the participants who either abandoned using dedicated PTM tools or were not inclined to use one suggests some barriers for using dedicated PTM tools: (1) barrier to discovery of PTM tools as it takes time and effort to find a tool that fits one's needs, (2) barrier to learning to use a PTM tool to its fullest capacity, (3) barrier to using an electronic PTM tool due to reasons such as the difficulty of typing for some people compared to writing on paper, (4) barrier to customizing which is currently the result of limited support of dedicated PTM tools for customization. These barriers may explain why many people still prefer to use general purpose tools instead of spending time and effort to find a good PTM tool to only realize that the tool is difficult to learn and is not personalizable enough to accommodate their specific needs. To increase their adoption, PTM tools need to remove these barriers. In Section 6, we discuss some ways for removing some of these barriers.

5.3. Benefits of assessing generalizability

A common caveat in both qualitative and quantitative studies is that the generalizability of their findings is rarely assessed. We tried to alleviate this problem by conducting a survey questionnaire to reach a broader population to see to what extent the findings of Study One generalize to a broader population. Although for some respondents the survey format did not elicit sufficiently rich data to enable that assessment, in general it extended our understanding of the differences across individuals and thus revealed the benefit of assessing generalizability of findings in small-scale qualitative studies similar to our focus group+contextual interviews. The importance of revisiting HCI findings is extensively discussed in the field (Hornbæk et al., 2014; Wilson et al., 2014). We hope that our studies and the evolution of our understanding they have enabled provides additional motivation and evidence for the need to revisit HCI findings.

5.4. Limitations and future work

The survey methodology in Study Two, compared to other contextual inquiry methods such as that of Study One, has some limitations. However, given our goal of assessing generalizability of the results of Study One, we opted for this methodology to reach a much larger number of people than what could be reached by other methods.

5.4.1. Sample in Study One

Our sample was weighted more toward grad students in Study One. However, that was one of the reasons that we assessed generalizability of our results to a broader population in Study Two.

5.4.2. Personalization behaviors of adopters

Our studies did not report personalization behaviors of adopters, because in Study One, personalization was a theme that emerged at the data analysis stage, more notably in the behaviors of participants who were using general tools. In fact, we did not ask the participants anything explicitly about personalization behaviors, and adopters did not report any personalization behaviors. An important future step would be to study the personalization behaviors of adopters and investigate to what extent they personalize their tools and to what extent their tools allow them to do personalization.

5.4.3. Effectiveness of individuals' PTM approach

In our studies, we did not investigate the effect of individuals' PTM behaviors on their productivity. Although this is an interesting and important avenue of research, we found it to be out of the scope of our studies, given the many factors that might play in the effectiveness of individuals' behaviors for managing their tasks.

5.4.4. Investigation of factors that might have influenced individual differences

Previous studies have shown that many PIM activities vary with age (e.g., finding web-based information in web search (Olmsted-Hawala et al., 2013)). However, we did not look at age of individuals in our studies to see if any of the differences across individuals relates to age. It is worth exploring what kind of changes occur in individuals' PTM behaviors as they grow older: do they rely more on their PTM systems, or have they developed sufficient PTM skills that the need for using a PTM tool is lessened. In addition to age, culture is another factor that can influence individual differences in PTM and that we did not examine. The cultural differences in how individuals measure or treat time (Levine, 2005) are most likely to affect how they manage their tasks.

6. Implications for design

While our focus was on understanding individual differences, we also gained some general insights into the design of PTM tools.

6.1. PTM tools should support variation in PTM across individuals

Grounded in our findings that individuals differ in the strength of their tendencies toward DIYing, make-doing, and adopting, we recommend that PTM tools have the capacity to accommodate this variation: they should be personalizable so that people with a strong DIY desire can personalize their tool when they need to, and should be relatively effortless to use and integrate well with other systems in use to satisfy make-do tendencies. This is somewhat contrary to our previous recommendation that we made after Study One—which was targeting and designing for different groups of users (Haraty et al., 2012)—and reflects the deeper understanding

gained by our follow-up study and analysis. Some UI elements and system functionality that need to be personalizable in a PTM tool to satisfy the needs of individuals with a strong tendency toward DIYing, and to support differences across individuals are the view/layout of tasks list, the way a PTM tool prints out task lists, reminders, use of color, and the integration with other tools such as email or web-browsers.

