Towards a spatialization of PIM tools

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Abstract. Personal Information Management is the study of how people store and retrieve data for their purposes. Traditionally the data is stored in applications like calendars, todo-lists, address books, etc... These applications or *PIM-tools* do not take the spatial character of much of the information into account. But space, just as time plays a major role in the way we organize and utilize personal information. In this paper we present ongoing research in which we try to identify a proper formalism for integrating space into PIM-tools. We therefore attempt to model an ordinary task from daily life experience and expect to find answers to the question of how and what to integrate into a system to move from a regular PIM-tool to a spatial-PIM.

Keywords. personal information, planning, spatial information, calendar, tasks

1. Introduction

The research field of personal information management (PIM) is about how we manage and handle information we encountered in our past to achieve our aims and goals in the present and future. The main notions of *finding, keeping, re-finding* [2,12,19] put a strong emphasis on digital information on the web and our computers. The applications we use are presently restricted to list of appointments, addresses, phone numbers or lists of errands. Personal information in most cases can be related to geographic context and therefore bears a lot more possibilities to be integrated into our applications.

By having GPS modules incorporated into devices used in our private life, such as mobile phones or digital cameras, ordinary people became producers of spatial data. The utilization of such devices for taking pictures, scheduling events, planning tasks, storing contact information or sharing our location with friends, produces very subjective geographic information. We do this in some cases intentionally and sometimes not, as recent discussions about privacy and location information illustrate.[1]

Privacy is one of the main distinctions between *personal geographic information* (PGI) and *volunteered geographic information* (VGI) [6] since it is not intended to be shared with a wider public. Personal geographic information is closely related to our personal context and we believe that GIS in future will become a tool not only exclusive to professionals, but widely utilized by the general public [1].

[1] http://www.guardian.co.uk/technology/2011/apr/20/iphone-tracking-prompts-privacy-fears

2. PIM and GIS

Usual PIM-tools such as calendars, todo-lists, address-databases etc., are spatially *blind*, hence they do not have any spatial reasoning capabilities. A calendar cannot see the impossibility of attending an event in London and another in Vienna within one hour. But space and time are fundamental concepts in our life, as described in time geography [9]. As it was put by [14] '*all human activities require knowledge about the earth - past, present, or future*'. To build a tool helping an individual with their ordinary tasks knowledge about the environment is crucial. GIS, as opposed to PIM-tools, has no representation of our motivations or intentions, although these are the driving factors for our wayfinding tasks [5]. At the same time we do not only need information from or about the past, as traditional PIM research is focusing on, but also about the future. Sellen and Whittaker [17] highlighted the issue with their critique, that very few effort is put on how PIM can help to support people with their *prospective memory* [8,15], hence the memory about things we need to do in future.

One of the main tasks of GIS-Systems is the management and manipulation of geographic objects. Traditionally these are mainly large-scale objects, things like: mountains, lakes, buildings, etc... These are the common things of interest to geographers, planners, engineers, or any other type of profession utilizing GIS for their purposes.

When we think about building an application integrating GIS into PIM-tools, we have to concern about the entities in the environment and information relevant to us in our specific context. In Figure 1 a graphic from Berners-Lee attempts to illustrate the linkage of different web applications by various concepts [2]. We altered the *place*-link to highlight the spatial dimension of some of the applications and their associated data, that are relevant to the field of personal information.

3. Motivation and Methodology

As mentioned in the beginning a PIM-tool's main purpose is to help us organize and store the information required to achieve goals. There are voices that pledge for a shift from the term *personal information management* to *task information management* since a lot of information is related to certain tasks [13]. We particulary share that point of view in the sense that a PIM-tool needs to comprehend our 'tasks', to help us achieving them. Therefore it is important to investigate the process of task planning, in order to understand the crucial factors contributing to the achievement of them.

Hayes-Roth and Hayes-Roth [10] define planning as one part of a twofold process, the other part beeing monitoring and controling of the execution.

