# Visualization of Clinical Protocols

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## The concept of AsbruView ...

We developed a time-oriented, skeletal plan-representation language called Asbru [1] used to represent clinical protocols. It is a modeling language which supports both the design and the execution of skeletal plans by a human executing agent other than the original plan designer. During the design phase, Asbru allows to express durative actions and plans caused by durative states of an observed agent. During the execution phase, Asbru allows flexibility to instantiate the skeletal plans with time-oriented patient data. Thus Asbru is a complex language and is hard to understand if the user has no training in formal methods or computer science. To solve this problem we developed a visual interface called AsbruView [2]. Based on visual metaphors like traffic signs and running tracks, AsbruView provides editing and visualizing. The three different views implemented, the Topological View (Fig. 1), the Temporal View, and the SOPO View (Set of Possible Occurances) are powerful tools to analyze and edit structural and temporal dependences of clinical protocols.

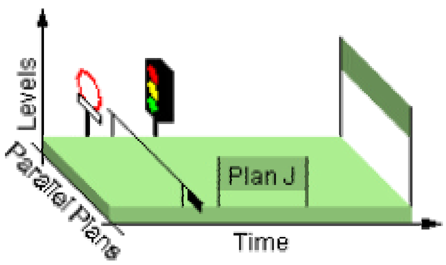


Fig.1: Topological View

The traffic sign „no entrance with exception" symbolizes the filter precondition; the barrier symbolizes the setup precondition; each light of the traffic light stands for one further condition (abort, suspend, and reactivate). The finishing flag, finally, symbolizes the complete condition, which specifies when the plan has reached its goal. Plans can have subplans which are stacked on top of the containing plan. Parallel plans, which are executed simultaneously, are situated next to each other. Sequenced plans are shown sequently along the time line. Although the visual interface is much easier to understand than the program code of Asbru, visualization becomes too complex. To help the user to keep track of the plans, we developed a technique to direct the user's attention.

## ... as an application of Semantic Depth of Field

Based on the concept of Focus and Context, our project member Robert Kosara set on an information visualization technique, called Semantic Depth of Field (SDOF) [3]. Depth of field (DOF) is widely used in photography. SDOF works similarly: By blurring the less relevant information, you can see the sharp and highly relevant parts immediately. In a user study performed by the Center for Usability Research and Engineering (CURE), SDOF was shown to be preattentive, i.e., perceivable in less than 200 ms, and to be highly effective in guiding the user's attention.

Figure 2 shows the Temporal View of AsbruView. If you search for plans according to particular criteria, e.g., the necessity of special equipment or medication in order to carry out a specific plan, SDOF could help you to locate the relevant plans. In Figure 3 Plan C and Plan E are shown sharply because they fulfill certain qualification, while the rest is blurred. We plan to implement such a feature in Asbru.

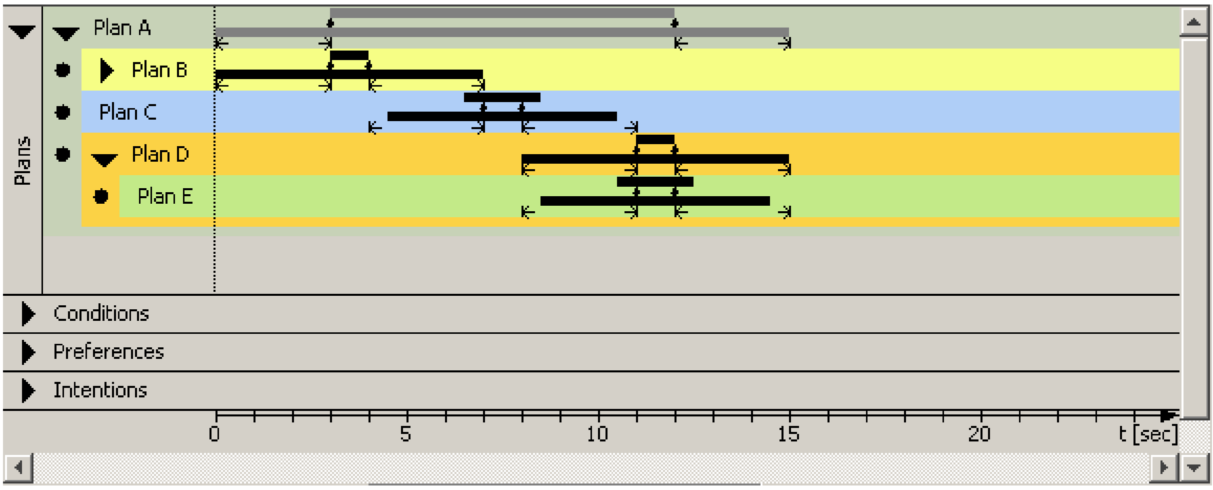

Fig. 2: Temporal View

After locating the relevant objects - usually in a very short time, users might want to go back to a sharp display. An autofocus feature is therefore implemented, which brings all objects into sharp focus again.

