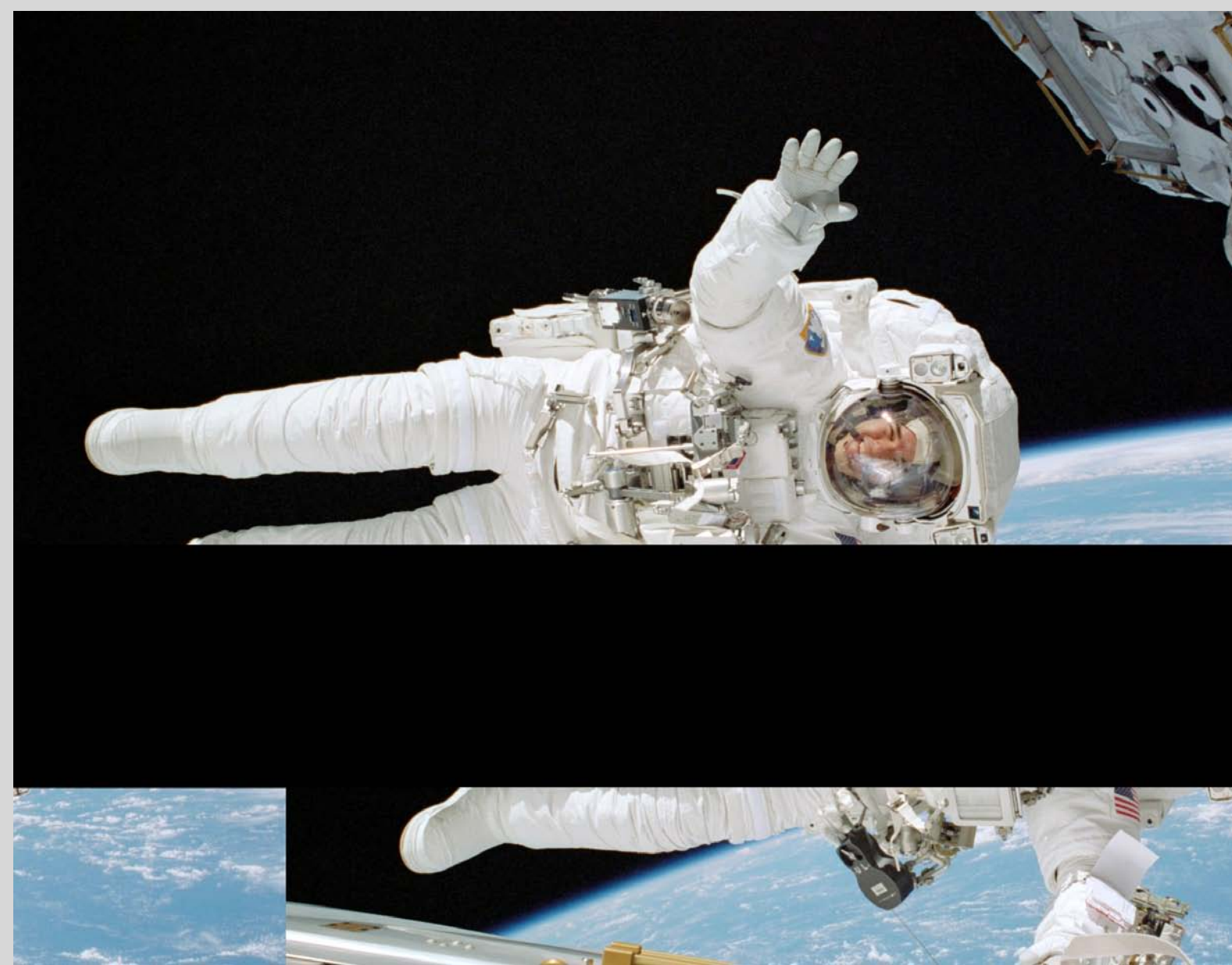


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When the Doctor is Really Far Away!

- ❖ During space exploration a physician may not be available if astronauts need medical care
 - ❖ All astronauts cannot be physicians, or the physician may need medical care
- ❖ Astronaut-physician may be unfamiliar with a particular medical procedure
- ❖ Many other settings also have low physician density
 - ❖ Rural areas, less developed countries, first responders, and battlefield situations.
- ❖ **Clinical guidelines can be a solution if implemented using technology and user interfaces appropriate to user's medical training**



Clinical Guidelines

Clinical Guidelines are stepwise instructions for performing diagnostic or therapeutic medical procedures
Typically guidelines are available as text, designed for use by physicians/nurses.

