

H-Anim Facial Animation

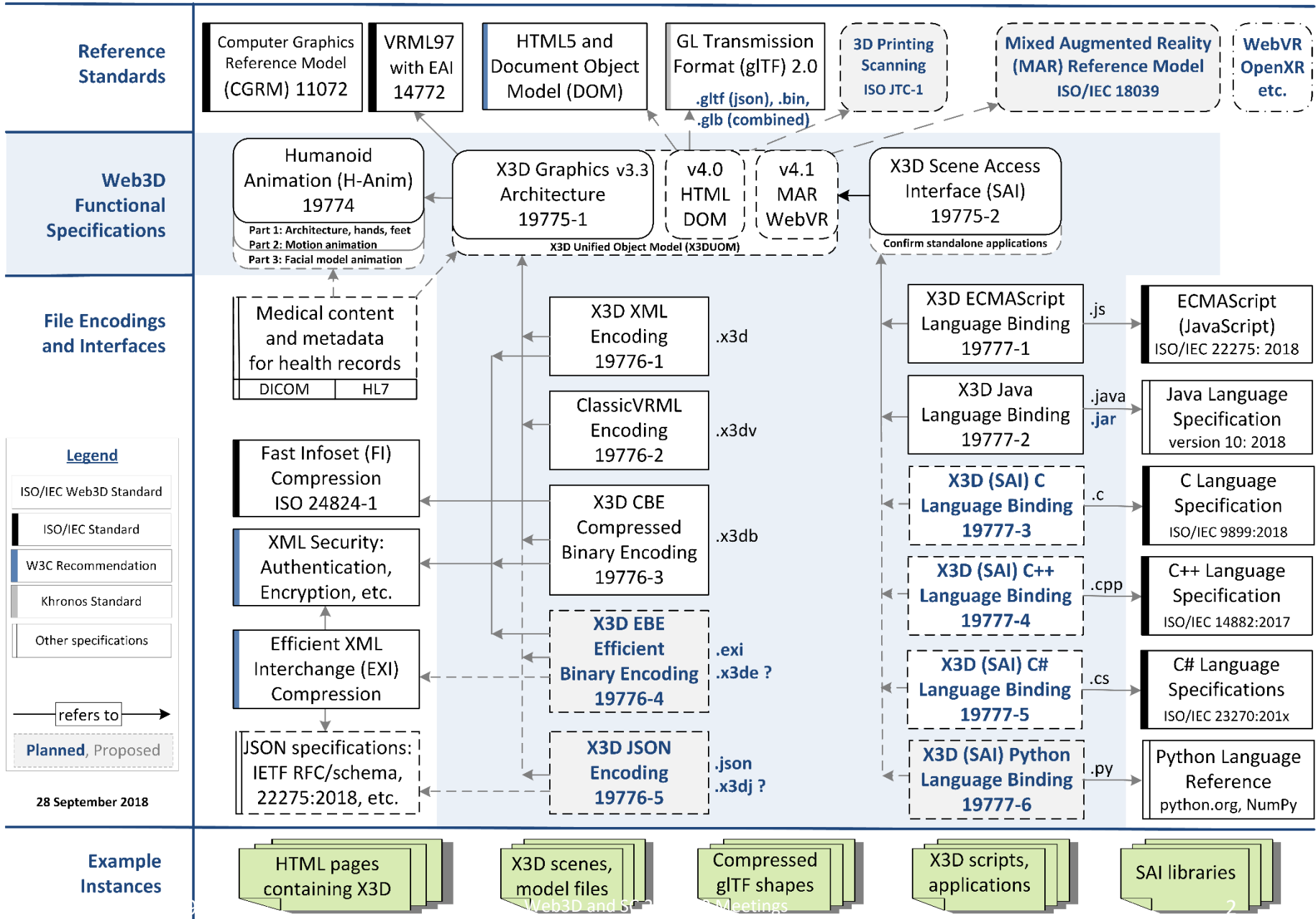
Web3D and ISO/IEC JTC 1/SC 24 WG 9 Meetings

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X3D Graphics Standards: Specification Relationships



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 - Nominal human face dimensions and levels of expression (LOE)
 - Facial feature points for the humanoid face
- Feature points는 LoE3에 맞출 예정, 필요한 만큼 선택해서 사용하는 방식
- Region과 FP 사이의 포함관계는 없음
- <It follows ISO/IEC DIS 19774-1:201x>

