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# Personal Experience Trace: Orienting Oneself in One's Activities and Experiences

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**Abstract**

In this paper, we present steps towards adequate support for answering the central questions of orienting oneself within one's past, current, and anticipated future activities and experiences, along with application areas, which will benefit from such support. The experience-trace concept is introduced and it is shown how support for mental time-travelling within and via elements of one's activities and experiences can be implemented as re-finding elements within one's experience trace. To this end, two interactive journal user-interfaces are proposed: ReflAction Journal and (GNOME) Activity Journal. They are enabled by the ContextDrive and Zeitgeist frameworks and their respective experience-trace implementations.

**Keywords**

Experience trace, companion computing, orient oneself, mental time travel, remembering, journal user-interfaces, enabling frameworks, event logging and processing, activities, experiences, open source

**ACM Classification Keywords**

H5.2 Information Interfaces and Presentation: User Interfaces – Evaluation/Methodology

## Introduction

Following current trends in technology development, *personal* always-on *companion* devices of the future might feature side-look or see-through/occluding head-mounted displays, in-ear headsets, speech recognition, single/two-hand chord and gesturing, unobtrusive user and device identification/authentication, abundant storage, ubiquitous connectivity, and a host of additional sensors, such as cameras, location and body sensors as well as more peripherals, for example, pens and large displays. Personal companion technology of this sort would lay the foundations for ubiquitous self monitoring analog to *sousveillance* [3], i.e. *self-perspective logging* of what one does and experiences. This again enables a personal *witness* with precise and reliable memory. Further, supporting a user's everyday relating to and dealing with a representation of the personal-companion provided "*sousveillances*" paves the way for *intimate* computing functions, dedicated to personal assistance for this user's benefits.

Anticipating the above sketch of the future, we look at people equipped with laptops and location-logging technology as a forerunner of the above envisioned machinery. Our focus of interest is on understanding and supporting activities and experiences of human individuals by means of personal technology, as many people literally depend on computers. Personal computing plays a central role in facilitating a still growing degree of users' everyday activities and experiences, be them work, leisure, or educational. However, adequate and consolidated computer-support for answering the central questions of *orienting oneself in one's activities and with respect to one's experiences* still poses due research and development work. Regarding a user's activities, the following questions are relevant:

"What did I do?" (retrospective perspective), "What am I currently doing?" (current perspective), and "What have I planned for the future?" (prospective perspective). We advocate that supporting individuals in answering these questions is, beyond facilitating a general *feeling of being in control*, beneficial for *awareness of one's commitments and priorities*, for the everyday experiment of *matching one's planning and doing* as well as for *resuming and switching activities*, in particular complex ones, the processing of which usually takes at least hours or days. In addition, *accounting* of as well as *reporting* and *reflecting* about one's activities and progress are facilitated. This, in turn, provides a good basis for continuous *self assessment*. Regarding a user orienting oneself with respect to one's experiences (German: *Erlebnisse*), the above questions are rephrased as "What happened?", "What is currently happening?", and "What did I anticipate happening in the future?".

Fundamental to tackling the above six questions is support for *mental time-travelling* and for *remembering*. Remembering is often termed "retrieval from episodic memory", which supplements knowing as "retrieval from semantic memory". Remembering past events/episodes and imagining future ones bear commonalities, but the definition of *episodic memory* only relates to remembering the past, as it contains "knowledge about personally experienced events and their temporal relations in subjective time and ... (affords) to mentally travel back in time" [9]. Still, this work tackles supporting to orient oneself, in the sense illustrated above based on a single continuous intimate representation. What need to be *evoked* (remembered or imagined) and put to use are (elements of) personal activities and experiences.