Example - Disorders of the Elbow*:

Search for any evidence of an open wound in the vicinity of the fracture.

Perform a clinical examination for deformity, tenderness, or ecchymosis, or associated nerve, neurovascular, or tendon injury. Also look for the inability to perform spontaneous movement of the elbow.

Search for any evidence of dislocation and arterial vascular compromise (cold, dusky hand and forearm with loss of sensation). If found, an immediate reduction should take place (prior to x-rays if necessary).

X-ray the elbow. Special views should be obtained when necessary.

(*www.guideline.gov, "Disorders of the Elbow")

However, these can be hard to understand and perform, especially for untrained or partially trained persons.

GuideView is a solution. It delivers clinical guidelines in an easy-to-understand and easy-to-use package

Main Features of GuideView

- ❖ Complex guidelines are broken into simple steps in a process flow
- ❖ Instructions for each step are presented in multiple modes
 - ❖ Text
 - ❖ Voice and sound
 - ❖ Pictures
 - ❖ Full motion video
 - ❖ Live action (with annotations)
 - ❖ Animation
- ❖ GuideView interacts with the user in two modes
 - ❖ Mouse clicks
 - ❖ Voice Navigation: both hands can be free to assist the patient
- ❖ GuideView can interact with medical sensors using Bluetooth (wireless) or wired connections
 - ❖ Automatically traverses guideline pathways depending on data values received
 - ❖ Saves time and improves accuracy
- ❖ GuideView is Multi-platform with consistent look-and-feel
 - ❖ Over the web on Windows and Macintosh clients running Internet Explorer
 - ❖ Stand-alone on Windows computers
 - ❖ On Windows Mobile PDAs (Pocket PCs)

GuideView User Interface

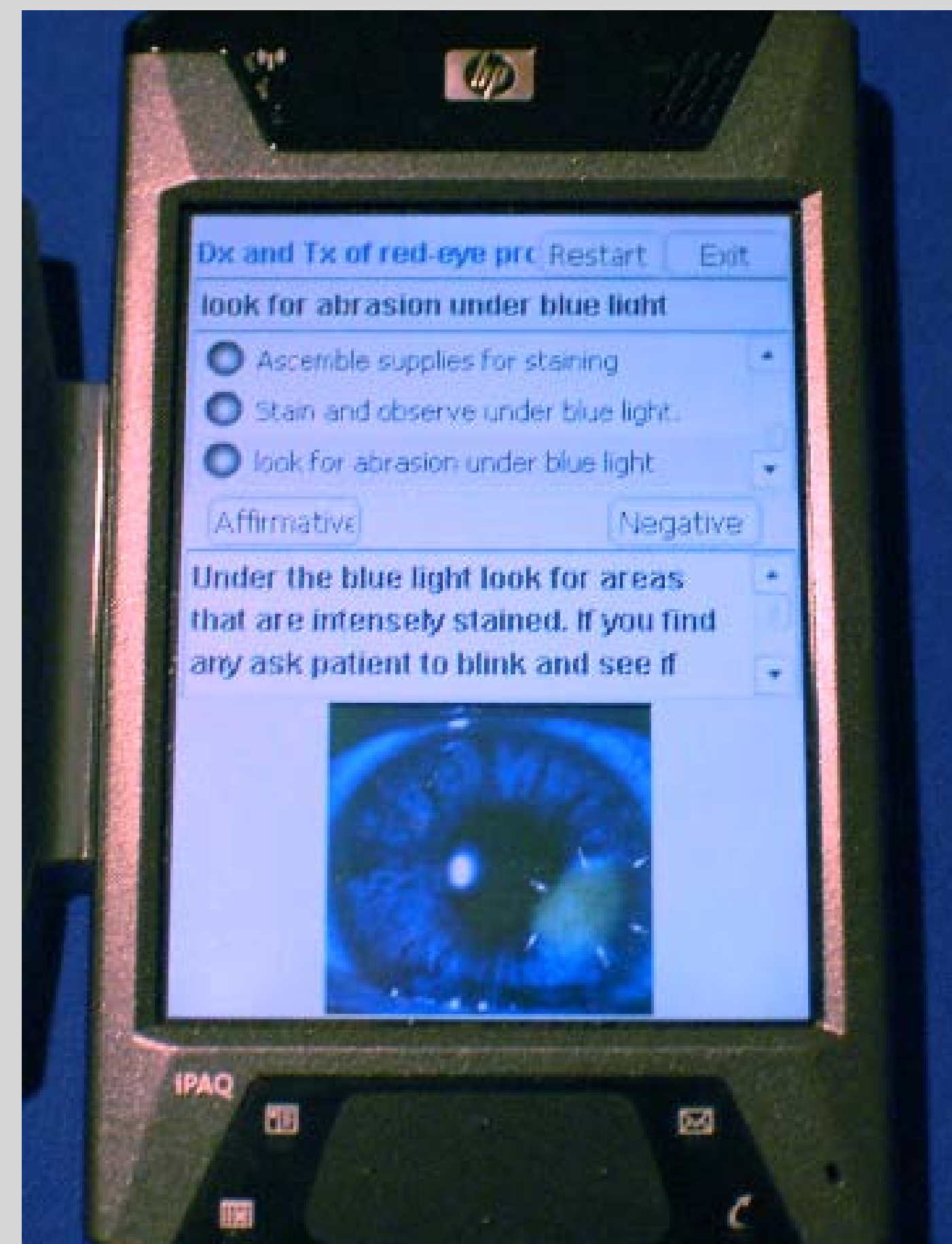
The screenshot shows a mobile device interface for 'Dx and Tx of red-eye problems'. It features a 'Restart' button, a list of procedure steps, and a 'History with active links' section. Below the list, there are 'Affirmative' and 'Negative' buttons, and a text instruction: 'Examine the lids, lashes, surface, white of eye, looking for foreign objects. Do you see anything?'. A video player at the bottom shows a close-up of an eye being examined with an ophthalmoscope. Labels point to 'Procedure Step', 'History with active links', 'Choices from this step', and 'Video Controls'.