1. Scope

❖ To represent a humanoid face and its animation

2. Normative references

- ❖ ISO/IEC (DIS) 19774-1:201x
- ❖ ISO/IEC (DIS) 19774-2:201x

3. Terms and Conditions

❖ Humanoid face (face)

- (Fore-headed) surface that covers a humanoid skull
- Humanoid face is usually represented by one-single skinned mesh and also a collection of face regions

❖ Face region

- A part of a humanoid face
- Usually consists of boundary and internal vertices
- Each region has zero or more marker vertices

❖ Facial feature points

- Extended surface features of feature points as in ISO/IEC DIS 19774-1:201x on a humanoid face

❖ Levels of Expression

- Degree of facial expression fidelity based on the number of regions

4.1 H-Anim facial figures

- ❖ H-Anim facial figures are the 3D deformable representation that depict humanoid facial animation
- ❖ Humanoid face object describes the H-Anim facial figures
 - Skinned mesh of humanoid face is defined as skin and its skin[Binding](Coords|Normals) in Humanoid object as in 19774-1
 - Humanoid face object refers to the vertices by indexing as likely as skin in 19774-1
 - Humanoid face object defines a sequence of regions
 - Humanoid face object manipulates skinCoords and skinNormals indirectly by regions in order to change the shape of humanoid face

4.2 Humanoid face object

- ❖ [4.2.1 Regions] Humanoid face object defines a sequence of regions, each of which is defined by
 - Boundary: a sequence of vertices that forms a simple loop and can be shared by multiple regions
 - Internal: a set of vertices bounded by the boundary of a region
 - Marker: zero or more vertices within a region
- ❖ [4.2.2 Facial feature points] Facial feature points are the extended surface features of feature points in 19774-1:201x on a humanoid face
 - Each feature point is located on a single region, but not vice versa.
 - One single region has zero or more marker vertices.
 - Therefore, facial feature points are the subset of marker vertices.
 - Levels of expression define typical hierarchical structures of the facial feature points that are identical to the marker vertices

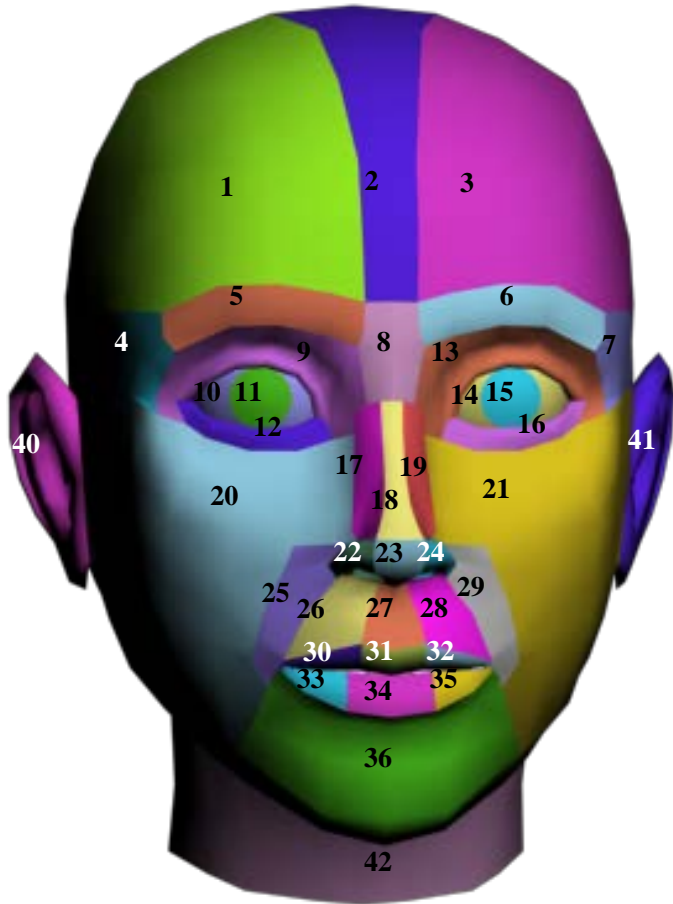
4.3 Modeling of humanoid face

❖ [4.3.1 Levels of expression] Levels of expression define the complexity and simplicity of facial expression based on the number of regions for humanoid face structure and its animation details.

