

Visualization of Patient Health Data



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Outline

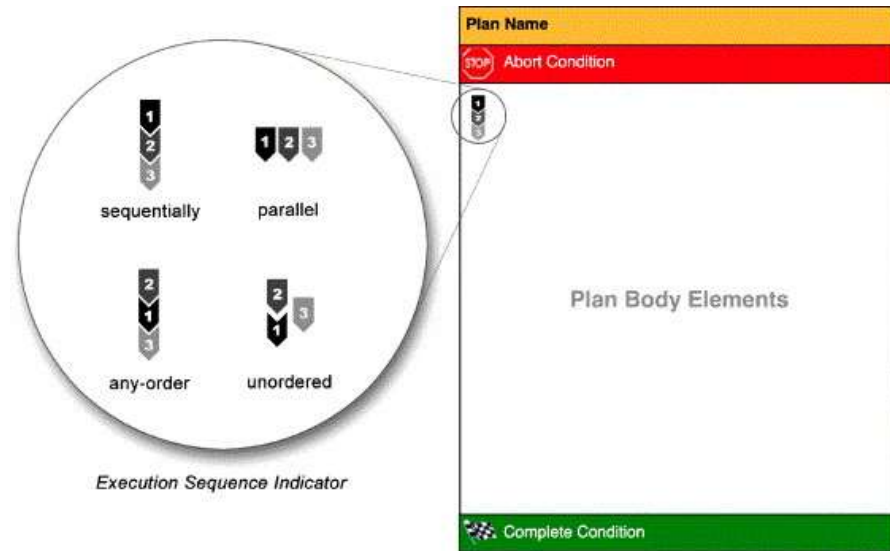
- ▶ Introduction: Personal Health Record
- ▶ Prior Work
 - ▶ CareVis
 - ▶ Level of Detail
- ▶ Main Paper
 - ▶ Adaptive Symbols
 - ▶ Symbols for PHR
- ▶ Conclusion

Personal Health Record

- ▶ Definition from the National Alliance for Health Information Technology:
 - ▶ *“An electronic record of health related information on an individual that conforms to nationally recognized interoperability standards and that can be drawn from multiple sources while being managed, shared, and controlled by the individual.”*
- ▶ Hold a variety of information from a variety of sources
 - ▶ Healthcare exams, scanned images, “baby books”, medication notes
- ▶ Difficult to communicate between different user groups

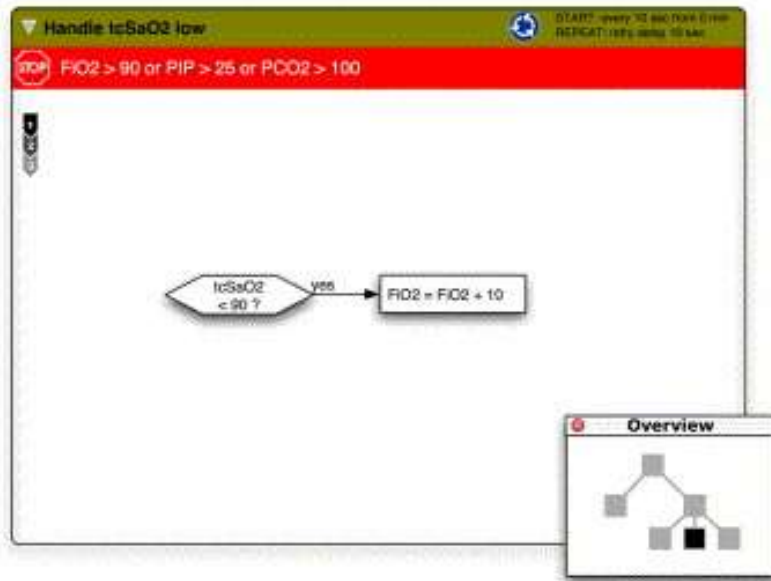
Related Work: CareVis [1]

- ▶ Provides multiple simultaneous views to physicians in order to convey different aspects of the underlying data structure of treatment plans and patient data
- ▶ Key Idea: Try to capture the patterns in the patient plans for the physicians
 - ▶ Logically
 - ▶ Temporally