6.2. PTM tools should support variation in an individual's PTM across different task types

We also observed some variations in PTM behaviors across different types of tasks (instead of across users). For example, having different remembering strategies appeared to be in part related to the different types of tasks: the social-distribution remembering strategy was used for tasks that involved other collocated people, and the notification-based strategy was used more for tasks with strict deadlines. We observed this variation across different task types only for remembering tasks. Although we do not have data to support this, we think that the variation across task types could exist for other PTM behaviors such as recording tasks and post-completion strategies as well. For example, one might choose to delete one-time tasks such as shopping tasks, but to archive work-related tasks when done with them. If true, perhaps PTM tools could allow the defining of different methods for various PTM behaviors across different types of tasks. For example, a user could define different effects for crossing off a task from each of a shopping category and a work-related category such that the tasks in the shopping category get automatically deleted, and the tasks in the work-related category get archived when crossed off.

6.3. Non-PTM tools should offer basic support for PTM

We learned that many people kept their tasks in tools where they were created or received. For example, open documents, open web pages, and unread/starred/flagged email messages were all representations of tasks. We also found that the majority of survey respondents preferred having the option of transferring such items to their task list, and that one of the sources of individuals' satisfaction (or dissatisfaction) with PTM tools was provision of (or lack thereof) an overview of tasks in one place (mentioned briefly in Table 5, and further expanded upon in Haraty et al., 2012). Providing such a feature requires an integration between PTM tools and non-PTM tools. For example, an email client integrated with a PTM tool could be configured to transfer the starred messages to the PTM tool or a web-browser could be configured to transfer open pages, perhaps explicitly marked as tasks, to a PTM tool. Lack of such integration was a frequently cited reason for switching tools.

We realize that no PTM tool would be able to fully support integration with all the non-PTM tools people use, unless these tools offered some basic support for PTM: an easy mechanism for users to record tasks *within* the tool and to output the tasks that were captured to a PTM tool, so that a PTM tool could provide users with a centralized overview of all their tasks. Such integration can have the additional benefit of preserving a task context and reinstating it, when a user selects a task in a PTM tool to work on. For example, selecting a web-browsing-related task in a PTM tool would open the relevant web pages that have been marked as to-dos within a web-browser.

6.4. PTM tools should support sharing of personalized tool use and practices

We found that the adopters' preferred method of becoming aware of their tool functionality was getting recommendations from other users who use the same tool. In addition, some participants reported learning things from others and having adopted tips, strategies, and tools based on others' recommendations. Finally, as the variation in individuals' tendency toward DIYing showed, not everyone was willing to invest time on designing one's own tool through personalization. Given all the above, if PTM tools were to support sharing of personalized tool use and practices, this could lower the entry bar of having a personalized tool, and could thereby enable more people to have a PTM tool that supports their specific needs. Some existing PTM tools such as "Remember The Milk" have forums where users share their personalized tool use and practices. However, the effectiveness of different methods of sharing personalized tool use or practices has yet to be explored.

7. Conclusions

Our studies build on and extend the previous research on PTM by focusing on understanding individual differences in that domain. We reported an earlier study—a focus group + contextual interviews—on individual differences in PTM, where we found that individuals belong to one of the categories of DIYers, make-doers, or adopters based on the tools they used and the extent to which they personalized their tools. Then, we conducted a survey to assess the extent to which the results of our first study, which was conducted with an academic population, would generalize to a broader population that includes non-academics. Contrary to the findings of our first study, we found that many of the survey respondents do not belong to *only one* of the user categories of DIYers, adopters, and make-doers. Instead, we found that individuals demonstrate coexisting tendencies toward DIYing, make-doing, and adopting, and what differed across individuals was the relative strength of these tendencies: some preferred using what were already available to them without personalizing them (people with a relatively strong tendency toward make-doing), and others preferred using a dedicated PTM tool (people with strong tendency toward adopting) or even designing their own PTM tool by using a general-purpose tool and personalizing it (people with relatively strong tendency toward DIYing). Based on this, we believe that PTM tools need to be designed in such a way that they accommodate the varying strengths of these tendencies across individuals rather than being designed only for people with strong DIY tendency or only for people with strong make-do tendency.