Our vision of a *spatial PIM* (SPIM) is that of a system not only passively providing us with information for the planning part but also pro-actively supporting us for the execution part, by alerting or reminding us of the things to do. In this sense we want the system to understand the task and react upon them, according to the users situation. So for example if a person seems to run late for an appointment, given the current location and time, the system can trigger an alert. Another illustration is the case of a person intending to return a book to the library. When leaving home without the book the system

[2] Original graphic available under: http://www.w3.org/2003/Talks/0922-rsoc-tbl/slide23-0.html

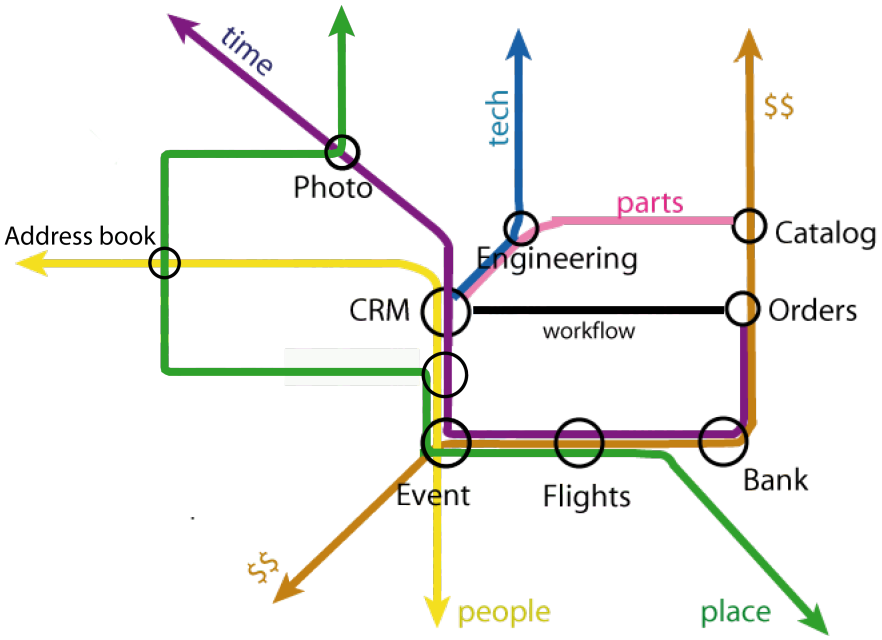

Figure 1. In the altered version of the original *Semanitc Web Metro Map* of Berners-Lee,*place* plays a more important role. The graphic is particularly useful for illustrating the concepts that link (personal) information together.

can actively remind the user of it. By integrating space and time into our PIM-tools they can become pro-active supporters for our tasks.

Planning plays a prominent role in the field of AI with work trying to offer models for the description and subsequent creation of plans (e.g.: STRIPS [4],Nonlin [18], NOAH [16]). Although we might use some of the common terminology, we do not pursue any of the proposed solutions. Our approach is to build a *conceptual model* [3] of an ordinary task, taken from real life experience. We expect that it will help us to identify the proper formalism required for a SPIM.

4. The scenario of a Passport-application

The scenario we chose to investigate is that of a person who plans to travel abroad and therefore needs to issue a new passport since the old one is expired. It is based on real experience of one of the authors, what helps understanding the actions taken to accomplish the task. The necessary information about where/when to apply and what to bring was acquired the night before. In the morning, after gathering all the relevant documents, the person headed towards the administrative office. Before being able to apply for the passport the person needed to acquire passport-photographs and withdraw money.

Figure 2 illustrates the abstracted planning process. First the person attempts to find out how the task can be achieved, by consulting a governmental website. In a description of the application process found there, the person extracts the minimum requirements, that are necessary to execute the final activity of *applying*.

