Activity Graphs of the Microstructure of Complex Work

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1 ABSTRACT

This poster presents activity graphs, an analytic approach to representing and understanding the microstructure of people's activity patterns. Activity graphs help us to describe and interpret concepts such as multi-tasking, interruptions, and media use. This approach may be useful for research into activity management and interruption management. Preliminary results are presented as illustrations of the outcomes of this analytic approach.

1.1 Author Keywords

Activity management, task management, interruption management, work analysis.

1.2 ACM Classification Keywords

H5.2. User Interfaces: Methodology; H5.3. Group & organization interfaces: Methodology.

2 INTRODUCTION

Recent work in CHI and CSCW has focused on human tasks and activities, including analyses of scheduling of tasks [2]; ad hoc management of multitasking and interruptions [1, 5, 6]; structuring of shared resources for an activity [8], and media used in performing activities [2, 3, 4].

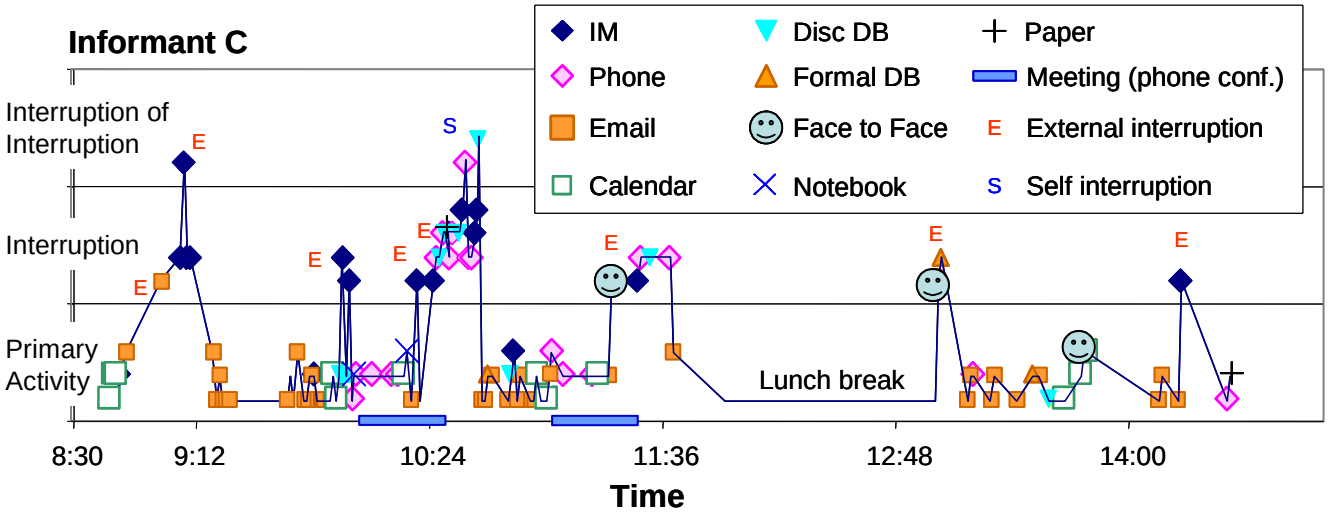

Figure 1. .Informant C's day-long activity graph. Informant C plans, manages, and facilitates customer-sales events

2.1 Activity Graphs

This poster presents activity graphs (Figure 1), an analytic approach to detailed, task-by-task or moment-by-moment observation logs of the activities of individual practitioners – appropriate to the data from several of these studies which involved intensive study of individual practitioners [1, 2, 3, 4, 5, 6]. Activity graphs help to visualize and analyze the complex interplay of multiple activities as they are orchestrated by expert workers. Through activity graphs, we can track interruptions, simultaneous and sequential management of multiple activities, and the relationships of temporally isolated components of larger, on-going work.

3 METHOD

Data for these analyses come from on-going research into the microstructure of activities of knowledge workers, part of an effort to bring an activity framework to the support of knowledge work. (e.g., [7]).[1] Three managers in a large software development organization participated. Informant A is a first-level manager, responsible for quality assurance. Informant B is a second-level manager with formal release-management responsibility. Informant C is a first-level manager responsible for customer sales events.