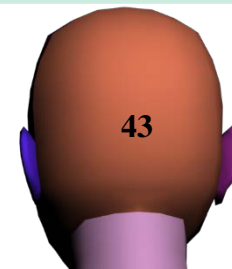
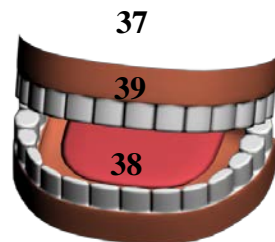
- There are three levels of expression.
- The higher LOE, the more regions and details.

4.3 Modeling of humanoid face

❖ [4.3.2] LOE-1

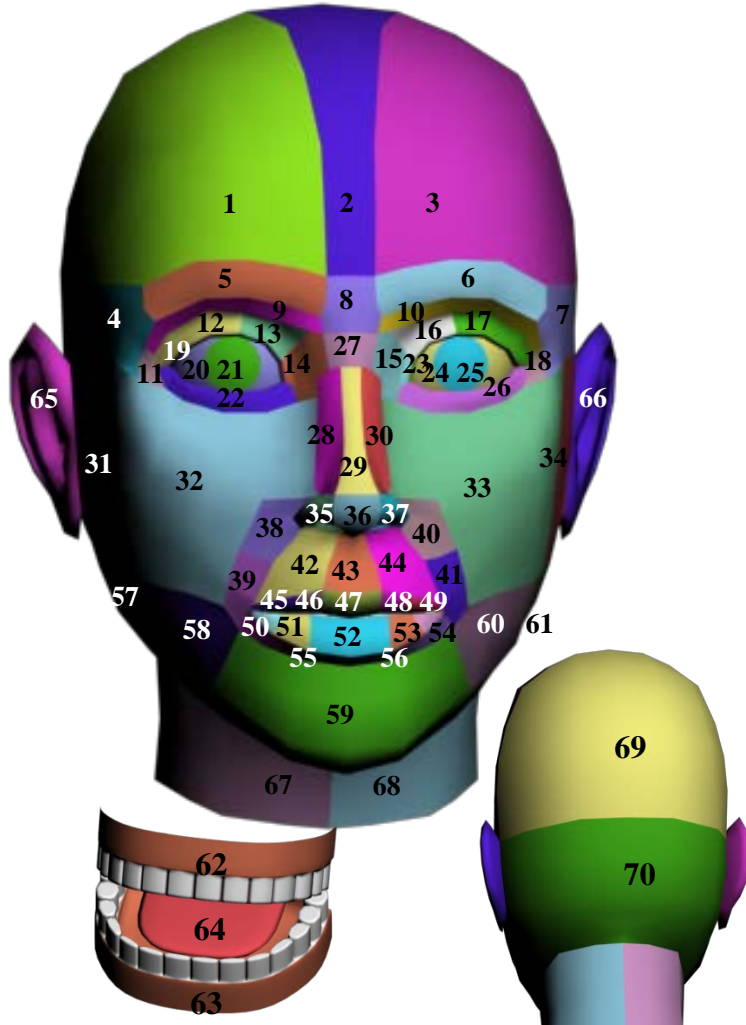


Right face	Middle face	Left face
Right forehead(1)	Mid Forehead(2)	Left forehead(3)
Right Temple(4)		Left Temple(7)
Right eyebrow(5)	Glabella(8)	Left eyebrow(6)
Right Upper Eyelid(9) Right Bulbar Conjunctiva(10) Right Pupil(11) Right Lower Eyelid(12)		Left Upper Eyelid(13) Left Bulbar Conjunctiva(14) Left Pupi(15) Left Lower Eyelid(16)
Right Dorsum(17)	Mid Nasal Dorsum(18)	Left Dorsum(19)
Right Cheek(20)		Left Cheek(21)
Right Nostril(22)	Nasal tip(23)	Left Nostril(24)
Right Nasolabial Cheek(25)		Left Nasolabial Cheek(29)
Right Upper Cutaneous Lip(26)	Philtrum(27)	Left Upper Cutaneous Lip(28)
Right upper vermillion lip(30)	Mid Upper Vermillion Lip(31)	Left upper vermillion lip(32)
Right lower vermillion lip(33)	Center lower vermillion lip(34)	Left lower vermillion lip(35)
	Chin(36)	
upper teeth(37)	Tongue(39)	lower teeth(38)
Right Ear(40)		Left Ear(41)
	Neck(42) Occipital Scalp(43)	