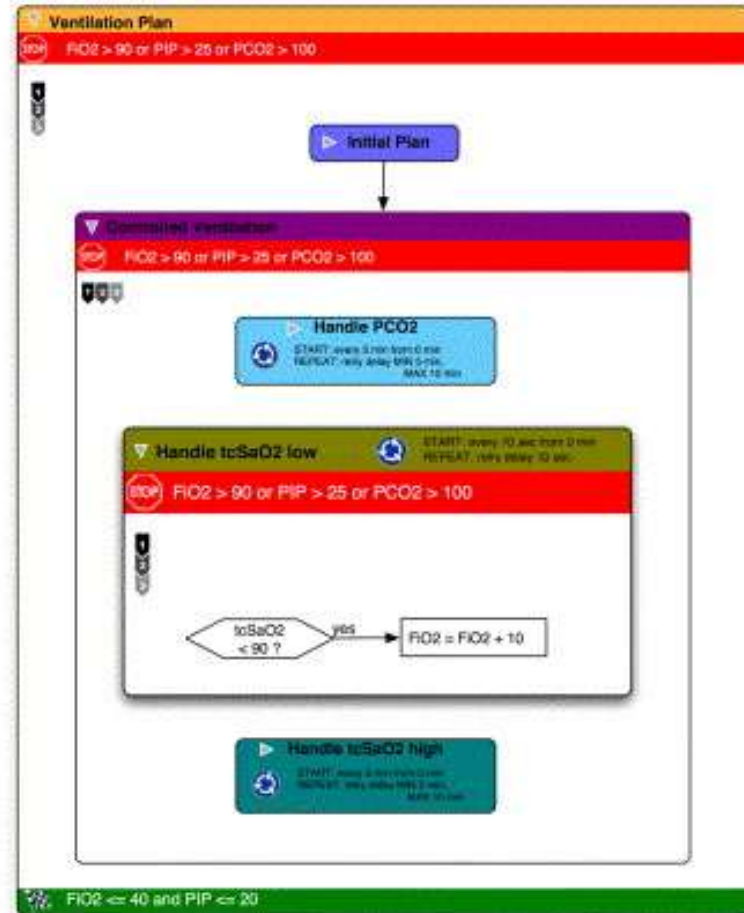


CareVis Example

Helpful for physicians, but probably won't be easily understood by patients, families, etc.



(a) Overview + Detail.



(b) Fisheye view.

Other Work: Level of Detail [2]

- ▶ EHR (Electronic Health Record) that clinician needs to read contains a lot of detail
 - ▶ Hard to extract valuable information quickly
- ▶ Visualization model tries to break down the record into levels of detail based on their clinical relevance
 - ▶ Hierarchical patterns for patient information

LOD Example

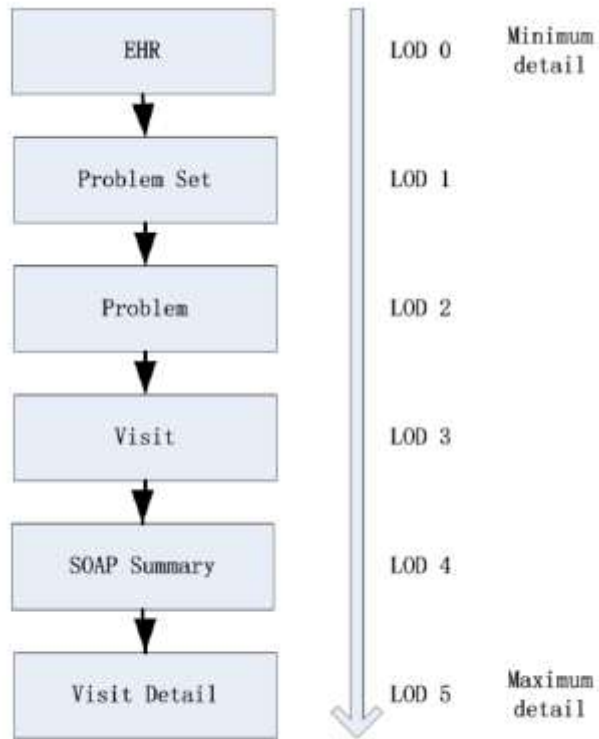


Figure 1. LOD Navigation model of EHR.

