Information Graphics as an active tool during the Interaction Design process

This paper presents a graphic structure used as a tool to organize, illustrate and handle information during the early stages of the interaction design process. This seems to be an alternative way to deal with today's need to manage large amount of diverse data making it visually available for the designer. The development of this graphic method is illustrated with a case where the tool was applied as well as a short guide to the use of the tool. The results demonstrate the benefits derived from the application of the method.

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All the events and reflections in this paper are based on the experience of an academic interaction design project. The focus was the improvement of the control system of a specialized forestry vehicle in terms of user interface. The goal was increasing profit from the activity by reducing the effects of cognitive overload on the workforce's health, performance and safety.

INTRODUCTION

"Information design in its widest range is about the selection, organization and presentation of information to a given audience […] As a discipline that has the efficient communication of information as its primary task […] implies a responsibility that the content be both accurate and unbiased in its presentation […] tries to present all the objective data required to enable the user to make some kind of decision." (p. 6) [7]

In the same way information design products such as a map at the airport, the charts presented at the annual report of a company, the on-screen instructions to program a home video recorder or the illustrated sequence of an industrial production line provide useful and accurate information to their users, our notes and thoughts should provide us designers with direction and inspiration to resolve our task from the beginning.

During the early stages of the interaction design process data gathering takes places. This serves to the purpose of approaching and understanding the elements, context and factors involved in the situation. The diverse media in which information is registered such as texts, sketches, photographs, sound recordings and videos can be collected sometimes in large quantities; this, in addition to the highly detailed information resulting from initial data analysis, can become problematic for the researcher if not properly organized and mapped. In order to get a detailed overview of the studied situation that leads to identify opportunities to develop design solutions or improvements, the interaction designer has many options to manage information in a practical and efficient way. The use of lists and diagrams is frequent during design projects. Information collected initially as notes from observation or interviews can be easily translated into a list of sequential events.

It is important to describe the situation in detail. In interaction design is very popular de use of the hierarchical task analysis method (HTA) [Annett and Duncan, 1967].

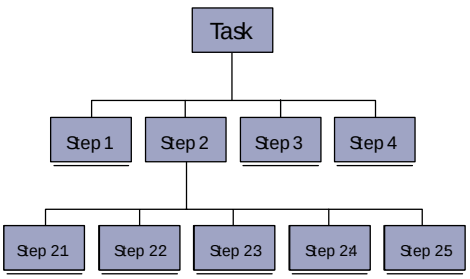

Figure 1. A graphical representation of HTA. Adapted from: Preece, J., Rogers, Y., Sharp, H. *Interaction Design.* John Wiley & Sons. New York. NY, USA, 2002, 231-232.

Originally developed to identify training needs, HTA consists is used to describe a user's goal or task by dividing it into the steps needed to complete it. Then each step is divided into sub-steps and so on (Fig. 1).

Then tasks are put together as a plan in order to describe a situation. HTA can be represented in a graphical way and visualized as a whole for the first time giving the possibility to include comments and observations.

PURPOSE

The use of the HTA method helps to build a basic structure, a time line that keeps track of the sequential tasks the user is performing but yet not intended to accomplish the goal of showing or describing what is happening to him at a cognitive level on a certain moment.

To make this possible additions were made to the original graphical representation of the HTA in order to make it descriptive of the situation at a cognitive level.

The purpose of this dynamic graphic method is setting an adequate scenario for the identification of the particular mental processes taking place, their frequency, importance and eventual disturbances in order to detect the causes of cognitive overload during the operation sequence.

CASE

Information was collected in diverse ways and media. Initially at lectures on Sweden's forestry economy, history and workforce labour and cognitive conditions; later, during presentations on the machinery and computer system, technical information was provided; harvester training simulator trial and visits to the forestry machine assembly factory and the woods where forestry works using this equipment were taking place. Notes and sketches were collected both by hand and computer. Images were recorded on video tape and digital cameras. The information in electronic media (photographs, videos, word processing, graphs) was reviewed, edited, printed out, annotated and integrated to the rest of the information, arranged and mapped.

Data was gathered to know the driver of a forest harvester machine's working situation, the tasks he has to do, the kind of information he is exposed to and what kind of decisions he has to make in different situations to detect the most critical moments of cognitive overload, one of the main causes of decreasing productiveness in the forestry business, and come up with a design solution. Graphs developed during the descriptive phase helped to map the information and the one resulting from analysis became the expected active tool.

Instead of the usual "tree" structure normally applied to graphical representations of the HTA method, a linear, sequential one was used. The decision was taken in order to represent time progress in a more appropriate way. Subdivisions of the particular tasks are represented then as text lists in the lower part of the graph. The original size of the following illustrations cannot be reproduced in this format so texts are not legible. Even though, it serves to describe different stages of the same graphic growing by addition of elements in a proper way.

Figure 2 shows the whole working day with an iteration of the actual cutting sequence. The blocks added above shows information about different factors that affect the actual sequence. This information is collected from video film and notes from observation, interviews, facts from lectures and the company, and so on.