GuideView Design Goals

- ❖ Reduce Complexity
 - ❖ Each process step is a simple task that can be completed even by those with minimal medical training
- ❖ Decrease Cognitive Load
 - ❖ At each step only a small (5 maximum) choices to next step
- ❖ Support backtracking
 - ❖ No choice is final: Can always return easily to a previous step and follow different path
- ❖ Enable repetition
 - ❖ Provides instructions for any step as often as desired
- ❖ Support modularity and re-usability of guidelines
 - ❖ Guidelines can be developed in small modules
 - ❖ Modules can be chained and nested as needed to create complex protocols
- ❖ Reinforce learning by providing multiple instructional modes
 - ❖ Each step is presented using multiple media, text, voice and visual aids
- ❖ Look-and-feel as similar as possible over multiple platforms
 - ❖ Achieved by using Flash technology from Macromedia
- ❖ Support mobility
 - ❖ GuideView may need to be used by mobile professionals, either within a space habitat or terrestrially
 - ❖ Separation of content and presentation
 - ❖ Content stored as XML

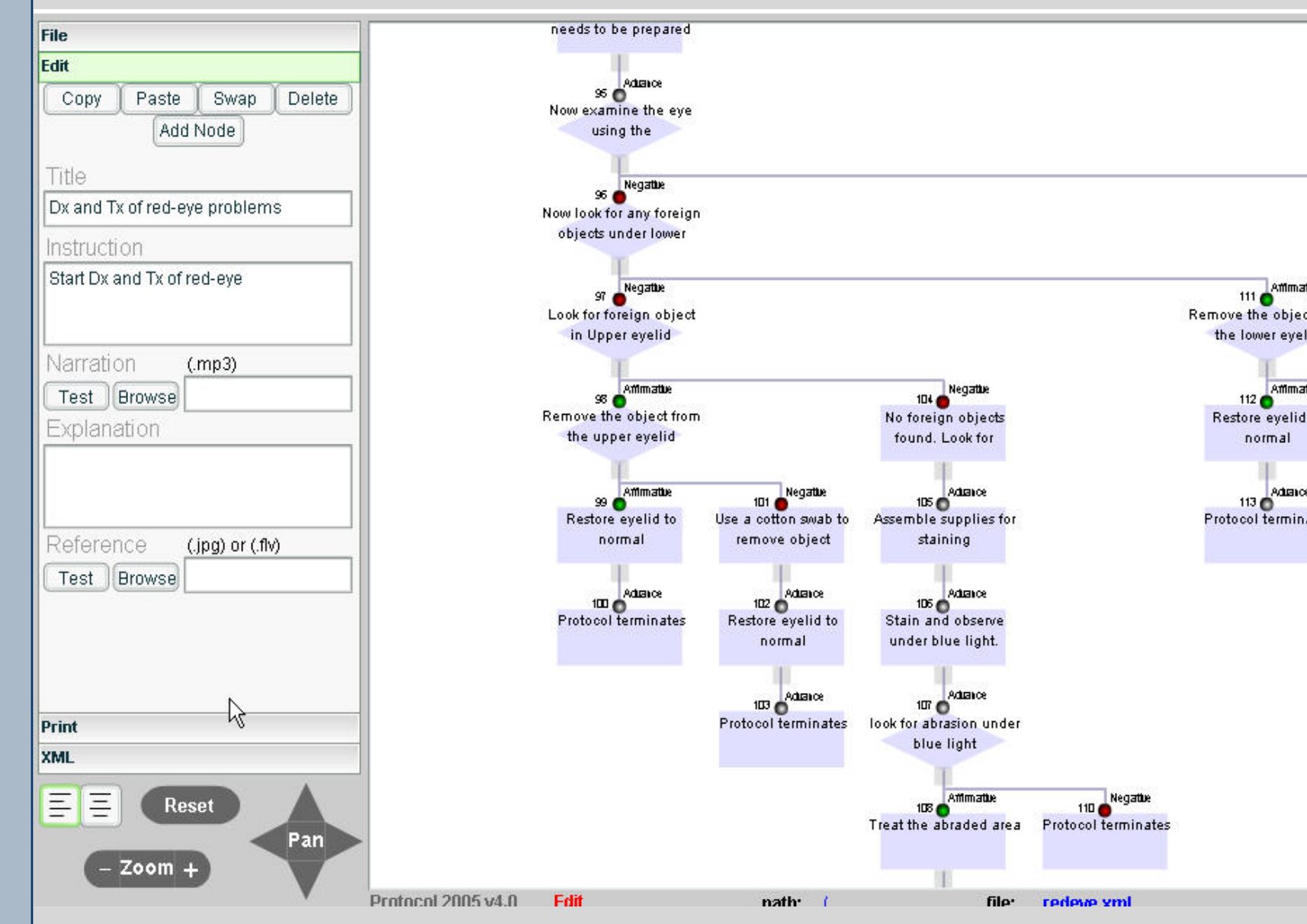
GuideView supports mobility

- ❖ User Interface identical to the desktop version
- ❖ Full-motion video and voice output available
- ❖ Weight and form-factor very desirable for mobile professionals and astronauts
- ❖ Voice navigation is being developed



GuideView Author

- ❖ Used to develop clinical guidelines and save them in a form capable of being played-back using GuideView
- ❖ Up to 5 branch points at each node
- ❖ Pan and zoom functions for navigating across complex, lengthy protocols
- ❖ Supports insertion of text, voice, pictures and video
- ❖ Content saved as XML
- ❖ Cross-platform capability
 - ❖ Can create GuideView-compatible protocols over the web
- ❖ A graphical editor for creating, editing, and updating GuideView process flows