4.3 Modeling of humanoid face

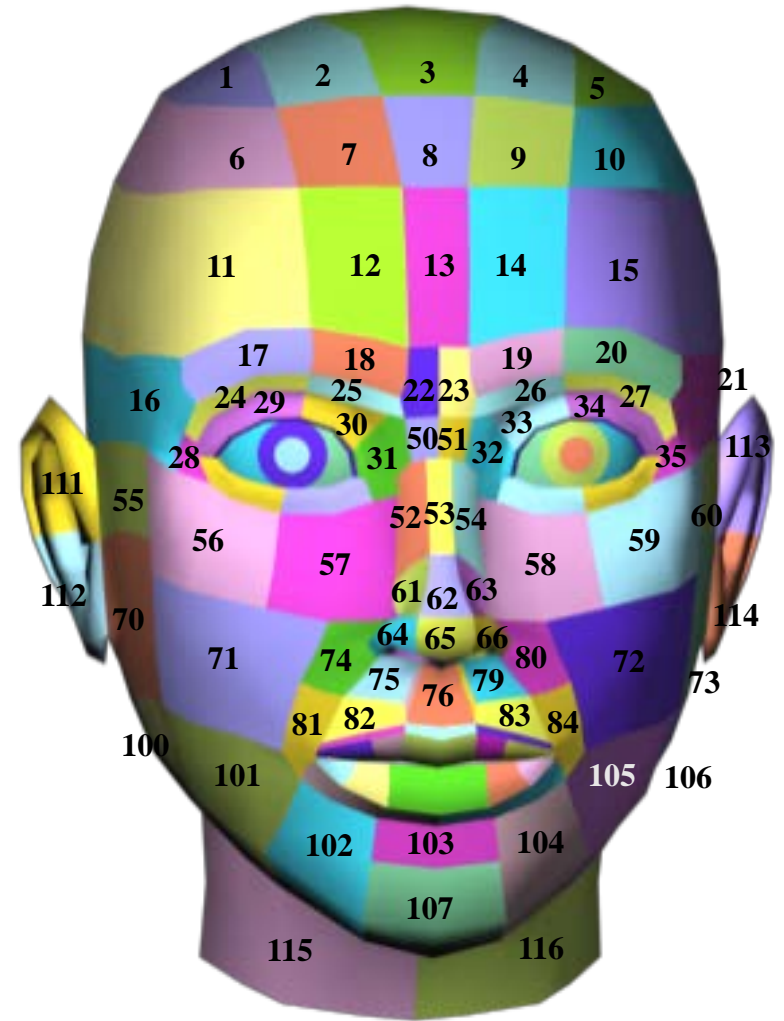
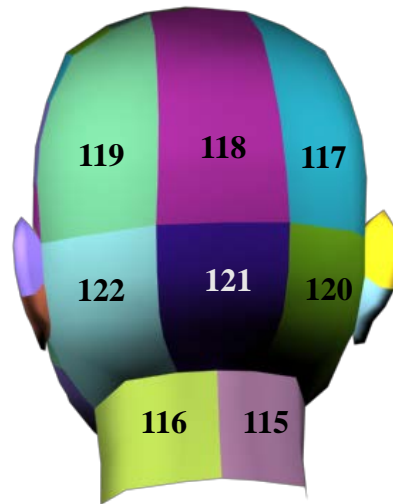
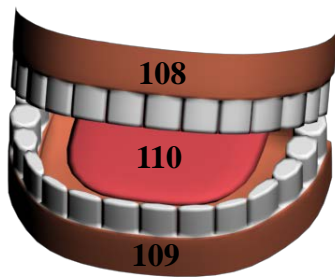
❖ [4.3.3] LOE-2



