DICOM Correction Item

Correction Number CP- 994	
Log Summary: Clarify Per-Frame Functional Groups	
Type of Modification Modification	Name of Standard PS 3.3-2009

Rationale for Correction:

Re-ballot of CP-994 due to substantial changes. The Shared Functional Group is included in the description and the text moved to Section C.7.6.16.1.1.

In the Multi-Frame Functional Groups Module, the Per-Frame Functional Groups Sequence (5200,9230) includes the requirement "Each Item shall contain the same set of Functional Group Macros". This implies that if a Functional Group is included in one item, it must be provided in all items. However, this conflicts with some other requirements in Part 3.

Conditional inclusion: In several IODs, inclusion of the Derivation Image Functional Group is conditional on a *frame* characteristic: “C - Required if the image or frame has been derived from another SOP Instance”. As there is no “May be present otherwise”, this implies that the Functional Group is present for only those frames that are derived, and not present in the Per-Frame Functional Groups Sequence Items of original (non-derived) frames. This could be resolved by making the condition “Required if ~~the image or~~ any frame has been derived from another SOP Instance”; since the Derivation Image Macro is headed by the Type 2 Derivation Image Sequence, it can be included in non-derived frames as an empty sequence.

User optional inclusion: Many Functional Groups are specified with usage “U”, in many cases presumably because the Functional Group may be applicable only to a particular subrange of frames. However, these Macros are often headed by a Type 1 sequence attribute with subsidiary Type 1 attributes in its Item specification. For instance, the Real World Mapping Functional Group might only be applicable to certain frames, but Real World Value Mapping Sequence (0040,9096) is Type 1, and its Items have Type 1 attributes, making it impossible to include this Macro on non-applicable frames.

Conditional attributes: The Frame Measures, Plane Position, and Plane Orientation Macros are mandatory in many IODs, and these Macros are headed by Type 1 sequence attributes. However, they are composed of subsidiary Type 1C attributes in their Item specifications, and it is possible that some frames will meet *none* of those attribute conditions, especially for frames that have Volumetric Properties (0008,9206) value of DISTORTED. These Macros must be present in every Per-Frame Item, but their sequence attributes may have no condition-matching subsidiary attributes, but as Type 1 they cannot be empty!

There may me other cases found by a comprehensive review of the Functional Groups. (We have not done an exhaustive review, only identified some classes of issues.)

Solution: If in the Per-Frame Functional Groups Sequence (5200,9230) it is allowed to skip those functional groups that have no attributes values the above mentioned cases are addressed. Each Functional Group inside an item per frame has its own SQ attribute identifying the particular functional group. By parsing each individual item a missing or added functional group can be identified.

Sections of documents affected

PS 3.3 Annex C .7.6.16

Correction Wording:

C.7.6.16 Multi-frame Functional Groups Module

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Table C.7.6.16-1
MULTI-FRAME FUNCTIONAL GROUPS MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Shared Functional Groups Sequence	(5200,9229)	2	Sequence that contains the Functional Group Macros that are shared for all frames in this SOP Instance and Concatenation. Note: The contents of this sequence are the same in all SOP Instances that comprise a Concatenation. Zero or one Item may be included in this sequence. See section C.7.6.16.1.1 for further explanation.
>Include one or more Functional Group Macros that are shared by all frames. The selected Functional Group Macros shall not be present in the Per-frame Functional Groups Sequence (5200,9230).			~~**See section C.7.6.16.1.1 for further explanation.**~~ For each IOD that includes this module, a table is defined in which the permitted Functional Group Macros and their usage is specified.
Per-frame Functional Groups Sequence	(5200,9230)	1	Sequence that contains the Functional Group ~~**Macros**~~**Sequence Attributes** corresponding to each frame of the Multi-frame Image. The first Item corresponds with the first frame, and so on. ~~**Each Item shall contain the same set of Functional Group Macros.**~~ This Sequence shall contain the same number of Items as the number of frames in the Multi-frame image. See Section C.7.6.16.1.2 for further explanation.
>Include one or more Functional Group Macros.			For each IOD that includes this module, a table is defined in which the permitted Functional Group Macros and their usage is specified.
…			

C.7.6.16.1 Multi-frame Functional Groups Module Attribute Description

C.7.6.16.1.1 Functional Group

A Functional Group is a set of Attributes that are logically related and may vary together. Functional Groups are defined in Macros. Those Functional Group Macros that apply to all frames are included in the Shared Functional Groups Sequence (5200,9229). Functional Group Macros whose attribute values may vary from frame to frame are included in the Per-frame Functional Groups Sequence (5200,9230).

A single Functional Group Macro shall not be included in both the Shared Functional Groups Sequence (5200,9229) and the Per-frame Functional Groups Sequence (5200,9230).

Notes: 1. In the case of a SOP Instance containing a single frame, some Functional Group Macros may be contained in the Shared Functional Groups Sequence (5200,9229) and others in the one Item of the Per-frame Functional Groups Sequence (5200,9230).

2. Even if there are no Functional Group Macros in the Per-frame Functional Groups Sequence 5200,9230) an empty Item is encoded for every frame.

~~**3. It may happen that a mandatory Functional Group Macro Item containing no values is required in either the Shared Functional Groups Sequence (5200,9229) or the Per-frame Functional Groups Sequence (5200,9230). In that case the Functional Group Macro is encoded as an empty Sequence (i.e. a sequence of zero length or a sequence with undefined length with only an end of sequence delimiter; see PS 3.5)**~~.

It may happen that a Functional Group Sequence does not contain any value (e.g., a condition for a single Type 1C attribute in the sequence is not met) or is not required for a particular frame (e.g., an optional Functional Group). In this case the Functional Group Sequence is not included in the Shared Functional Groups Sequence (5200,9229) or the Per-frame Functional Groups Sequence (5200,9230) for a particular frame.

Note: The absence of the sequence attribute corresponding to a particular functional group macro indicates that the functional group is not used for a particular frame.