An ethnographer observed each manager for a single day, logging each activity or subactivity in terms of the time of occurrence, the people involved, the tools/media used, what other activities occurred during the same time period.

4 RESULTS

Activities were analyzed into components (e.g., Figure 1). Related components (parts of the same compound activity) were further analyzed into a hierarchical tree structure, in

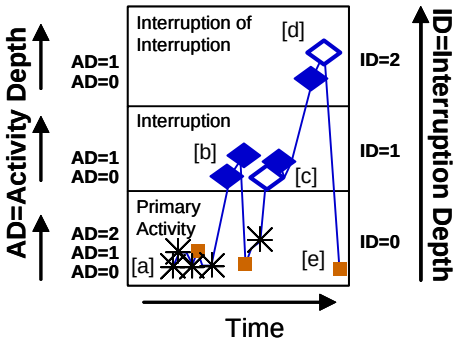

Figure 2. Portions of the beginning of the work day for Informant B, a second-level manager in a development organization. Activities consist of one or more actions or events, and are represented as tree-structured threads [8], with the first or "root" component closest to the bottom of the graph, and child, grandchild, etc. components above the root. Interruptions are represented as a separate "layers" of activity components, above the primary activity. Different tools/media are shown by specific symbols. This excerpt shows a series of primary activities [a], interrupted by two complexes of secondary activities [b], [c]. The second of the two interruption sequences [c] was itself interrupted [d]. Finally, Informant B has dealt with all interruptions, and can return to primary activities [e].

[1] A report of an ethnographic study from another component of this research, involving different informants and a different method, was submitted as [9].

which a root activity event had one or more dependent child sub-activities, which could in turn have additional dependent sub-activities (grandchildren, etc.). This concept of related activity components has proven valuable in user-structured *activity threads* [8], and appears to be similar to the *work spheres* concept of González and Mark [6], but perhaps more structured and somewhat narrower in scope.

Figure 2 shows an excerpt of the activity graph for Informant B. Root activity components appear at the bottom of the figure, with child components above them, and grandchild components above the children, and so on. This increasing complexity of compound activity is referred to as "Activity Depth."

In many cases, an activity was interrupted by another activity. These interruptions are represented in the activity graph by a second "layer" of tree-structured activity components. Sometimes one interruption was itself interrupted by a further interruption. This increasing complexity of interruptions is referred to as "Interruption Depth (Figure 2).

Figure 2 illustrates the ability of activity graphs to capture and present simple activities (several "root" components with no children, within cluster [a]), interruptions (clusters [b] and [c]), and interruptions of interruptions (cluster [d]). Figure 1 illustrates the ability of activity graphs to provide an overview of concepts such as activity depth, interruption depth, interruption initiation (self or external), media/tool use, and context (e.g., telephone conference calls).

4.1 Exemplary Quantitative Analyses

This poster presents activity graphs as an analytic method. I present the following quantitative summaries as *examples* of the types of analyses that this method can inform. Of course, a larger sample size would be required for meaningful results.

- **Length and complexity:** Activity length (number of components) varied across the three informants from 1-15 components, with an activity depth (root activity component, child, grandchild, etc.) from 1-4. These kinds of measures could be used to characterize the complexity of different types of tasks or work domains.
- **Interruption and simultaneity:** Across informants, 33%-44% of activities occurred simultaneously with other activities, largely through interruptions. These kinds of measures could be used to quantify interruption loads, and inform the design of interruption management tools.
- **Media/tool use:** Multiple-component activities were very to involve multiple tools or media (67%-86% across informants). These kinds of measures could be used to generate requirements for activity-support environments, or for activity-capture/knowledge-management tools.

5 DISCUSSION

Activity graphs have been presented as an analytic tool for representing and interpreting complex tasks and work. Future research will use this tool in mores systematic studies of task-structuring and activity self-management.

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