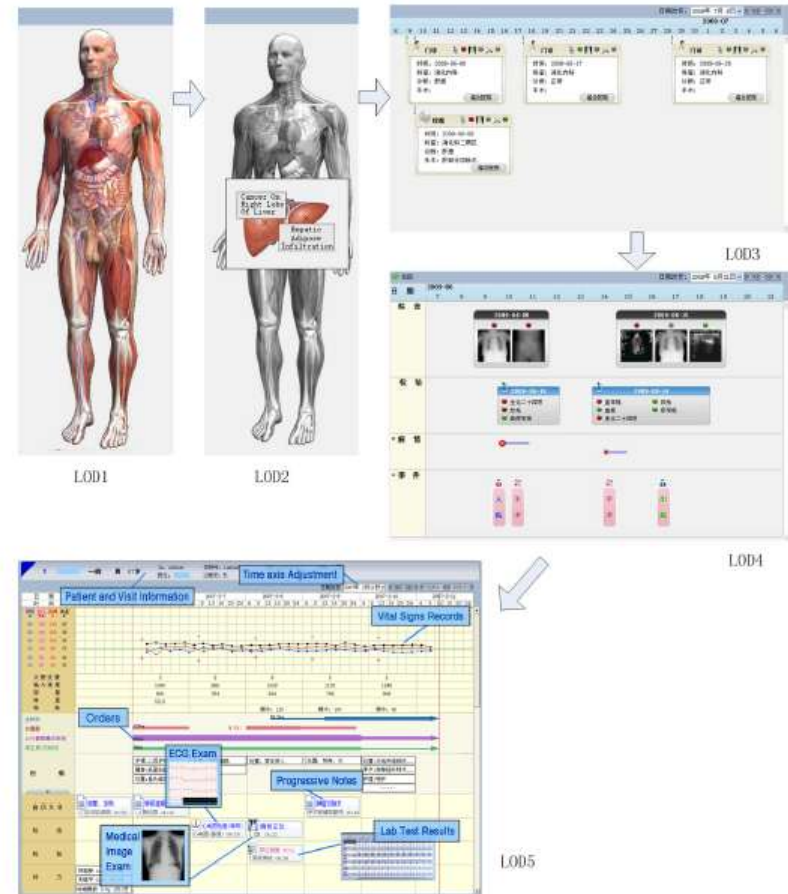


Figure 2. LOD navigation and visualization of EHR.

Main Paper: Adaptive Visual Symbols [3]

- ▶ “Adaptive Visual Symbols for Personal Health Records,” 2011.
 - ▶ Muller, H.; Maurer, H.; Reihls, R.; Sauer, S.; Zatloukal, K.;
- ▶ **The idea: allow the user interface to adapt its visual appearance and codes to the needs of a user**
 - ▶ **Patient vs. Physician**

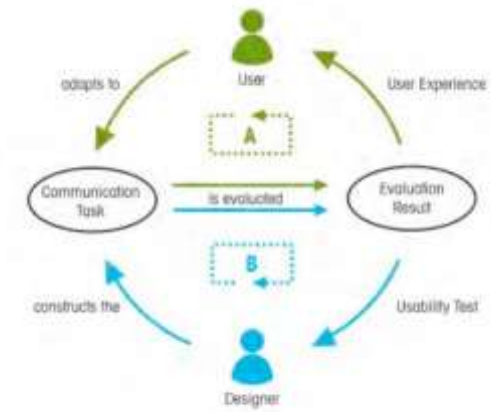


Figure 1 - Feedback cycles in user interface design

Adaptive Visual Symbol (AVS)

- ▶ Consists of 3 parts:
 - ▶ Intended denotation
 - ▶ Coding
 - ▶ Semantic Inspection
- ▶ Modeled in an object orientated way (data and methods)
- ▶ Fundamental innovation is the distinction between the semantics of a message and the used visual sign