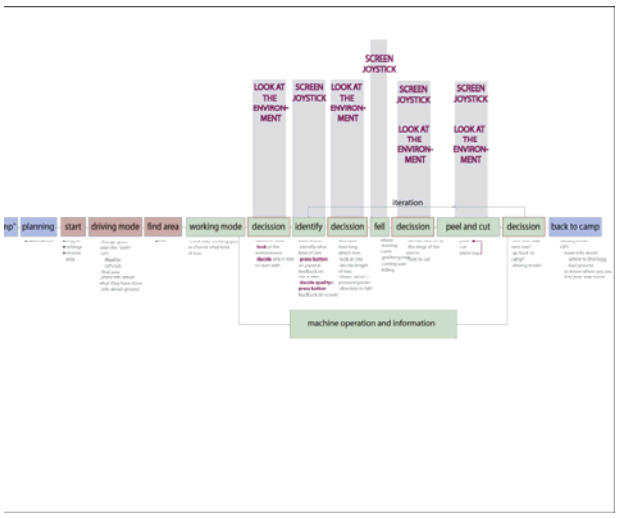

Figure 2

Figure 3 is a "zoom" into the part of the sequence found to be the most critical during the cutting process and the part we decided to focus on in our project. Compared to other moments during the work day, this sequence involved diverse simultaneous physical actions and cognitive processes. Then iterated many times.

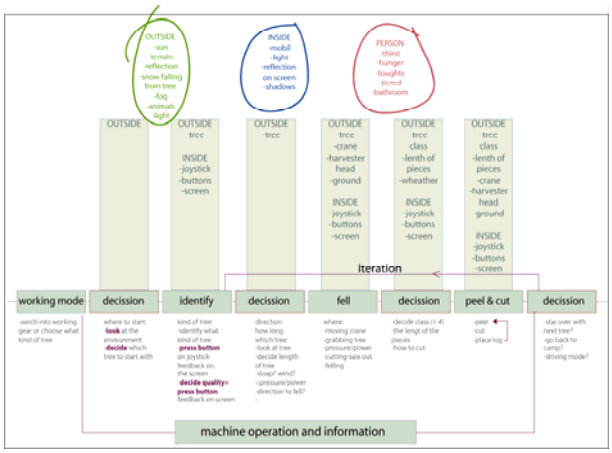

Figure 3

Then we looked at the information on the screen that the driver is exposed for during his work (Fig. 4). We tried to visualize how big the cognitive load is today and as a result from the previous graphics we could now make suggestion on how to lower the cognitive load. This both show information showed during the sequence of the actions/tasks.

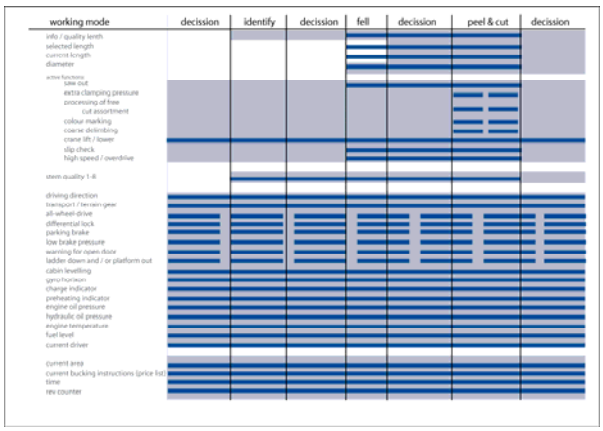

Figure 4

RESULTING METHOD

The experience that began with the graphics developed in a natural, spontaneous way evolved in a set of two graphic structures.

Putting it all together: the descriptive phase

Establishing the sequence

The first set of graphics is made to map all the information collected to obtain a detailed overview of the situation beginning with the graphic representation of the initial hierarchical task (functional) analysis with the description obtained from observation and preliminary studies (Fig. 5).

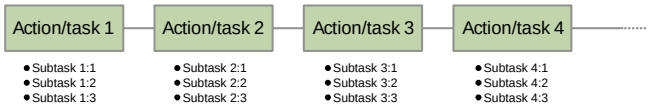

Figure 5

Context description

This is complemented with contextual information that describes the situation in terms of the surrounding space, objects and operational conditions of the user to identify the different kinds or categories of external elements directly involved in the situation (Fig. 6).

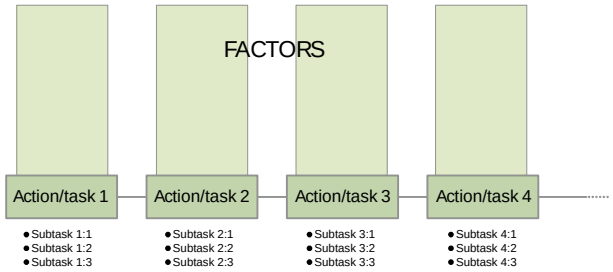

Figure 6

Critical moments

These categories of elements appear initially as titles. As details are needed they can be included as comments or sub-categories. Most of the contextual information obtained by direct observation was complemented and detailed after an exhaustive review of photographs and video recordings (Fig 7). “Critical moments” of cognitive overload are defined at this point as the ones with more factors involved simultaneously in the situation at one particular instance of the sequence.

