HCI to HII (HCC): From Limen to Ligature

Workshop on Human-Centered Computing
National Science Foundation
September 7-8, 2006

Gary Marchionini
University of North Carolina at Chapel Hill
march@ils.unc.edu
Outline

• HCI evolving from a peripheral add on to the core of cyberinfrastructure
• Information and interaction focus
• Open Video case
Human-Centered Computing Evolution

• Field
  – From Appendages to CS and Psychology: CHI and HCI
  – To HCI as discipline (with specializations CSCW, UA, etc.)

• UMD/UNC Group
  – From HCI in hypertext and DLs ----HCIR
  – To Human Information Interaction

Cyberinfrastructure: Seamless Interaction with Information Tools and Resources
Open Video Case
open-video.org

• Theory: Video representation and human sense making embodied in Agileviews design framework

• Practice: Build and evaluate a video DL for research and education communities
  – Build: content, database, UI
  – Visual representations (surrogates): ss, sb, ff, ex
  – Evaluation paradigm
Open Video Vision

- An open repository of video *files* that can be re-used in a variety of ways by the education and research communities
  - A testbed for interactive interfaces
- An easy to use DL based upon the *agile views interface design framework*
  - Multiple, cascading, easy to control views (pre, over, re, shared, peripheral)
  - Views based upon empirically validated surrogates
  - An environment for building theory of human information interaction
- A set of methods and metrics that reveal how people understand digital video through surrogates
Background & Status

• Begun 1995 with colleagues at UMD & BCPS
• NSF Funding: IIS-0099538 1999-2003; IIS-0455970 (2005-6)
• Collaborators/Contributors/other funding: I2-DSI, ibiblio, CMU, UMD, NIST, LC, Internet Archive, NASA, ACM, Google, IBM
• ~4000 video segments
• ~30000 unique visitors per month (more during school year)
• ~1.5M hits/month
• MPEG-1, MPEG-2, MPEG-4, QT
• OAI provider
• PR: Yahoo, NYT, SLMQ; dozens of project papers
• Open source tools, Creative Commons licenses
• Ongoing user studies
• All SIGCHI videos as well as all UMD HCIL videos
Agile Views Interface Research

- Provide a variety of access representations (e.g., indexes) and control mechanisms
- Usual search and browse capabilities
- Leverage linguistic and non-linguistic cues
- Create and test visual surrogates for overview preview, shared and history views (current emphasis shifting to audio)
Digital Video Surrogates

• Classes
  – Textual
  – Visual (slide show, storyboard, fast forward, excepts)
  – Audio

• Cost benefit analysis: maximize ‘meaning’ per unit time
  – Transmission time
  – Compaction rate
  – Cognitive processing time

• Performance vs. Preference
Research Framework (Evolved)

GOALS
learning, work, entertainment

TIME
- time spent searching and viewing results

MENTAL LOAD
- perceptual load
- cognitive load

PHYSICAL LOAD
- amount of muscle movement

EFFORT

TASKS
- select video for viewing
- select scene for viewing
- copy and use scenes
- copy and use frames
- other tasks?

VIDEO CHARACTERISTICS
- genre: documentary, narrative
- topic: literal, figurative
- style: visual, audio, textual, place

SURROGATES, AGILE VIEWS
- display controls
- keywords
- storyboard w/ text, audio
- slide show w/ text, audio
- fast forward w/ audio
- poster frames

INDIVIDUAL CHARACTERISTICS
- domain experience
- video experience
- cultural experience
- computer experience
- info seeking experience
- metacognitive abilities
- demographics

PERFORMANCE
- retrieval (precision, recall)
- recognition (objects, action)
- gist comprehension (linguistic, visual)

SATISFACTION
- perceived usefulness
- perceived ease of use
- flow
- user satisfaction

OUTCOMES
- domain experience
- video experience
- cultural experience
- computer experience
- info seeking experience
- metacognitive abilities
- demographics

Gary Marchionini, UNC-CH
Quick Tour of More than a Dozen User Studies
Exploratory Study (1999)

• What are the strengths and weaknesses of different surrogates from the users’ perspective?
• Are any of the surrogates better than the others in supporting user performance?
The Surrogates

- Storyboard with text keywords (20-36 per board@ 500 ms)
- Storyboard with audio keywords
- Slide show with text keywords (250ms repeated once)
- Slide show with audio keywords
- Fast forward (~ 4X)
Method

- 7 video segments (2-10 min), 5 surrogates created for each
- 10 subjects with high video and computer experience
- Three phases (all multi-camera videotaped)
  - View full video then use 3 surrogates, repeat
    - Participant observation and debriefing
  - Do NOT view full video, use 3 surrogates, repeat
    - Participant observation and debriefing
  - Complete 3 assigned tasks with surrogates of choice
    - Think aloud and debriefing
Tasks