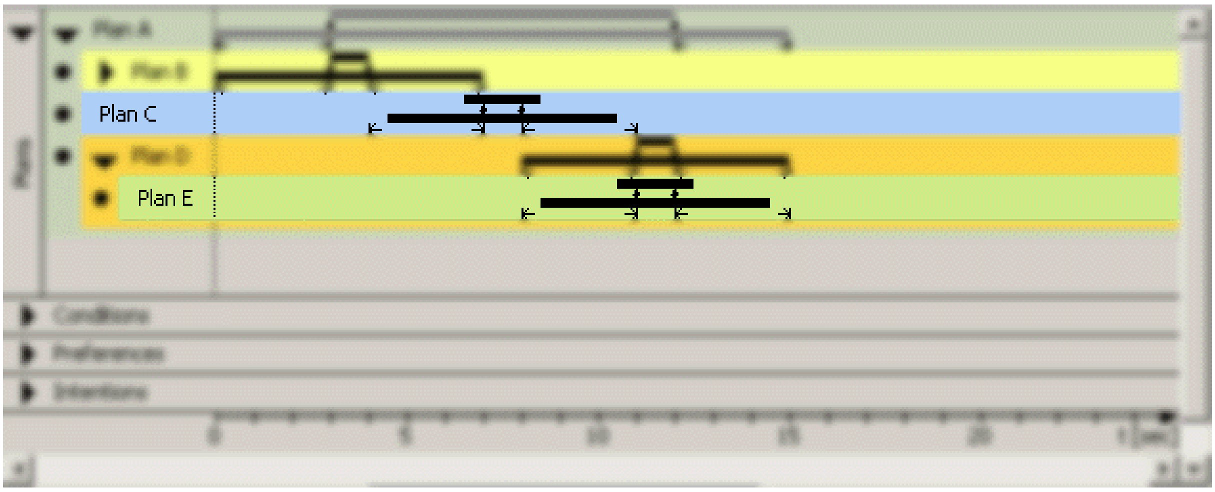

Fig. 3: Temporal View, applying SDOF to focus on Plan C and Plan E

SDOF is data-driven, that means that the user selects certain value ranges, for example, by using enriched sliders [4]. According to this selection, objects are relevant or nonrelevant. Other kinds of interaction that are typical for SDOF applications are: Selecting the SDOF dimensions, selecting and defining the relevance function, and changing the threshold. Of course this is not the entire list! We will do further research on this issue.

Some advantages of SDOF are: It is preattentive; compatible with other retinal properties, like orientation, shape, color, etc.; convenient for color blind people; and executable on an everyday computer.

## We need interdisciplinary approaches

Visualizations in general are external representations of thought processes. Such external representations facilitate cognitive tasks like problem solving, reasoning, and decision making. They provide information that can be perceived directly und used without being interpreted and formulated explicitly and can anchor cognitive behavior [5].

We all know the saying "A picture is worth ten thousand words" and it really seems to be so. But do we know why? Cognitive Science and Computer Science together have some important questions to explain and therefore need to intensify their cooperation. A huge amount of questions and challenges emerge. For example: How does visual perception work? Perception and cognition versus sense and interpretation: how do they intertwine? How can we use the findings on perception and cognition to create effective visualizations? Which interactions take place while using visualization as external representation of cognitive processes? Which requirements to follow and constraints to accept in designing user interfaces?

So I look forward to hearing the invited talk by Ben Shneiderman "Beyond Smart Graphics: Building tools to empower users" and the other very interesting presentations, e.g. R.A. Rensink: "Internal vs. External Information in Visual Perception", M. Götze, S. Schlechtweg, T. Strothotte: "The Intelligent Pen – Toward a Uniform Treatment of Electronic Documents", at the Symposium on Smart Graphics 2002. It will also be very interesting to discuss the AsbruView concepts with these experts.

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