Semantic Inspection

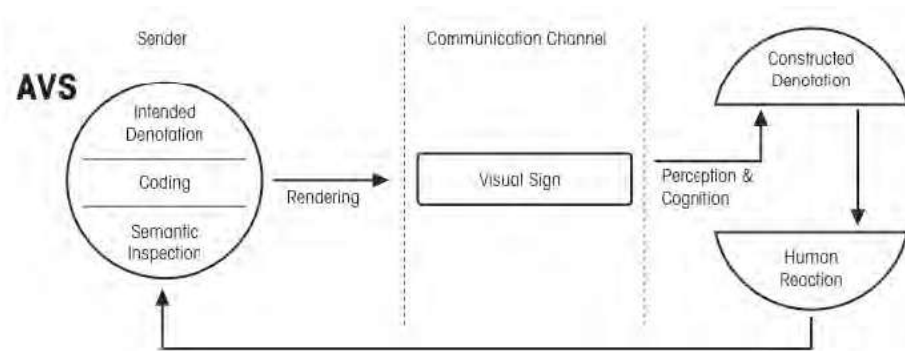
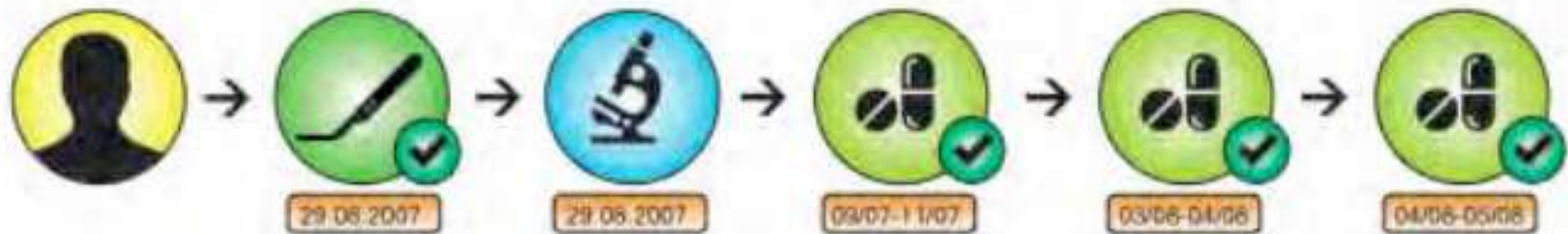


Figure 3 – Adaptive Visual Symbols

- ▶ Semantic Inspection does analysis in 3 levels
 - ▶ 1: Was the communication process successful?
 - ▶ 2: Is the interpretation task finished?
 - ▶ 3: Is the constructed meaning equivalent with the intended meaning?
- ▶ Analysis of eye movements, facial interactions, user actions, etc.