The assessment of generalizability of our prior findings showed how categorizing individuals into specific user groups for the purpose of summarizing individual differences can be an oversimplification of reality.

We showed how job, level of busyness, and reliance on one's memory for remembering tasks were associated with the above tendencies. Our data also suggested four barriers to using dedicated PTM tools (barrier to discovery, barrier to learning to use, barrier to use, and barrier to customizing) that needs to be minimized in order to increase adoption of dedicated PTM tools.

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Appendix A. Interview Script (Study One)

Start with some general questions

So we're just going to start off the interview with a few general questions to get familiar with how you feel about your task organization capabilities. Following this will be an exercise where you will demo the tools you use to us, and then we will finish off with some final questions to fill in the gaps.

1. How organized would you consider yourself in regards to handling your everyday tasks? [1=not very well organized, 2=somewhat organized, 3=about average, 4=organized most of the time, 5=very well organized]
2. What does it mean to be organized to you?
3. Do you feel as though you have a difficult time keeping track of your tasks?
4. Of your overall set of tasks in a day, what percentage of them are you likely to get done? (i.e. 100% – all tasks, 50% – half the tasks...)
5. What kind of task lists do you normally have? (i.e. work related, school related task lists)

Observation

1. *Can you show us the tools you are using for handling your everyday tasks?*
2. *Can you tell us a little bit about the various tasks you are dealing with?*
   [*If they didn't start to talk about some of their tasks that they had entered, we will probe them to tell us the story behind some of their tasks, how did they record? for what reason?...*]
   [*If there was no task from the categories of meeting, event, deadline, …, ask: How do you handle your meetings/events/or deadlines*]
3. *What about stuff like payments, grocery shopping, or other routine tasks?*
4. *What about the tasks that don't have time/date associated with them?*
5. *Is there any other kind of task that you normally keep track of?*
6. *What kind of reminder mechanism are you using to get notified of your tasks?*

For each tool that they are showing, ask the following after they are done with their own explanations:

1. What do you like about this tool?
2. What do you dislike about this tool?
3. How long have you been using this tool?
4. How would you improve it?

[Ask the following only if not answered]

1. How many tasks do you typically have in your task list (for a day)?
2. How often do you create tasks in your task manager?
   a. At specific times of the day *(i.e. every morning)*
   b. Whenever I find a free time during the day
   c. Never
   d. Other (please specify)
3. Do you record your tasks directly into your primary task manager right from the start? Or do you ever record them in a temporary location first to allow for some organization before you record them in your primary task manager? *(i.e. writing them down first on a piece of paper before entering into the tool itself)*
4. Do you record each task as it comes in? Or do you wait until you have several task items before you record them in your task manager? *(i.e. just trying to remember tasks throughout the day and recording them at the end of the day)*

Viewing tasks (activity):

[Observe the participants as they view their tasks to answer the following questions. Ask questions when needed.]

1. Do you like to view all of your tasks in one view? Or do you like to only view a subset of your tasks at once?
   a. *If they view all tasks in one view:*

   i. Do you rely on specific task attributes to organize your view in order to differentiate the tasks from another? (i.e. using color or category names to group tasks, or a sequential view of tasks sorted by date or priority).
  b. *If they view only a subset at once:*
   i. How is this subset determined? (i.e. category? only tasks for today, or this week?
2. How do you view your tasks…*(depends on what they use)*
  a. on your computer
  b. on cell phone
  c. on your piece of paper
3. How often do you view your tasks?
  a. Specific times of the day (e.g. every morning)
  b. Whenever I find a free time during the day
  c. Never
  d. Other (please specify)

Managing tasks (activity):

[Ask some general task managing questions if not answered]