Right face	Middle face	Left face
Right forehead(1)	Mid Forehead(2)	Left forehead(3)
Right Temple(4)		Left Temple(7)
Right eyebrow(5)	Glabella(8)	Left eyebrow(6)
Right Superior Upper Eyelid(9)		Left Superior Upper Eyelid(10)
Right Lateral Canthus(11) Right Inferior Lateral Upper Eyelid(12) Right Inferior Medial Upper Eyelid(13) Right Medial Canthus(14)		Left Medial Canthus(15) Left Inferior Medial Upper Eyelid(16) Left Inferior Lateral Upper Eyelid(17) Left Lateral Canthus(18)
Right Upper Eyelid(19) Right Bulbar Conjunctiva(20) Right Pupil(21) Right Lower Eyelid(22)		Left Upper Eyelid(23) Left Bulbar Conjunctiva(24) Left Pupil(25) Left Lower Eyelid(26)
	Nasal Root(27)	
Right Dorsum(28)	Mid Nasal Dorsum(29)	Left Dorsum(30)
Right Pre-Auricular Cheek(31) Right Cheek(32)		Left Cheek(33) Left Pre-Auricular Cheek(34)
Right Nostril(35)	Nasal tip(36)	Left Nostril(37)
Right Superior Nasolabial Cheek(38) Right Nasolabial Cheek(39)		Left Superior Nasolabial Cheek(40) Left Nasolabial Cheek(41)
Right Upper Cutaneous Lip(42)	Philtrum(43)	Left Upper Cutaneous Lip(44)
Far Right upper vermillion lip(45) Right upper vermillion lip(46)	Mid Upper Vermillion Lip(47)	Left upper vermillion lip(48) Far left upper vermillion lip(49)
Right lower oral commissure(50) Right lower vermillion lip(51)	Center lower vermillion lip(52)	Left lower vermillion lip(53) Left lower oral commissure(54)
Right Lower Cutaneous Lip(55)		Left Lower Cutaneous Lip(56)
Right Cheek near Angle of Jaw(57) Right Inferior Lower Cheek(58)	Chin(59)	Left Inferior Lower Cheek(60) Left Cheek near Angle of Jaw(61)
upper teeth(62)	Tongue(64)	lower teeth(63)
Right Ear(65)		Left Ear(66)
Right Neck(67)		Left Neck(68)
	Superior Occipital Scalp(69) Inferior Occipital Scalp(70)	

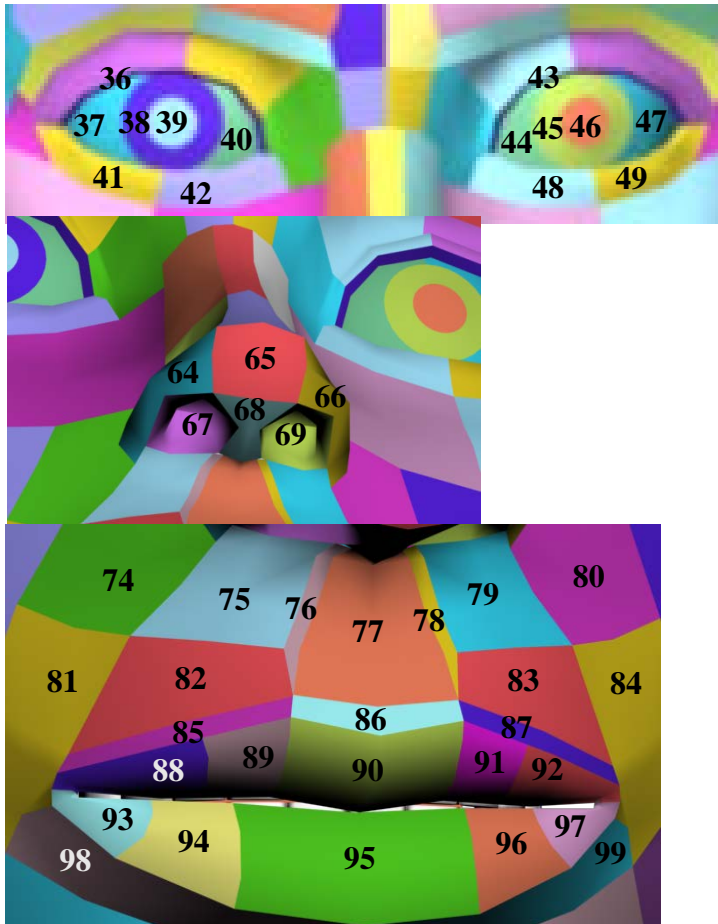
4.3 Modeling of humanoid face

❖ [4.3.4 LOE-3]



4.3 Modeling of humanoid face

❖ [4.3.4 LOE-3]