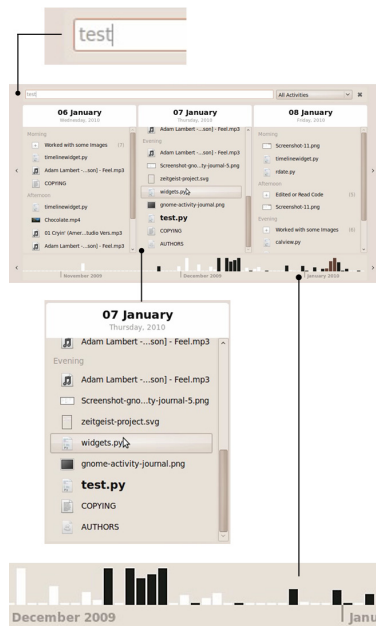
## Approach

We propose the concept of a *personal experience trace* per user [5]. A user's experience trace represents a consolidation of "computer-experienced" events of this user's activities and experiences. This exploits computers' potential to log everything they "experience", be it traces of implicit or explicit human-computer interaction [6]. The word "interaction" denotes the (feedback loop of) "acting and experiencing in the world" [1]. The purpose of a personal experience trace is to adequately mirror what a person actually does and experiences by capturing a comprehensive, coherent, and continuous picture of a user's activities and experiences, encompassing traces on, i.e. referring to, elements/objects of retrospective, current, and prospective character. This picture is continuously evolving as the user acts and experiences. This said, we see and accept the *principal gap* between what humans do/experience and what computers can sense and represent of it. We understand this gap as a design challenge and approach it by allowing the respective user to annotate/enrich, to correct, adapt, and to design the personal experience trace. It is mandatory, that users are and feel in control of this intimate representation and related means; associated privacy and security issues and the issue of controlling means to gather experience-trace data are discussed in [5].

Additional to implicitly and explicitly added traces (events "belonging together"), a personal experience trace comprises computed and user-indicated *labels* to name, describe, group, classify, or otherwise relate, denote (e.g. conditions of) and articulate about a user's activities and experiences. Acting and experiencing (German: Erleben) provide a high-level dichotomic scheme for the attribution of human behavior [2].

Albeit *acting and experiencing* being mutually interdependent notions, a time span of human behavior is characterized rather as acting or as experiencing, depending on the amount of control a person executes on the course of a behavior or phenomenon. "An experiencing actor perceives something happening" indicates that the actor exercises rather little or no control on the "something". However, the actor is still active, as perceiving is in itself considered an activity as long as the actor is consciously controlling perception. This is opposed to automatic perceiving, as exemplified in stimulus-driven attentional capture and peripheral perception, where the attribution of perceiving changes from activity to experience. Humans act towards, employ, or otherwise relate to subjects (including themselves), objects, behaviors, and phenomena, while continuously experiencing their surroundings and themselves (self experiencing), including their own acting and experiencing.

As mentioned above, the most fundamental elements of personal experience traces are *events*. They model *time-bound indicators* of the user's doing and of what's happening or of what the user experiences of what happens. They are the computer-experienced time-bound "percepts" of a person's past (up to "now") acting and experiencing. Events tie together an actor, an object/subject/behavior/phenomenon an activity/experience is directed/related/facilitated to/by, a possibly computerized "mediating artifact"/tool, an event type, and a timestamp. The fundament of this event notion is activity theory [1], which is currently expanded in [5]. Note, that event components may be embedded in ontologies. The phenomenon of activities and experiences proceeding in parallel is included via allowing several events to have the same timestamp.



**Figure 1.**  
(GNOME) Activity Journal:  
Searching for “test”, one result event is highlighted in the middle column. Further results are indicated via the black vertical bars in the below calendar widget. Clicking on the bars refocuses the column views. The heights of the bars represent different amounts of a user’s acting/experiencing.

Relating events to the higher-level concepts of *activities and experiences*, combining inductive and deductive means, is one of the duties of personal experience-trace infrastructures and the UIs capitalizing on them. As, for example, activities and experiences expand in time, for some of them start and end times can be recognized or determined by users, and therefore acting/experiencing be modeled as *intervals*. Moreover, a user activity can be interrupted and later resumed. Hence, it can be a composite of activity *fragments* (again intervals).