1. Do you often modify your tasks between the time of recording the task in your task manager and completing the tasks? If so, what do you modify?
2. Do you often find yourself reorganizing your tasks before they get completed? (i.e. moving tasks around between categories) If so, what do you reorganize?
3. Do you keep completed task items around for reference? Or do you permanently clear them from your task list?
  a. *If they keep them:*
   i. Why?
  b. *If they clear them:*
   i. How often do you cross off tasks from your task list?
    1. Immediately after the task is complete
    2. After a group of tasks is complete
    3. Never
    4. Other (please specify)
1. What do you do when you have a task to record, but at that very moment, you do not have time to record the task?
  a. What if you had the time, but none of your tools were available?
2. Are there any other tools that you stopped using?
  a. *If so:*
   i. Why? (i.e. was it due to any changes in your job or due to any changes in your tasks or did the way you manage your tasks change?)
   ii. What did you dislike about these tools that caused you to stop using them?
3. How much time on average in a day do you spend managing your task list(s)?
4. Out of that time, what proportion of it would you say is used for adding details to those tasks, viewing them, and crossing them off?

Appendix B. : Survey questions (Study Two)

9. APPENDIX B : SURVEY QUESTIONS (STUDY TWO)

<<<<<<<<<Questions 1-13 : Figure 3's Section-1 (generic questions)>>>>>>>

1) Have you ever used any tool such as a calendar, a paper planner, a piece of paper, or a dedicated task list application for managing and keeping track of your tasks?

2) What is your gender?

3) What is your occupation?

For Q4-9, Please indicate the extent to which you agree/disagree with the following statements

4) I consider myself a busy person.

5) It is EASY for me to find time for personal things (e.g. going to gym, seeing friends).

6) I am very organized in regard to managing my everyday tasks.

7) I am satisfied with the way I manage/keep track of my tasks.

8) I have always been interested in finding new ways to improve my task management.

9) I rely on my memory for remembering MOST of my tasks.

10) Which of the following do you CURRENTLY use for managing your tasks? (Check all that apply)

- Plain text files (e.g. Notepad, TextEdit)
- Word processor files (e.g. Word document, Google document)
- Digital Note-taking tools (e.g. Microsoft OneNote, Evernote, Google Notebook)
- Email
- Paper planner
- Other paper (e.g. sticky notes, pieces of paper, physical paper notebook)
- Other (please specify)

Please answer q12 and q13 considering the following definition of "dedicated task list application"

Dedicated task list application: "An electronic application that is used solely for the purpose of task management. Note that this does NOT include general purpose electronic applications such as email, wiki, calendar, or a word document that you might use for managing your tasks."

12) Which of the following "dedicated task list applications" have you used IN THE PAST and stopped using?

AbstractSpoon □ Errands □ Google Tasks □ GTD TiddlyWiki □ Nirvana □ OmniFocus …

13) Which of the above "dedicated task list applications" do you CURRENTLY use most frequently?

<<<<<<<<<End of Section 1>>>>>>>

<<<<<<<<Questions 14-32 : Figure 3's Section-2 (Adopters' only section)>>>>>>>

Please answer the following questions for the task list application that you are CURRENTLY using (specified in the previous question).

14) Which form of this application do you use? (Check all that apply)

Desktop Web-based□ Mobile □ Other (please specify)

15) How did you find out about this application? (Check all that apply)

- Searching the Internet
- Word of mouth (e.g. from a friend)
- A time/task management workshop Book
- Advertisement
- It was installed on my computer
- It was integrated into an application that I use for other purposes
- Other (please specify)

16) Approximately what percentage of the functionality provided by this application do you use?