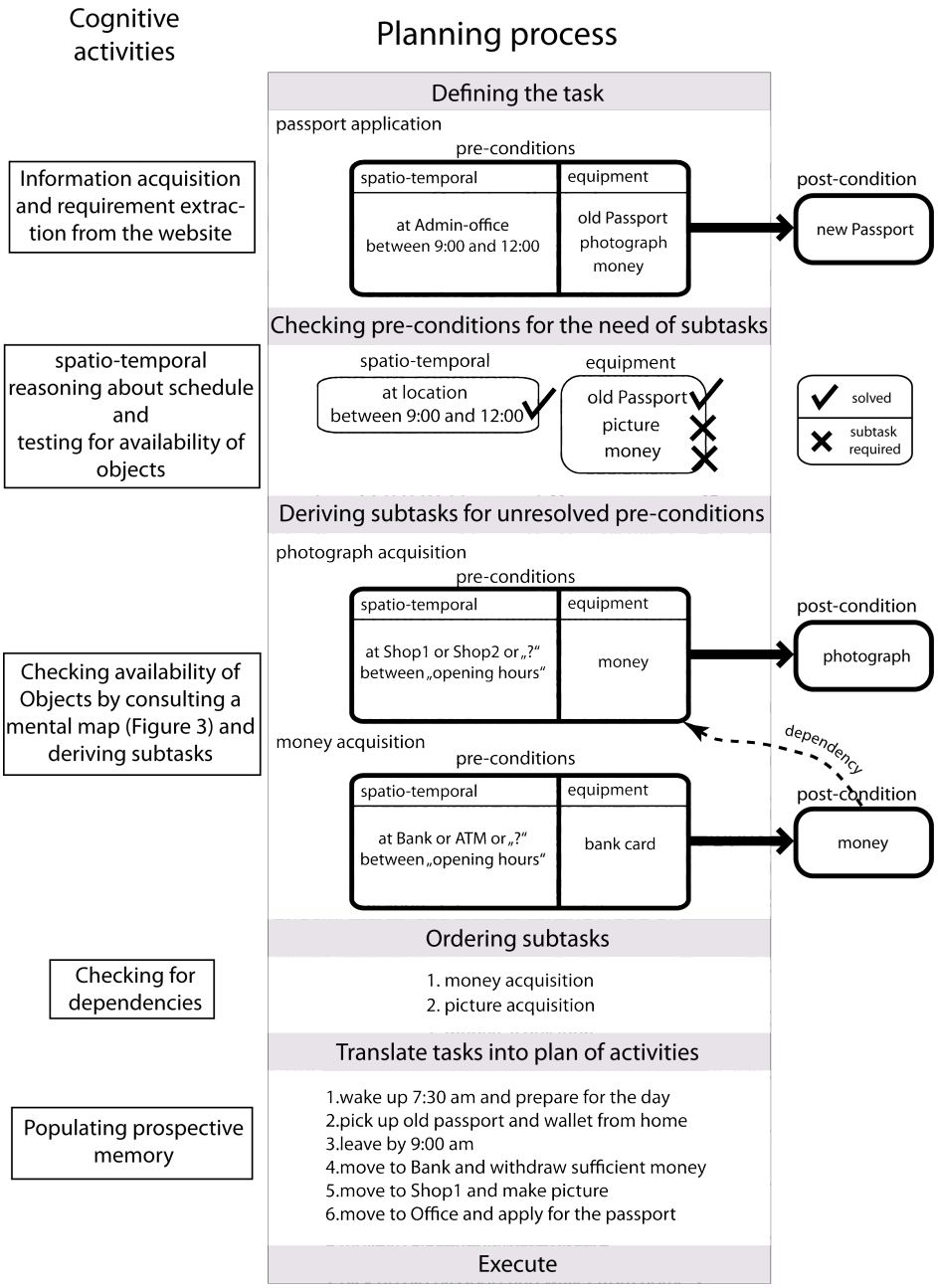

Figure 2. A simplified illustration of the planning process the person goes through. On the left the person's cognitive activities are pointed out. In the middle the planning process is subdivided into certain steps. Outcomes (post-conditions) for the defined tasks are found on the right side.

These are on the one hand spatio-temporal, hence the physical presence of the person at the administrative office within the opening hours, and on the other a set of objects. Thus the task exhibits clear *pre-conditions* and resulting *post-conditions*, in our case the acquisition of a passport. In a second stage the person compares the current state of the situation with the pre-conditions.

Concerning the object pre-conditions, the person evaluates what objects are available. Since the person is located at home at the time of evaluation, it is found that only the old passport is *immediately accessible* and is therefore mentally marked as resolved.

The other two parts of equipment require further actions, what leads to the specification of subtasks: 'photograph acquisition' and 'money acquisition'. For each of these there are again pre-conditions determined, although that time, the person consults a *mental map* [7](Figure 3) to map the open tasks upon fitting places. In terms of 'picture acquisition' the person is aware of two shops.

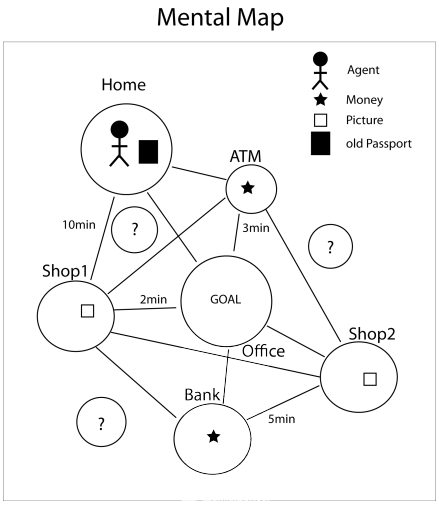

Figure 3. The mental map, based on previous experience, provides the person with information about where places are that contain the missing objects, how to get there, how long it takes and how to obtain them.