First hand information on cognitive issues was collected in-situ with the user. He provided information of his experience in this kind of work, personal opinions on the situation, a general description of the task sequence and details on his cognitive processes that was included in the map in the form of hand written annotations.

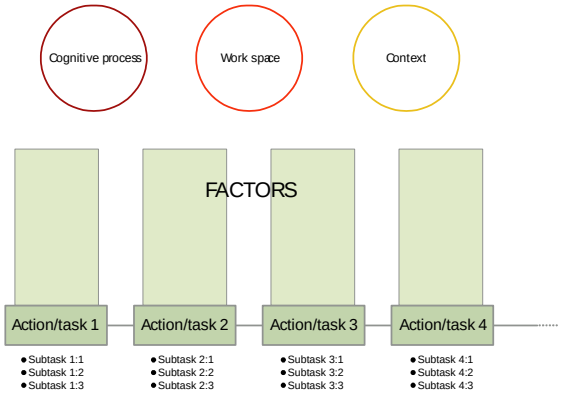

Figure 7

Making use of information: Analytical phase

The designer then decides where to take action and focuses on a particular action or routine. By representing when in time a particular event takes place, the information defined during the last part of the descriptive phase is refined.

At this point, the map should provide enough information to define order and hierarchy of the steps required to accomplish the task so the designer can decide the appearance and temporariness of graphic elements on the redesigned user interface depending on the information needs of the user.

The linear structure of the graph has evolved from a linear one (Figs. 6-7) to a two axis chart where actions and cognitive processes are on the x axis (Fig. 8). The y axis contains information shown the actual user interface.

The figure shows how a sequence involving a large amount of simultaneous actions and decisions at different levels generating textured zones in the graphic, where the most dense represent higher levels of cognitive overload (light fields), can be simplified by making some of them intermittent or just invisible until needed (dark thick lines).

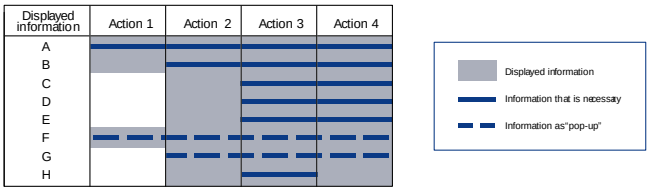

Figure 8. The word “action” on this table refers to physical observable actions as well as to cognitive processes.

An active tool

The physical actions mapped on the descriptive graph were found to be equivalent to those represented on the GUI of the computer system in the tree cutting machine. This makes possible to apply any finding or design criteria, derived from the user–context study to the mediating computer system timeline.

The “active” nature of the analytical graph appears when, only by showing the light fields serves as a template where the designer can explore as many timeline alternatives, with their respective sets of design criteria or parameters, as they decide.

CONCLUSIONS

The modified hierarchical task analysis graphic, not only proved to be simple and effective but flexible enough to admit additions extending its well-known capabilities to manage the description of physical actions, cognitive processes and time progress.

The analytical graph was successful at representing a group of simultaneous events causing cognitive overload. It also serves as an active sketching format during the early creative stages during the design of a graphic user interface.

This way of using and collecting information can be generalized to other design disciplines projects because ,although some times cognitive processes or time are not considered while developing solutions, putting attention on these aspects may give a more detailed and accurate overview of the evaluated situation, and as a consequence, more material for reflection and a conscious creative process.

DISCUSSIONS

The application of this method in different fields and situations can be left open for discussion since it has been tested just in one single case. We encourage our colleagues and anybody interested to try this method on their own projects.

The following can be points of discussion, suggestions and other observations.

- This method was tested on a case that had a predefined need or situation to solve. To prove it could be used as a generic method for interaction design projects, it would have to be tested because might not work in the case we also need to identify needs from scratch.
- The most important limitation noticed as the descriptive graph was completed was that using a large format with big enough text and graphic elements was the only way to keep all the information visible and available all the time reducing mobility and archiving possibilities to some extent.
- As a suggestion for the administration of the material collected at the beginning of the project, keeping a log book; annotating date, time, source and other references helps to reorganize the pieces in case they have been moved. It can also facilitate the construction of the initial sequence.

RECOMMENDATIONS

Graphics helped us to structure and visualize the information we collected, and later on helped us make decisions and present our ideas. Information graphics were applied on the whole design process, not only made for presentation but also for analysis and decision making. It helped us keep our goal.

More interaction designers should try using Information Graphics formally during their design process as an active tool not only by applying existing methods but making adaptations of them according to the actual needs of their projects, giving a try to the benefits of the potential of information graphics on creativity, data management and decision making.

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