<u>Conference Paper</u>

The FIT-System: A New Hand-Held Computer Tool for Ergonomic Assessment

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THE FIT-SYSTEM: A NEW HAND-HELD COMPUTER TOOL FOR ERGONOMIC ASSESSMENT

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Abstract: Objective is the recording of tasks, links and team work of anesthesia work procedures a multidiscipline operating room (OR) facility. Method is a common mobile hand-held computer device with a flexible interface technique, called the FIT-System. Main idea is, that the observer can design his own computer interface on a paper overlay according to his representation of the situation. Anesthesia procedures during surgery and induction were inspected with the FIT-System in several projects. Some of them are presented in this paper as examples to demonstrate the use of the FIT-System which shows it's usability and the advantage in time, costs, flexibility and ethics, that event recording can be done without video filming.
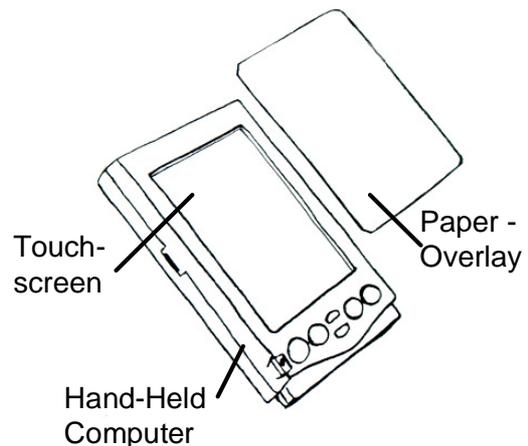
Introduction

The analysis of: task, links, postures, movements, episodes of communication or co-operation is a valuable learning process and information source for the understanding of work processes. Video filming is often a disturbing factor and later analysis a time consuming process. Therefore mobile computer are used for online and onsite event recording [1]. Disadvantages of those tools are: they often restricted to a certain kind of events (only tasks, or only postures) and: the observer has to learn and to train the use of the event recorder because the event recorder interface is predefined (function keys, menu lists, abbreviation) and can't match the observer's individual mental representation of the observation task.

The FIT-System (flexible interface technique) is a new event recording technique to overcome those problems.

Materials and Methods

Figure 1 show the FIT-System hardware components, a paper template, i.e. overlay, covering the touch-screen of an hand-held computer device (Figure 1).

1. The observer and FIT-System user design his own interface (hand-written) on the paper overlay, according to his semiotics of the recording process.
2. The observer record the identified events, by typing with a stylus on the related paper area (symbols, text, etc.). The co-ordinates of the typed point and the actual time code are stored in the hand-held's memory.

Figure 1: The hardware of the FIT-System

3. The observer transfers his data to a personal computer (PC). The recorded points are represented in the same way as they are typed in, and polygons can be drawn with the PC mouse to encircle them according to the meaning of the paper overlay. The result of this definition is a table of the events name and the time when they occurred. Further analysis (statistics, graphs and diagrams) is done in a standard calculation program.

For the application of the FIT-System, the recording of observations, manual tasks and communication as well as those of the movements (links) should be demonstrated.

Results

Observations, manual tasks and communication: First, the situation has to be observed and the events of interest have to be analysed and categorised. The situation is in the OR (Figure 2).

The tasks of interest are the manipulation and the observation of the patient (surgical field) and of the equipment (monitor, respirator, infusion, medication) as well as the communication and documentation. The observer decided to design the paper overlay with rectangular symbols for each object of the workplace, and an abbreviation for the related task or object (o:observation, m:manipulation, I:Infusion, etc.).

But he can draw all of his symbols according to the spatial situation of the observed OR (Figure 2 and 3).
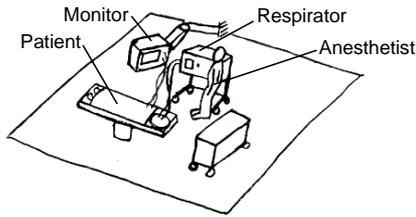

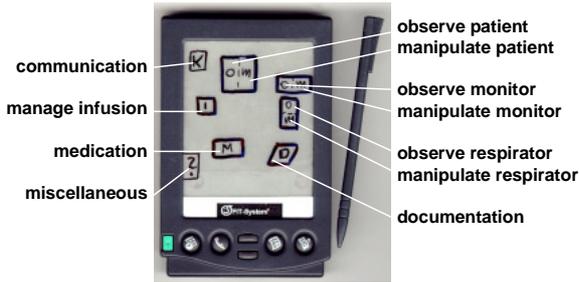Figure 2: The situation in the OR.