17) Which of the following best describe(s) how you HAVE BECOME aware of your tool's functionality? (Check all that apply)

- Coming across the functionality by accident
- Searching the help documentation for a specific functionality
- Looking for a specific functionality (e.g. browsing menus)
- Getting recommendations from other users who use the same tool
- Other (please specify)

18) Which of the following best describe(s) how you WOULD LIKE to become aware of your tool's functionality? (Check all that apply)

19) Name one to three features that you LIKE the most about this application:

20) Name one to three features that you DISLIKE the most about this application:

21) What are the typical types of tasks that you record into your tool? (Check all that apply)

Things to read Administrative Project/course deliverable Scheduled events Other

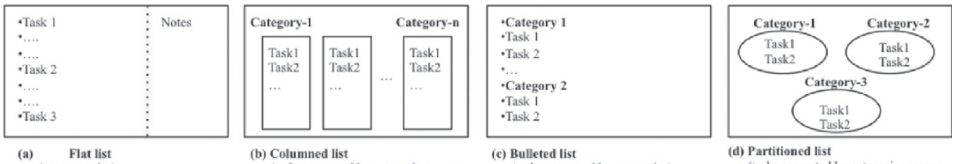
22) What do you do with a recorded task in your tool once it is completed?

Cross off □ Delete □ Archive □ Add detail of how it was done □ Do nothing □

Depends on the type of tasks (please explain in the "additional comments" field)

23) Which of the following do you use when making or modifying tasks recorded in your tool? color□ symbols (e.g. star, arrows, circle) □ sketching□ Other (please specify)

24) Which of the following pictures is most similar to the arrangement of tasks recorded in your system?



(a) **Flat list** (no categories)

(b) **Columned list** (tasks separated by categories across columns)

(c) **Bulleted list** (tasks separated by categories)

(d) **Partitioned list** (tasks separated by categories across different parts of the tasks-page)

25) If the arrangement of tasks in your tool is slightly different from the chosen one in the previous question, please describe the difference:

26) Which of the following best describes how you chose the arrangement of tasks in your tool?

- I came up with this arrangement by myself
- This was the DEFAULT arrangement supported by the tool I use
- This arrangement was built in the tool I use, but it was not the DEFAULT arrangement
- Other (please specify)

27) How often do you change the arrangement of your tasks in your tool?

28) Which of the following attributes determines the spatial location of a task in your tool? (Check all that apply)

Task category □ Task importance □ Task urgency□ Task's due date □ Task's recording date

29) I manage my tasks in an ad hoc way. (I don't have a consistent method for recording my tasks) (Strongly Agree…Strongly Disagree)

30) I type my tasks into different parts of the page based on their attributes (e.g. category or priority). (Strongly Agree … Strongly Disagree)

31) Do you keep your tool open all the time so that you can check it regularly?

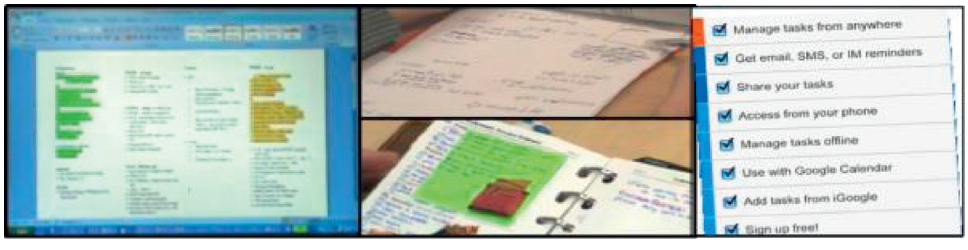
32) How often do you revisit your tasks in your tool?

<<<<<<<<<End of Section 2>>>>>>>

<<<<<<<<Questions 33- 47 : Figure 3's Section-3 (List makers' only section)>>>>>>>

Terminology

"Tasks-page": A physical or digital page/note on which you write/type/enter your tasks. The following are examples of digital and physical tasks-pages.



33) Do you have a "tasks-page" where you write/type your tasks on/into?

34) What are the typical types of tasks that you record into your "tasks-page"? (Check all that apply)

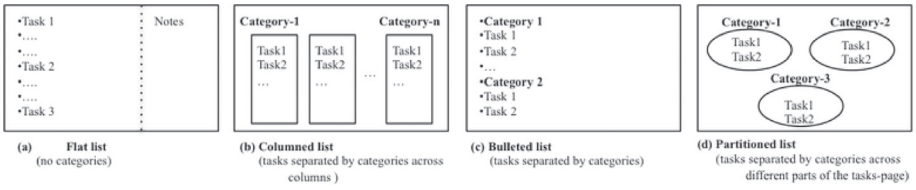
35) What do you do with a task on your "tasks-page" once it has been completed? (Check all that apply)

36) Which of the following describes your "tasks-page"?

