# An Hour In The Life: Towards Requirements for Modelling Multiple Task Work

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**ABSTRACT**
It is accepted that changes in technology, work practices and the general socio-economic environment affect the way we plan and perform tasks. Support, opportunity and pressure for people to 'multitask' has increased. We cannot assume that because an IT is designed well for a single-user single-task perspective, that it will effectively support multitasking. Some work has been undertaken into understanding these phenomena in a HCI context, but with little permeation into mainstream HCI methods. This paper provides an interim report into work into multiple task phenomena within the Task Knowledge Structures task analysis approach.

**Keywords**
Multiple task work, modelling, Task Knowledge Structures

**INTRODUCTION**
It is widely accepted that changes in technology, work practices and the general socio-economic environment affect the way we plan and perform tasks. Complete listing of these changes is beyond this paper's scope, but examples include: the convergence of media forms in one electronic workspace; support for specialist tasks by generalists; knowledge and service work that is less constrained by the physical environment; and advances in computer power, mean time lags for everyday tasks are minimized and support for application switching is better.

Overall support, opportunity and pressure for people to 'multitask' has increased. The design of IT artefacts is rarely designed to take account of phenomena such as multiple tasks, multiple instances of the same task, interruptions, exceptions, multiple ways of ordering the sequence of subtasks and opportunism in a dynamic task environment. We cannot assume that because an IT is designed well for a single user - single task, that it will effectively support for multitasking [1]. At best, IT artefacts may be inefficient, at worst inflexible, frustrating, error causing, and ultimately unusable. Despite rapid advances in technology, human abilities have not changed as quickly. Our capacity to deal with multiple goals and streams of information have not increased and we need to find ways of analyzing and designing for these contexts. As is often the case in HCI, theory lags technological advances. Deeper insight into how people interleave elements from different tasks within different tasks and contexts have not informed the array of technology support for such phenomena. Some work has moved us towards an understanding of multiple tasks [1,2]. This research portrays tasks driven and constrained as much by priorities, resources and opportunism as they are by domains, IT artefacts or cognitive limitations. But the work is either fragmented or has failed to permeate into mainstream user / task / activity analysis methods.

Our work is concerned with applying and extending the task analysis approach Task Knowledge Structures (TKS) to the multiple task phenomena [3]. TKS posits that people represent knowledge about the tasks they carry out. Using a range of knowledge elicitation techniques TKS creates a task representation that is held to be functionally equivalent to a user's task knowledge about roles, goals, subgoals, objects, actions and the centrality and representativeness of task elements [3]. The effort of modelling high level single tasks such as radiography and architectural design by single task performers has been significant [3]. However with the rise of increased technological and socio-economic impetus for multitasking, TKS needs extending.

**AN HOUR IN THE LIFE**
Within this paper our main concern is to present a number of findings and related conjectures from one of our studies.

**Background**
The study reported here is a detailed analysis of a video recording of a time slice of a researcher performing a number of tasks. The subject in question was a researcher with additional teaching duties. On questioning the subject about her higher level motivations, she noted that she needed to clear time to focus on doing her own data analysis. At the time she was also new to the department and faced questions along the lines of 'how do I' and 'where is', as well as a general concern to build social relations with new colleagues. This 'hour in the life' was exhaustively analyzed in detail, with participation of the subject, to take account of the roles, tasks, objects,


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participants, locations, tools, artefacts, events, and interruptions.

### Key Observations

The subject had 6 main roles which generated attempts to plan and execute 17 distinct tasks during the observed period. The subject was the explicit recipient of 5 interruptions by other agents. She also interrupted her own task performance on 9 occasions and she interrupted other people 14 times. These interruptions and other events meant that task suspension and switching / interleaving was common. In terms of the wider environment the subject interacted with 16 different participants (35 cumulatively). Over the hour, tasks and interactions took place in 8 different locations excluding traversed corridors.

Further interesting phenomena included:

*Plans and Planning.*

The subject had a plan which was externally represented within a number of artefacts (to-do-list, diary, desktop). The plan was partial, informally constructed and represented, and it and its representations were referred to and modified at several points during the observed period.

*Groupings.*

A number of groupings of tasks and task elements occurred. Grouping by tool; checking for, reading and writing of email. Grouping by location; a number of tasks that needed to be performed within a certain area were grouped. Grouping by participant; a number of unrelated tasks were grouped by a specific participant.

Groupings appear to entail a set of pre-conditions that can be composed of preconditions for the individual tasks and those conditions generated by the grouping itself.

*Execution Choices*

At several points in the observed period the subject could have used alternative ways of performing a task e.g., phone or email rather than face-to-face meeting. On reviewing the data, the subject indicated that her concern to build social relations influenced her preference for face-to-face meetings.

## DISCUSSION: TOWARDS REQUIREMENTS FOR TASK MODELLING

Our concern now shifts to how we can describe and model such phenomena in TKS. TKS holds that subgoal ordering and interleaving is not random and that it reflects structuring principles that are a joint reflection of how a task is represented in memory and carried out in the world [3]. Are there similar task structuring principles that govern how a person plans and interleaves the execution a set of similar or dissimilar tasks in their environment?

The observed task groupings show one possible indicator of such structuring principles. TKS could be extended to observe and model relevant facets of context. However, it would be important to be able to form explanatory accounts that are not bound to 'surface' factors of context. For example, all tasks occur in a location and in theory we could claim that everything we do is grouping by location. Rather our concern is distinguishing how location is used in the planning and ordering of certain tasks, and not in others. Equally important is the consideration of factors that can prevent such groupings. Two examples would be deadlines and reporting requirements acting against the grouping of tasks.

Task suspension and switching can be described with the traditional temporal operators of task analysis. But for modeling recourse is needed to some notion of higher level of goals or priorities that guide task ordering and execution in the face of given resources.

In summary, TKS and other task analysis methods should be extended to take account of: task locations, participants, and grouping of elements, as well as the dynamics of the work environment and impartial nature of plans and their representation. Any 'layers' of goals that may affect the planning, execution choices and ordering of tasks should be elicited and represented in some form. At this point it may be enough to set a requirement to acknowledge that goals exist in layers and represent the relationships between them. In the future, recourse may need to be made to some formal model that takes into account the priorities groups and individuals have and how these are mapped into multiple task structures and available resources.

## FUTURE WORK

This is very much work in progress. Our current efforts centre around: 1) replicating these phenomena and these forms of study; 2) Providing deeper explanatory accounts of the phenomena from the case studies to enable the development of principles [c.f., 3] for structuring tasks and devices, rather than generating yet another set of design heuristics; 3) Design efforts, one way of gaining further insight is prototype development that supports a number of these phenomena (constant re-planning, grouping, switching and suspension of tasks) in general. Feedback from these efforts would provide further insight into the way people arrange tasks. We will also compare general task planning and performance between people using or not using supportive devices.


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