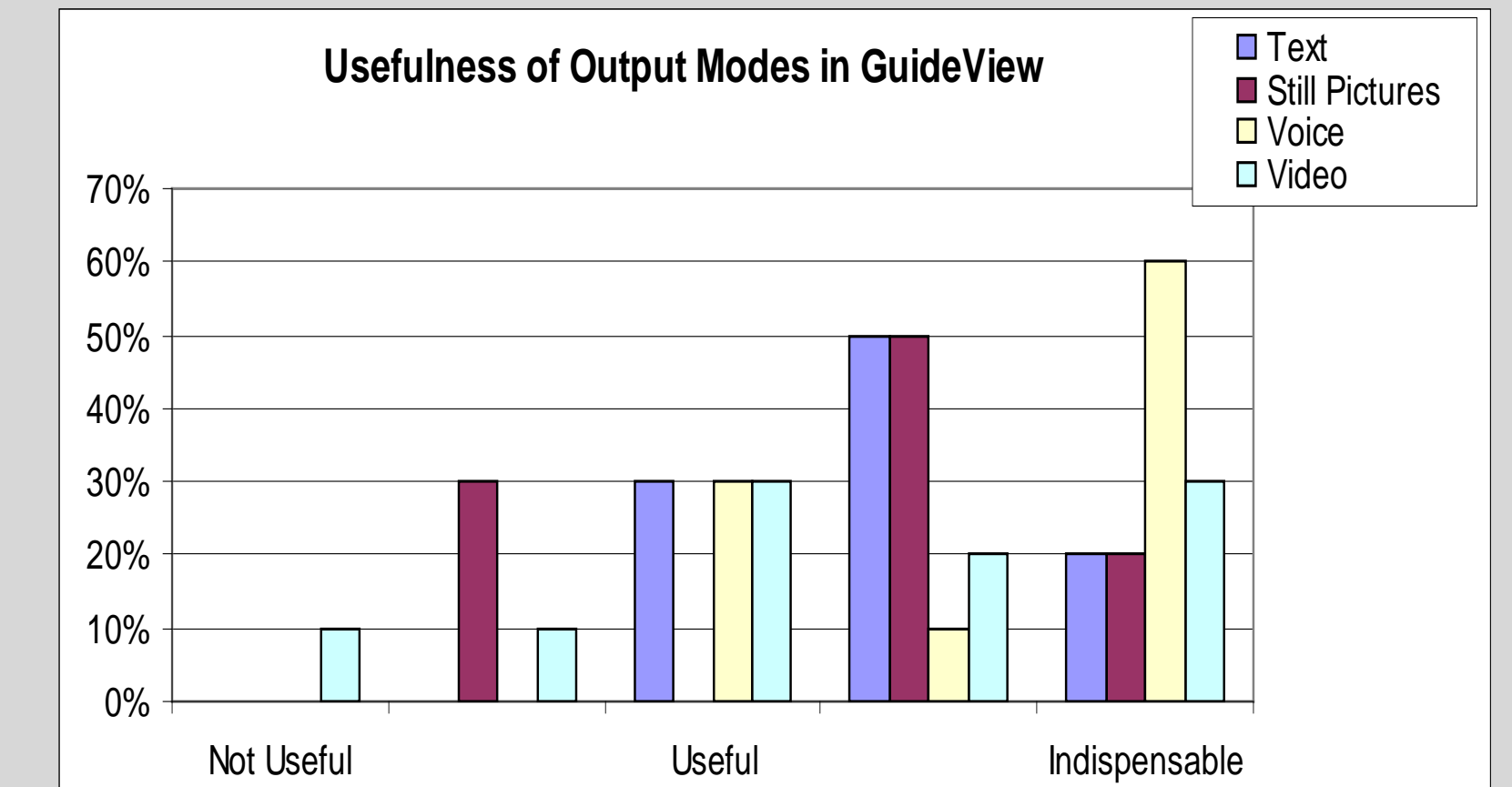
Two GuideView Procedures

- So far two GuideView procedures have been developed.
- ❖ **Ophthalmic:** Evaluation of redevy includes diagnosis and treatment of eye irritation:
 - ❖ Instructions for performing eye exam
 - ❖ Detection and removal of foreign body in eye
 - ❖ Detection and treatment of abrasions in eye
 - ❖ Diagnosis and treatment of bacterial and viral conjunctivitis
 - ❖ Foreign body in the eye is the most common medical problem in space travel. (J.Clark, MD, personal communication)
 - ❖ **Airway triage.** Diagnosis and treatment of acute breathing problems
 - ❖ Heimlich maneuver
 - ❖ Insertion of ILMA (Intubating Laryngeal Mask Airway)
 - ❖ Cricothorotomy
 - ❖ Assisted breathing using Ambu bag
 - ❖ Others

Usability Study

- ❖ A usability study¹ was performed at the Human Patient Simulation Laboratory, WYLE Life Sciences, Houston, TX
- ❖ Ten subjects used GuideView on a laptop to perform two procedures: Heimlich maneuver and insertion of ILMA
- ❖ A usability questionnaire and the NASA Task Load index² were administered immediately after completion

Results of Usability Study



- ❖ Voice instructions rated useful to indispensable by 100% of subjects
- ❖ Video also rated highly
- ❖ Task Load Index significantly higher ($p < 0.002$) with voice navigation than without
 - ❖ Reason: Microphone and recognition software were over-sensitive and interpreted external noises as commands

Future Work

- ❖ Interface GuideView with electronic health record systems
- ❖ Improve voice navigation
 - ❖ Add voice navigation to Windows Mobile version
- ❖ Add an expert mode for use by physicians
- ❖ Develop extensive module library with management and search features
- ❖ Enable connectivity with medical devices and sensors
- ❖ Explore engineering applications for GuideView technology

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- 1M Sriram Iyengar, S.Sarkar, et al. "GuideView: Structured Multimodal Delivery of Clinical Guidelines", Poster presented at AMIA 2005 Washington DC
- 2Hart S, Staveland L. Development of NASA TLX (Task Load Index). Human Mental Workload (Hancock, Meshkati Eds), pp 139-183. Elsevier 1988

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