- Digital document (e.g. a Word document, a text file)
- Physical (e.g. a piece of paper, sticky notes, notebook, paper planner)
- Digital calendar (e.g. Google calendar, iCal)
- Other (please specify)

37) Which of the following do you use when making or modifying your “tasks-page” ?

38) Which of the following pictures is most similar to the arrangement of tasks on your "tasks-page"?



(a) **Flat list** (no categories)

(b) **Columned list** (tasks separated by categories across columns)

(c) **Bulleted list** (tasks separated by categories)

(d) **Partitioned list** (tasks separated by categories across different parts of the tasks-page)

39) If the arrangement of tasks on your "tasks-page" is slightly different from the chosen one in the previous question, please describe the difference:

40) Which of the following best describes how you chose the arrangement of tasks on your "tasks-page"?

- I came up with this arrangement by myself
- This was the DEFAULT arrangement supported by the tool I use
- This arrangement was built in the tool I use, but it was not the DEFAULT arrangement
- Other (please specify)

41) How often do you change the arrangement of your tasks on your "tasks-page"?

42) Which of the following attributes determines the spatial location of a task on your "tasks-page"? (Check all that apply)

Task category □ Task importance □ Task urgency□ Task's due date □ Task's recording date

For the following 2 questions, Please indicate the extent to which you agree/disagree with the following statements:

43) I manage my tasks in an ad hoc way. (I don't have a consistent method for recording my tasks)

44) I write/type my tasks on/into different parts of my "tasks-page" based on their attributes (e.g. category or priority).

45) Do you keep your "tasks-page" visible all the time so that you can check it regularly?

46) How often do you revisit your tasks-page?

47) Would you like to have the option of setting reminders for some of your tasks in your "tasks-page"?

<<<<<<<<<End of Section 3>>>>>>>

<<<<<<<<Questions 48-58 : Figure 3's Section-4 (Other generic questions)>>>>>>>

48) Do you keep email messages in your inbox to remind yourself of the tasks that need to be done?

49) I would like to have the option of easily transferring the email messages that act as reminders of my tasks to my "tasks-page".

50) Do you keep web pages open in your web browser as reminders of the tasks that need to be done?

51) Approximately how many web pages do you usually keep as reminders of your tasks?

52) On average, how long do you keep web-pages open as reminders of your tasks?

Please indicate the extent to which you agree/disagree with the following statements.

53) I would like to have the option of having links in my "tasks-page" to these web pages.

54) If I had links to the web pages which act as to-dos in my "tasks-page", I would not keep the web pages open.

55) I would like to have an overview of all my tasks in one place.

Thank you very much for your participation!

<<<<<<<<<End of Section 4>>>>>>>

References

Allen, D., 2001. Getting Things Done: The Art of Stress-Free Productivity. Penguin Group USA.

Bellotti, V., Dalal, B., Good, N., Flynn, P., Bobrow, D.G., Ducheneaut, N., 2004. What a to-do: studies of task management towards the design of a personal task list manager. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, New York, NY, USA, pp. 735–742: ACM. ⟨http://doi.org/http://doi.acm.org.proxy.lib.sfu.ca/10.1145/985692.985785⟩.

Bellotti, V., Ducheneaut, N., Howard, M., Smith, I., 2002. Taskmaster: Recasting Email as Task Management. PARC, CSCW, 2. Retrieved from ⟨http://www.researchgate.net/publication/228912071_Taskmaster_recasting_email_as_task_management/file/72e7e51700e6071e30.pdf⟩.

Bellotti, V., Ducheneaut, N., Howard, M., Smith, I., 2003. Taking email to task: the design and evaluation of a task management centered email tool. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, New York, NY, USA, pp. 345–352: ACM. ⟨http://doi.org/http://doi.acm.org.proxy.lib.sfu.ca/10.1145/642611.642672⟩.