Figure 3: The individually drawn FIT-System interface.

Further the observer can record the events online in the OR. He can change his interface by adding new symbols or he can design a new interface. Different recordings can be stored as files in the hand-held computer.

After all observation is done, the data are transferred to the PC. Polygons can be drawn with the PC mouse to encircle them and names can be assigned to define them. Result is a time table in a spreadsheet format (Figure 4 and Table 1).
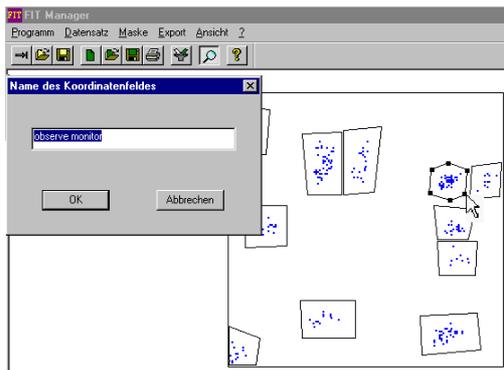

Figure 4: The definition of the recorded data on the PC.

Table 1: The recorded and defined events (extract)

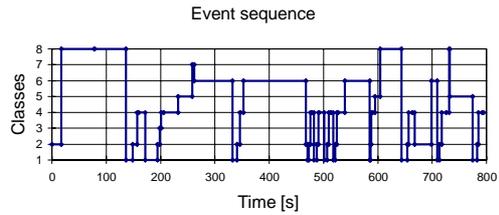| Eventname	Timestamp
...	...
manipulate monitor	00:00:11
documentation	00:00:17
observe patient	00:00:33
...	...

Figure 5: Sequence of Events (classes see Fig. 3)

Movements: Due to the possibility to relate the interface and the spatial situation, the observer can draw a raster of boxes on the interface to track the position of the observed person by pointing in the related box. Result is a graph of movements (Figure 5).
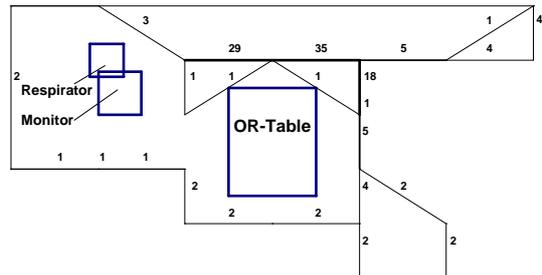

Figure 6: Paths and frequencies of the movements.

Discussion and Conclusion

„Did you ever see the engineer (architect, designer), analysing our work?". This question might be mentioned by an user, wondering himself about design which doesn't match his requirements. But more often they not even realised all the mismatches. The conclusion is:
1. The designer need simple, mobile and flexible tools, to support him in recording the user's work, 2. The users need an understandable insight in their work. The latter can be done by presentations like shown in Figure 6. The first requires a solution which can be easily adapt online and onsite according to the designer's progress in learning and analysing. The FIT-System, a pocket-size recorder of any observational data, can fulfil this [2],[3].

References

[1] M.B. Weinger, O.W. Zornow, M.D. Paulus, D.M. Gaba and M.D. Dallen, „An objective methodology for task analysis and workload assessment in anesthesia providers", *Anesthesiology*, vol 80, pp. 77-92, 1994.
[2] J. Held: „Fitting the mental model: a new technique for computerised event recording", in: Engineering Psychology and Cognititve Ergonomics - Volume Four, D. Harris, Eds., Aldershot: Ashgate 1999, pp.293-300.
[3] J. Held and H. Krueger: „Das FIT-System: Ein mobiles computergestütztes Verfahren zur Erfassung beobachtbarer Ereignisse in der Arbeitsanalyse", in *Belastungsanalyse und Arbeitsgestaltung*, Stuttgart: Haefner, accepted for publication.