• Gist determination—free text
• Gist determination—multiple choice
• Object recognition—textual
• Object recognition—graphical
• Action recognition (2-3 second clips)
• Visual gist—’vist’ (predict which frames belong)
Fast Forward Study

• How fast can we make fast forwards?
  – 4 ff conditions (32X, 64X, 128X, 256X)
  – Four video segments for each condition
  – 45 subjects (1/2 UG, 1/2 grad, 2/3 female)
  – 6 tasks (full text gist, multiple choice gist, word object recognition, graphical object recognition, action recognition, visual gist)
  – Counterbalance speed and videos
  – Web-driven experimental condition, 3-camera video tapes, single subject at a time in usability laboratory
Speed Effects on Performance

- Visual gist at 32 is better than at other speeds.
- Gist comprehension (ft) at 32 and 64 is better than at 128 and 256.
- Object recognition (g) at 32 and 64 is better than at 256.
- Action recognition at 32 is better than at 128 or 256.
Text or Pictures?

• Research Questions:
  – Given both textual and visual metadata; which surrogate will be utilized, which surrogate will be preferred?
  – Does the placement of the surrogates affect how they are used?
  – Does the assigned task affect how surrogates are used?
  – Does personal preference play a role in how surrogates are used?

• Eye-tracking Study
Narrativity Study (CHI 02)

- CHI walk up kiosk, 20 people used
- 20 one-minute clips (half b&w, no audio) selected on 2 criteria: contain characters, have cause/effect relations between scenes (5 in each category)
- SRD on chars, cause, and interaction
- (ASIST 03 paper)
Shared Views and History Views Studies (02-03, Geisler dissertation)

- Evaluate AV Design Framework by instantiating and evaluating a design
- Shared (based on recommendations) and History Views (based on logs)
- Phase 1: compare OV to Views interface (28 participants). OV>accuracy; NSRD on time, but learning effect; AV>navigation/efficiency; AV>satisfaction
- Phase 2: qualitative analysis of shared and history views
VisOR study (Fall 03)

- Interface effects of automatically extracted features (TREC 02 features); 17 subjects each doing 14 search tasks
- Sliders to adjust weights of different features did not affect performance
- Keywords, indoors/outdoors and cityscape/landscape most useful
- Use of color and brightness helped with exact match searches
- General satisfaction with using different features
- (Gruss Master’s paper, 2004)
Look vs Read Study (Sp 03)

• Twelve subjects think aloud while viewing results pages for five search tasks with text (titles, descriptions) or visual (3 keyframes, storyboard) surrogates
• Surrogates used differently depending on task; neither primary with considerable switching and combining (e.g., find airplane, most used visual first)
• Time a factor in deciding which to use and when
• (Hughes Master’s Paper, 2004)
TREC 03 Study

• Compare transcript only, feature only, and combined surrogates with 36 subjects
• NSRD in precision across 3 surrogates, transcript only and combined yielded SR higher recall in less time and SR greater satisfaction results.

( TREC notebook; ACM MM 04)
Video Relevance Judgments

• How do people make relevance judgments for video? Qualitative study (Yang dissertation; CHI 05; ASIST 04)
  – 3 groups
    • Video editors/producers
    • Video librarians
    • Video users (professors)

• 9 visual gist attributes
• Differences across users
Other Studies

• Relative value of surrogates in context
  – Four sets of surrogates (ff, sb, excerpt, combined) compared (in analysis)

• Mu dissertation: cognitive load effects on collaborative learning with video (ISEE)
  Investigation of tasks

• TREC 05 study
Take Away Summary

• User studies inform good design
• Give people multiple views and easy control mechanisms
• No silver bullets (many factors determine performance and preference); people make context-dependent tradeoff decisions
• Video offers new kinds of potentials for learning and communication; do not ignore audio channel semantic richness
• Good user interfaces get used
Next Steps for OV?

• Long-term
  – How do people make sense of video?
  – How does video get integrated into interpersonal communication (mobile)?
  – OV production system sustainability and preservation?

• 2006-2009
  – Video use by teachers (Ron Brown, NASA fellowship)
  – Spanish language videos and finding aids
  – New surrogates (e.g., audio, IBM Faculty Research Award)
  – Workflow management (Gary Geisler, IMLS grant)
  – Mobile device delivery
  – Next generation agile interface
  – Curator’s preservation decision template (NDIIPP grant)
HCC--HII

- Our work is no longer add on but central to human adoption
- We can adapt our lessons and techniques to other problems, (e.g., statistical data, personal health records at UNC)
- Our students are highly recruited
- How do we define research agenda that assumes HCC as central (ligament) rather than add on (limen)?