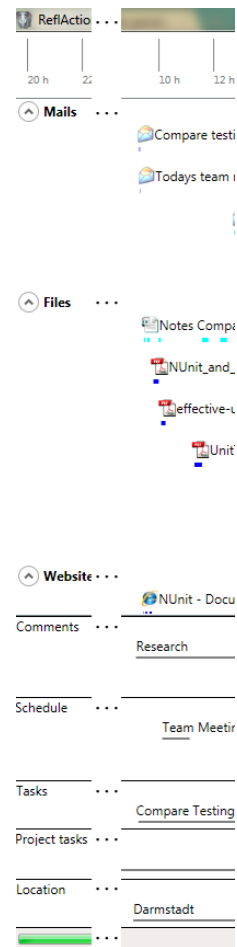
To be able to comprehensively represent human behavior as part of the experience trace, both acting and experiencing are modeled as having *intentional* (conscious, controlled, goal-driven) and *unintentional* (automatic, habitual, opportunistic) fractions. This mirrors that goals and descriptions, relating to the *planning level*, of what one has done or experienced can sometimes be expressed only afterwards, i.e. “deferred labeling”. On the other hand, experience-trace elements such as articulations of plans, to-dos, and conditions can refer to one’s anticipated/imagined future, i.e. “labeling in advance”.

As an example, demonstrating the experience-trace concept, consider the user Frederic, who edits a document D and during that process considers relevant information from other documents or, generally, from computer-represented information items/objects. The *outcome* of this activity is commonly reflected in the changes to a file holding the document D. Complementary, the experience trace, amongst others, further provides metadata representing his activity of *viewing* the consulted items as well as of the activity of *changing and viewing* of D. Furthermore, consider that

Frederic, at some point before beginning the editing and reading described above, has started the playback of an mp3 album he had newly bought, and which keeps playing. By employing elements of his remembrance of the peripheral music experience (general, or a specific song, album, singer, etc.) as query elements (*entry points*), he could therefore later on jump/teleport to the above described and other “situations”, i.e. intervals in his experience trace. These situations represent his acting and experiencing, *while* he also experienced the remembered music. Thereby, he could re-find the collection of documents he had been involved with at that time – “I was preparing a holiday trip last week, while my new album was playing. I didn’t save the links and I don’t know, where I put this document I gathered information in.” Combining this *teleporting* [7] strategy with browsing back and forth in time from the respective “situation” he could further *orienteer* [7]: “Frederic, when zooming out becomes aware of an email conversation with Tonia he wanted to come back to, does so, and decides to browse through the last week. There were simply too many things going on in parallel, so he doesn’t quite remember.” Analogs hold true for similar activities and experiences proceeding in parallel and preceding each other as well as for their subjective and “intersubjective/ objective” framing conditions (expressed as experience-trace labels), such as locations (Fig. 3) as well as possibly scheduled activities, task work, and project/s.

### Journal User Interfaces

With both the ContextDrive ReFlAction Journal (Fig. 2) and the (GNOME) Activity Journal (Fig. 1) we support and investigate the above illustrated means of orienting oneself according to the six questions presented in the introduction section. The UIs are separated in an



**Figure 2.**  
ContextDrive  
Reflaction Journal

above pane, representing a user’s doing (short for acting and experiencing) and a below labeling pane.

The *ReflAction Journal* is a continuous zooming and scrolling UI, where zooming only applies to the time dimension, in order to keep the shown cues readable. On the top of the window, the current *timeline resolution* is indicated. The *doing pane* below shows the objects of a user’s activities and experiences (actual or potential), together with viewing and editing intervals, for example. These objects can be opened, if accessible. Again below, the labeling pane displays *time-expanded labels*, which serve to connect the multiple levels of activities and experiences.