Bellotti, V., Ducheneaut, N., Howard, M., Smith, I., Grinter, R.E., 2005. Quality versus quantity: e-mail-centric task management and its relation with overload. Human–Comput. Interact. 20 (1–2), 89–138.

Bergman, O., Beyth-Marom, R., Nachmias, R., 2006. The Project Fragmentation Problem in Personal Information Management. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. New York, NY, USA, pp. 271–274: ACM. http://doi.org/10.1145/1124772.1124813.

Blandford, A.E., Green, T.R., 2001. Group and individual time management tools: what you get is not what you need. Pers. Ubiquitous Comput. 5 (4), 213–230.

Boardman, R., Sasse, M.A., 2004. Stuff goes into the computer and doesn't come out: a cross-tool study of personal information management. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. ACM, Vienna, Austria, pp. 583–590. http://dx.doi.org/10.1145/985692.985766.

Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. Qual. Res. Psychol. 3 (2), 77–101.

Cecchinato, M.E., Cox, A.L., Bird, J., 2015. Working 9-5?: Professional differences in email and boundary management practices. In: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems. ACM, New York, NY, USA, pp. 3989–3998. http://dx.doi.org/10.1145/2702123.2702537.

Corbin, J., Strauss, A., 2008. Basics of qualitative research 3e. Sage, London.

Covey, S.R., Emmerling, J., 1991. The Seven Habits of Highly Effective People. Covey Leadership Center.

Czerwinski, M., Horvitz, E., Wilhite, S., 2004. A diary study of task switching and interruptions. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 175–182.

Ducheneaut, N., Bellotti, V., 2001. E-mail as habitat: an exploration of embedded personal information management. Interactions 8 (5), 30–38. http://dx.doi.org/10.1145/382899.383305.

Fisher, D., Brush, A.J., Gleave, E., Smith, M.A., 2006. Revisiting Whittaker & Sidner's "Email Overload" ten years later. In: Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work. ACM, New York, NY, USA, pp. 309–312. http://dx.doi.org/10.1145/1180875.1180922.

Flanagan, J.C., 1954. The critical incident technique. Psychol. Bull. 51 (4), 327.

Forster, M., 2006. Do it Tomorrow and Other Secrets of Time Management. Hodder & Stoughton.

Gwizdka, J., Chignell, M., 2004. Individual differences and task-based user interface evaluation: a case study of pending tasks in email. Interact. Comput. 16 (4), 769–797. http://dx.doi.org/10.1016/j.intcom.2004.04.008.

Haraty, M., McGrenere, J., Tang, C., 2015. How and why personal task management behaviors change over time. In: Proceedings of the 2015 Graphics Interface Conference. Canadian Information Processing Society (p. GI'15).

Haraty, M., Tam, D., Haddad, S., McGrenere, J., Tang, C., 2012. Individual differences in personal task management: a field study in an academic setting. In: Proceedings of the 2012 Graphics Interface Conference. Canadian Information Processing Society, Toronto, Ont., Canada, Canada, pp. 35–44, Retrieved from.

Hornbæk, K., Sander, S.S., Bargas-Avila, J.A., Grue Simonsen, J., 2014. Is once enough?: on the extent and content of replications in human–computer interaction. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. ACM, New York, NY, USA, pp. 3523–3532. http://dx.doi.org/10.1145/2556288.2557004.

Jones, W., 2007. Personal information management. Ann. Rev. Inf. Sci. Technol. 41 (1), 453–504.

Jones, W., Bruce, H., Foxley, A., Munat, C.F., 2006. Planning personal projects and organizing personal information. Proc. Am. Soc. Inf. Sci. Technol. 43 (1), 1–24.

Jones, W., Dumais, S., Bruce, H., 2002. Once found, what then? A study of "keeping" behaviors in the personal use of Web information. Proc. Am. Soc. Inf. Sci. Technol. 39 (1), 391–402.

Jones, W., Munat, C.F., Bruce, H., Foxley, A., 2005. The universal labeler: Plan the project and let your information follow. Proc. Am. Soc. Inf. Sci. Technol. 42, 1.