The task 'money acquisition' is realizable at an ATM and a Bank known to the agent. Although the person potentially knows more places to conduct the tasks, the chosen ones are those closest to the location of their supertask 'passport application'.

Now that the tasks are defined, the persons puts them in order, by checking for dependencies. Since the task 'photograph acquisition' exhibits money as a pre-condition, it is derived that 'money acquisition' needs to be conducted beforehand.

Finally the tasks are translated into a series of future actions (see bottom of Figure 2). In that part again a mental representation of the world is facilitated for the determination of travel times and routes. This is also were the person's 'prospective memory' is populated. When time and situation is suitable, the person starts to execute the plan and finally applies for the passport.

5. Future Research

In this paper we argue for the spatialization of PIM-tools. Using a case study we intend to identify a proper representation of tasks for SPIMs as well as the geographic information required to comprehend the plans. Having such representations will enable such applications to pro-actively support us in our daily life. Based on the investigated case study, we assume that we can model most of our tasks by defining pre- and post-conditions, similar to the general notion in AI [11]. Further we think that we are able to set an order for tasks, when the outcome (post-condition) of a task forms one or more pre-condition of another. By looking at the example the role of small-scale objects becomes apparent, what poses the questions of how to incorporate them into a SPIM. The vision is an application that handles tasks/plans and relates them to the spatial context of an agent. These are some of the assumptions and conclusions made from this preliminary work and will certainly be refined throughout the process of formalisation.

References

[1] Abdalla, A. and Frank, U. A. Personal geographic information management. In Proceedings of the Workshop on Cognitive Engineering for Mobile GIS, Belfast, USA. CEUR Workshop Proceedings. 2011.

[2] Barreau, D. and Nardi, B. A. Finding and reminding: file organization from the desktop. ACM SIGCHI Bulletin, **27**(3) (1995), 39-43.

[3] Brodie, M. L., Mylopoulos, J., and Schmidt, J. W. On Conceptual Modelling: Perspectives from Artificial Intelligence, Databases, and Programming Languages. Springer-Verlag, 1984.

[4] Fikes, R. and Nilsson, N. Strips: A new approach to the application of theorem proving to problem solving. Artificial intelligence, **2**(3-4) (1972), 189-208.

[5] Golledge, R. and Gaerling, T.: Cognitive maps and urban travel. Handbook of transport geography and spatial systems, **5** (2004), 501-512.

[6] Goodchild, M.: Citizens as sensors: the world of volunteered geography. GeoJournal, **69**(4) (2007), 211-221.

[7] Gould, P. and White, R.: Mental Maps. Allen and Unwin. Sabine, 1986.

[8] Graf, P. and Uttl, B.: Prospective memory: A new focus for research. Consciousness and Cognition, **10**(4) (2001), 437-450.

[9] Haegerstrand, T.: What about people in regional science? Papers of the Regional Science Association, **24** (1970), 7-21.

[10] Hayes-Roth, B. and Hayes-Roth, F.: A cognitive model of planning*. Cognitive science, **3**(4) (1979), 275-310.

[11] Hendler, J., Tate, A., and Drummond, M.: Ai planning: Systems and techniques. AI magazine, **11**(2) (1990), 61.

[12] Jones, W. and Teevan, J.: Personal Information Management. Uni- versity of Washington Press, 2007.

[13] Lepouras, G., Dix, A., Katifori, A., Catarci, T., Habegger, B., Poggi, A., and Ioannidis, Y.: Ontopim: From personal information management to task information management. Personal Information Management: Now That We are Talking, What Are We Learning? 2006.

[14] Longley, P., Goodchild, M., Maguire, D., and Rhind, D.: Geographic Information Systems and Science. Wiley, 2001.

[15] Roedinger, H. L.: Prospective memory: Theory and applications. L. Erlbaum, 1996.

[16] Sacerdoti, E.: The nonlinear nature of plans. Technical report, DTIC Document, 1975.

[17] Sellen, A. and Whittaker, S.: Beyond total capture: a constructive critique of lifelogging. Communications of the ACM, **53**(5) (2010), 70-77.

[18] Tate, A.: Generating project networks. In Proceedings of the 5th international joint conference on Artificial intelligence, Morgan Kaufmann Publishers Inc., **2** (1977), 888-893.

[19] Teevan, J., Capra, R., and Quinones, P. M.: How do People Find Personal Information. University of Washington Press, 2007.