This timeline visualization is inspired by similar diagrams as often found in history books for overview of what had happened during certain time periods. By their temporal nature and by mapping out multiple “threads” in parallel, these diagrams provide an easy-to-capture interpretational frame for understanding historical events in historical context, i.e. with respect to what is represented by the threads. In the *ReflAction Journal*, this features, for example, easily recognizing potential conflicts in planning from overlapping prospective time-expanded labels. By confronting a user with such an integrated multi-thread temporal representation of her/his doing and experiencing, labeling it with “user-language”-level subjective and “objective” attributes seems an evident option for user interactions supporting reflection about one’s activities and experiences. Moreover, time-expanded labels can be employed by users to explicitly indicate relationships among cues of different-level activity and experience via drag & drop. They thereby support both containment and linking relationships, which can be inspected

via context-menus, for example. The time-expanded labels represent *articulations*, e.g., reflections about one’s activities and experiences (Comment row), *conditions* of acting and experiencing (Location, Schedule, and Project-Tasks rows) as well as representing *self-set goals and achievements*, manifested in mapping out one’s to-do items over time – beforehand (“labeling in advance”), during, or after accomplishment (“deferred labeling”): Project-Tasks and Tasks / task work rows (together with deadlines and milestones). *Direct manipulation* is implemented for these labels, including for “future location labels”. Time-expanded labels can be horizontally enlarged and diminished as well as horizontally moved about on the timeline. Labels of the types Schedule and Project Tasks bear a synchronizing connection to MS Outlook and MS Project, respectively. The Location row is automatically marked with city-level names from GPS-logger data.

All of the above mentioned cues are beneficial for browsing, but can also be used as *entry points* (query elements), using them to index into the experience trace (Fig. 1). Additionally, journal UIs reduce the often fragmented and confusing user experience, when going back to diverse computer-represented elements of one’s activities and experiences as necessitated when resuming / switching among and reporting about one’s activities and experiences.

### Experience-Trace Infrastructures

ContextDrive and Zeitgeist are both implemented as extensible frameworks and support acquiring, storing, providing (via queries and subscriptions), and flexibly processing events, while also embracing labels. *ContextDrive* [4,5] is a service framework research-prototype, now in its 2<sup>nd</sup> major revision,



**Figure 3.** ContextDrive *GeoTrace*: Personal geographic traces are shown on a map. In the depicted case, the pins represent locations, where a user took pictures. Indicating a geographic area on the interactive map, a user can employ it as entry point into the personal experience trace. This facilitates queries such as “Show me, what I did north of Frankfurt, e.g., last Sunday”.

developed in C#, using the MS CCR&DSS Toolkit, and running on Windows. *Zeitgeist* [8] is a Linux open-source framework implemented in Python, with the purpose of deployment (e.g., candidate for the next GNOME release). It features a very light and performant engine, which exposes a DBus API as well as alternative DBus interfaces for extensions, which reside within the same process as the engine’s core logic.

### Outlook

Semantic technology usually sets out to model and provide meaning of computer-represented objects, independent of specific users. Thereby, it abstracts away the user’s personal relationship to the objects of her/his activities and experiences. Consequently, this approach doesn’t relate well to additional meaning developed on the user’s side, in the course of interaction. By contrast, our efforts are directed at exploiting personal experience traces to inform useful personal statistics and investigate experience-trace induced notions of relatedness and relevance. We consider the technology we are developing *personal semantic technology*, as it is based on an intimate understanding of the mechanics of a user’s acting and experiencing. We are experimenting with embedding cues and functionality based on personal semantic technology within the above presented UIs as well as providing other hooks or more aggregated views. One’s personal machinery could for example learn to recognize one’s “working sets” or visualize personal “dashboards”.

### Acknowledgements

We greatly appreciate working within a team of very talented and dedicated open-source enthusiasts in implementing and bringing forward the *Zeitgeist* framework and the (GNOME) Activity Journal.

We are particularly grateful for the efforts and support of (in alphabetical order): Ketil W. Aanensen, Youness Alaoui, Randy Barlow, Hylke Bons, Jamal Fanaian, Sebastian Faubel, Ivan Frade, Alex Gabriel, Siegfried Gevatter, Sumana Harihareswara, Mikkel Kamstrup Erlandsen, Markus Korn, Federico Mena Quintero, Daniel Siegel, Jason Smith, and Natan Yellin. We moreover express our gratitude for sponsorship and support to Canonical, Codethink, Collabora, the GNOME foundation, Mandriva, and TIS innovation park.

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