User Interface Issues for DICOM Presentation States

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• Added in 1999 as supplement 33
• Major departure for DICOM moving from data content and transmission into display
• Closely related to (but independent of) Supplement 28/Part 14 (Grayscale Standard Display Function)
• GSPS objects may be created at any time after imaging by any equipment
• GSPS are independent of the original image(s) and do NOT require modifications to the original image(s)
• Handled exactly like other instance objects
  • C-STORE, G-FIND, C-MOVE etc.
  • Easy for existing SCPs to handle
• No specific GSPS support in the Q/R model
Items controlled by GSPS

- All LUTs/transformations
  - Modality
  - VOI
  - Presentation
- Displayed Area & Shuttering
- Rotation & Flipping
- Mask Subtraction
- Independent Annotations
  - Text & graphics
  - Both image & display relative
- Activation of overlays in the image, or in the GSPS object
Place of GSPS objects in the DICOM Model

- Strictly part of one study
- Only refer to image(s) in that study
- In their own series
- May be stored on off-line media etc.
- Generally, they may be treated just like any other composite object
• One “manifest” (Referenced Series Sequence) sequence defines a list of images to which this PS object relates
• Huge choice of granularity
  • All series in a study
  • One or more specific series
  • One or more specific images
  • One of more specific frames within an image
  • Any combination of the above!
“Top level” Items
No reference to series / images

- Masking
- Shuttering (geometric & overlay)
- Spatial Transformation (Rotate & Flip)
- Modality LUT/rescale
- Presentation LUT
- Overlay Activation
“Image specific” Items
With Reference Image Sequence

- Displayed Area
- Annotations - graphic & Text
- VOI LUT/Windowing
How PS objects may be created

- Automatically by the modality
  - As default or reflection of radiographer choices
  - As part of PGP
- Explicitly by users
  - As part of reporting
  - For conferences etc.
  - For teaching
  - etc.
Other information in a GSPS object

- Presentation Label
  - type 1 but no coding
- Presentation Description
  - type 2
- Creation Data & Time
- Presentation Creator’s Name
  - type 2
Key Object Note Support

- KON (and SR) objects can specify the relationship between images and GSPS objects.
- Achieved using the “Referenced SOP Sequence” element (0008,1199) element in the Image Reference Macro.
  - This is specialised to allow only a single entry, and to specify a GSPS object only.
Clinical Scenarios:
(in a GSPS-capable viewer)

- User has queried for and retrieved image instances directly
  - The PACS has PS objects for that study
  - Possibly many for the same image with different scope
- User selects and retrieves GSPS object
- User selects and retrieves KON object
GSPS Deficiencies, Ambiguities & Problems:

- No C-FIND method to find GSPS objects for a given instance
- So need to retrieve every PS object in the study to inspect them internally
- What should the viewer do if > 1 possible GSPS for an image?
- There is no predefined coding (like there is in KON) to indicate “intent” of the GSPS object
- How to handle overlapping GSPS
Overlapping GSPS Objects
• User retrieves a KON (or SR) with GSPS references
  • All is well-defined and unambiguous
• User retrieves a PS and associated images
  • e.g. IHE presentation of grouped procedures (PGP)
  • semantically suspect but technically OK
Summary of GSPS Issues

- There is no clearly defined mechanism to indicate which GSPS object should be used as the default for which image.
- There is even a lack of supporting data (such as the document title used in KON – CID 7010) to assist choice algorithms.
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Dave Corrie
SOP Class Support

- Greyscale Softcopy Presentation State
- Colour Softcopy Presentation State
- Pseudo-Colour Softcopy Presentation State
  - Record application of false colour LUT to greyscale images

- Private Attributes
  - Convolution Filters (edge enhancement etc.)
  - ROI stats
Creation Granularity

- Presentation state created for series
- Multiple states used to record “conceptual” state of one series
- “Streamlined” method to create presentation states for study
• Automatic application of “best” presentation state
• Apply to series
  – Coalescence of “similar” states to form single conceptual state
• Apply to image
Metadata

• Prompt for metadata on creation
  – Content Label (pick list)
  – Description

• Creator name and date/time

• Used to choose “best” initial state
Auto-loading

- Load presentation state + referenced images
- Load study/series/images + relevant presentation states
- Applies to Query/Retrieve and DICOMDIR sources
Loose Ends

- Font selection
- Curve algorithms (for INTERPOLATED graphic annotation)
- Representation of existing graphic annotations
  - Angle measurements
Questions/Comments?

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