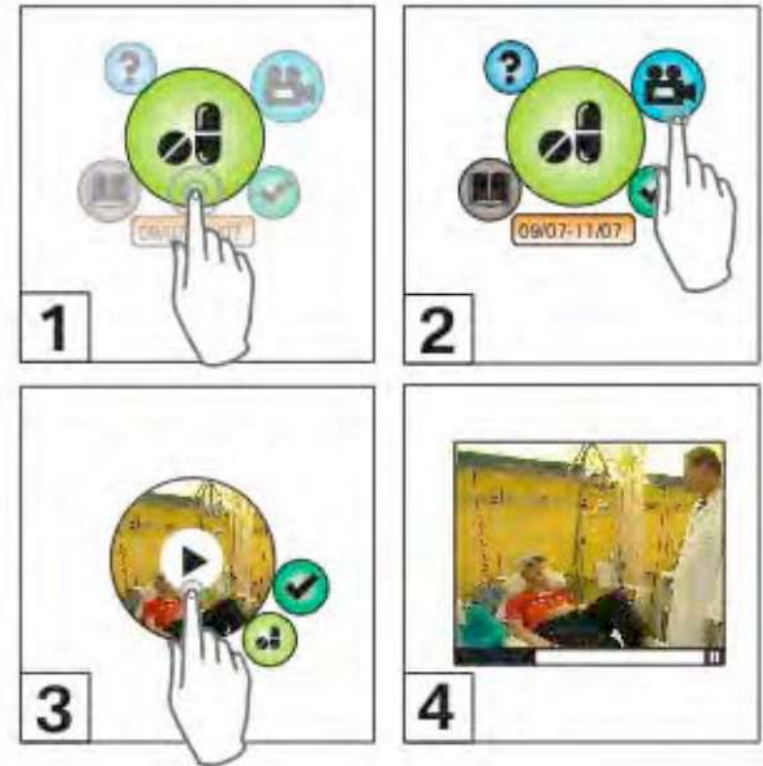
Symbols for PHRs

- ▶ Worked with doctors and focus groups of patients to develop a visual language for medical events
 - ▶ What, when, outcome



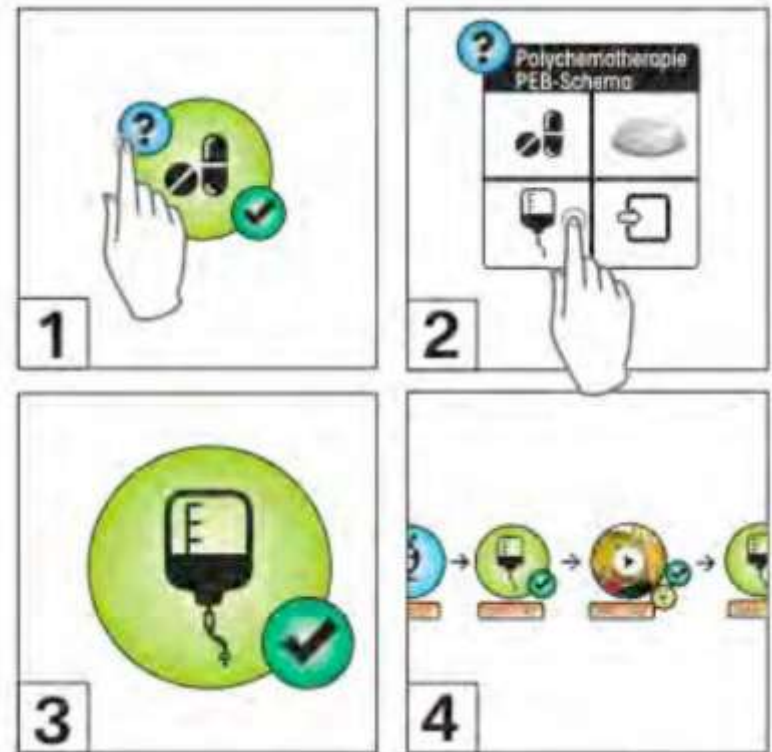
Multimedia Aspect of Symbols

- ▶ User may click on an icon to view additional information
 - ▶ Video
 - ▶ Scans
 - ▶ Notes



Adaptive Aspect of Symbols

- ▶ User may change an icon at any time



Conclusions

- ▶ Many ways to visualize personal health data
 - ▶ Need to keep the user in mind
- ▶ Adaptive symbols are most useful in visual languages
- ▶ Future Work of Research Group
 - ▶ Planning on supporting tablets and gesture-based interactions next

References

[1] Wolfgang Aigner, Silvia Miksch, CareVis: Integrated visualization of computerized protocols and temporal patient data, *Artificial Intelligence in Medicine*, Volume 37, Issue 3, July 2006, Pages 203-218. (<http://www.sciencedirect.com/science/article/pii/S0933365706000595>)

[2] Jiye An; Zhe Wu; Hushan Chen; Xudong Lu; Huilong Duan; , "Level of detail navigation and visualization of electronic health records," *Biomedical Engineering and Informatics (BMEI), 2010 3rd International Conference on* , vol.6, no., pp.2516-2519, 16-18 Oct. 2010.
(<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=5639696&isnumber=5639312>)

[3] Muller, H.; Maurer, H.; Reihls, R.; Sauer, S.; Zatloukal, K.; , "**Adaptive Visual Symbols for Personal Health Records**," *Information Visualization (IV), 2011 15th International Conference on* , vol., no., pp.220-225, 13-15 July 2011.
(<http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6004004&isnumber=6004000>)