Krämer, J.-P., 2010. PIM-Mail: consolidating task and email management. In: Proceedings of the 28th of the International Conference Extended Abstracts on Human Factors in Computing Systems. ACM, New York, NY, USA, pp. 4411–4416.

Kwasnik, B., 1989. How a personal document's intended use or purpose affects its classification in an office. ACM Press, pp. 207–210. http://dx.doi.org/10.1145/75334.75356.

Leshed, G., Sengers, P., 2011. I lie to myself that i have freedom in my own schedule: productivity tools and experiences of busyness. In: Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems, pp. 905–914.

Levine, R., 2005. A geography of busyness. Soc. Res.: Int. Q. 72 (2), 355–370.

Mackay, W.E., 1988. More than just a communication system: diversity in the use of electronic mail. In: Proceedings of the 1988 ACM Conference on Computer-Supported Cooperative Work. ACM, New York, NY, USA, pp. 344–353.

Malone, T.W., 1983. How do people organize their desks?: implications for the design of office information systems. ACM Trans. Inf. Syst. 1 (1), 99–112. http://dx.doi.org/10.1145/357423.357430.

Marshall, C.C., Bly, S., 2005. Saving and using encountered information: Implications for Electronic Periodicals. In Proceedings of the SIGCHI conference on Human factors in computing systems-CHI'05, p. 111. Portland, Oregon, USA. doi:10.1145/1054972.1054989.

McGrenere, J., Baecker, R.M., Booth, K.S., 2002. An evaluation of a multiple interface design solution for bloated software. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Changing Our World, Changing Ourselves. ACM, New York, NY, USA, pp. 164–170. http://dx.doi.org/10.1145/503376.503406.

Olmsted-Hawala, E., Bergstrom, J C.R., Rogers, W.A., 2013. Age-related differences in search strategy and performance when using a data-rich web site. In" Universal Access in Human–Computer Interaction. User and Context Diversity (pp. 201–210). Springer. Retrieved from ⟨http://link.springer.com/chapter/10.1007/978-3-642-39191-0_23⟩.

Payne, S.J., 1993. Understanding calendar use. Human–Comput. Interact. 8 (2), 83–100.

Siu, N., Iverson, L., Tang, A., 2006. Going with the flow: email awareness and task management. In: Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work. ACM, Banff, Alberta, Canada, pp. 441–450. http://dx.doi.org/10.1145/1180875.1180942.

Van Kleek, M. G., Styke, W., Karger, D., et al., 2011. Finders/keepers: a longitudinal study of people managing information scraps in a micro-note tool. In: Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems, pp. 2907–2916.

Whittaker, S., 2005. Supporting collaborative task management in e-mail. Human-Comput. Interact. 20 (1), 49–88.

Whittaker, S., Bellotti, V., Gwizdka, J., 2006. Email in personal information management. Commun. ACM, 49; , pp. 68–73. http://dx.doi.org/10.1145/1107458.1107494.

Whittaker, S., Jones, Q., Nardi, B., Creech, M., Terveen, L., Isaacs, E., Hainsworth, J., 2004. ContactMap: organizing communication in a social desktop. ACM Trans. Computer–Human Interact. (TOCHI) 11 (4), 445–471. http://dx.doi.org/10.1145/1035575.1035580.

Whittaker, S., Sidner, C., 1996. Email overload: exploring personal information management of email. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Common Ground, pp. 276–283.

Whittaker, S., Swanson, J., Kucan, J., Sidner, C., 1997. TeleNotes: managing lightweight interactions in the desktop. ACM Trans. Comput.–Human Interact. (TOCHI) 4 (2), 137–168. http://dx.doi.org/10.1145/254945.254958.

Wilson, M.L., Chi, E.H., Reeves, S., Coyle, D., 2014. RepliCHI: The Workshop II. In CHI'14 Extended Abstracts on Human Factors in Computing Systems. ACM, New York, NY, USA, pp. 33–36. http://dx.doi.org/10.1145/2559206.2559233.