Right face	Middle face	Left face
Right Lateral Frontal Scalp(1) Right Medial Frontal Scalp(2)	Mid Frontal Scalp(3)	Left Medial Frontal Scalp(4) Left Lateral Frontal Scalp(5)
Right Lateral Upper Forehead(6) Right Medial Upper Forehead(7)	Mid Upper Forehead(8)	Left Medial Upper Forehead(9) Left Lateral Upper Forehead(10)
Right Lateral Lower Forehead(11) Right Medial Lower Forehead(12)	Mid Frontal Scalp(13)	Left Medial Lower Forehead(14) Left Lateral Lower Forehead(15)
Right Temple(16)		Left Temple(21)
Right Lateral Eyebrow(17) Right Medial Eyebrow(18)		Left Medial Eyebrow(19) Left Lateral Eyebrow(20)
Right Glabella(22)		Left Glabella(23)
Right Superior Lateral Upper Eyelid(24) Right Superior Medial Upper Eyelid(25)		Left Superior Medial Upper Eyelid(26) Left Superior Lateral Upper Eyelid(27)
Right Lateral Canthus(28) Right Inferior Lateral Upper Eyelid(29) Right Inferior Medial Upper Eyelid(30) Right Medial Canthus(31)		Left Medial Canthus(32) Left Inferior Medial Upper Eyelid(33) Left Inferior Lateral Upper Eyelid(34) Left Lateral Canthus(35)
Right Upper Eyelid(36) Right Lateral Bulbar Conjunctiva(37) Right Iris(38) Right Pupil(39) Right Medial Bulbar Conjunctiva(40) Right Lateral Lower Eyelid(41) Right Medial Lower Eyelid(42)		Left Upper Eyelid(43) Left Medial Bulbar Conjunctiva(44) Left Iris(45) Left Pupil(46) Left Lateral Bulbar Conjunctiva(47) Left Medial Lower Eyelid(48) Left Lateral Lower Eyelid(49)
Right Nasal Root(50) Right Superior Nasal Dorsum(52)	Mid Nasal Dorsum(53)	Left Nasal Root(51) Left Superior Nasal Dorsum(54)
Right Superior Pre-Auricular Cheek(55) Right Malar Cheek(56) Right Supramedial Cheek(57)		Left Supramedial Cheek(58) Left Malar Cheek(59) Left Superior Pre-Auricular Cheek(60)
Right Inferior Nasal Dorsum(61) Right Nasal Ala(64) Right Nostril(67)	Inferior Nasal Dorsum(62) Nasal Tip(65) Inferior Nasal Tip(68)	Left Inferior Nasal Dorsum(63) Left Nasal Ala(66) Left Nostril(69)
Right Inferior Pre-Auricular Cheek(70) Right Medial Mid Cheek(71)		Left Medial Mid Cheek(72) Left Inferior Pre-Auricular Cheek(73)
Right Superior Nasolabial Cheek(74) Right Infranasal Upper Cutaneous Lip(75) Right Philtral Column(76)	Philtrum(77)	Left Philtral Column(78) Left Infranasal Upper Cutaneous Lip(79) Left Superior Nasolabial Cheek(80)
Right Inferior Nasolabial Cheek(81) Right Upper Cutaneous Lip(82)		Left Upper Cutaneous Lip(83) Left Inferior Nasolabial Cheek(84)
Right Vermillion Border of Upper Lip(85)	Cupid's Bow at Vermillion Border of Upper Lip(86)	Left Vermillion Border of Upper Lip(87)
Far right upper vermilion lip(88) Right upper vermilion lip(89)	Mid Upper Vermillion Lip(90)	Left upper vermilion lip(91) Far left upper vermilion lip(92)
Right lower oral commissure(93) Right lower vermilion lip(94)	Center lower vermilion lip(95)	Left lower vermilion lip(96) Left lower oral commissure(97)
Right Lower Cutaneous Lip(98)		Left Lower Cutaneous Lip(99)
Right Cheek near Angle of Jaw(100) Right Inferior Lower Cheek(101) Right Chin(102)	Median Chin near Mental Crease(103) Mid Chin(107)	Left Chin(104) Left Inferior Lower Cheek(105) Left Cheek near Angle of Jaw(106)
upper teeth(108)	Tongue(110)	lower teeth(109)
Right Superior Ear(111) Right Inferior Ear(112)		Left Superior Ear(113) Left Inferior Ear(114)
Right Neck(115)		Left Neck(116)
Right Superior Occipital Scalp(117) Right Inferior Occipital Scalp(120)	Midline Superior Occipital Scalp(118) Midline Inferior Occipital Scalp(121)	Left Superior Occipital Scalp(119) Left Inferior Occipital Scalp(122)

4.4 Animation of humanoid face

❖ [4.4.1 Keyframe animation]

- Using interpolator node

❖ [4.4.2 Facial motion capture]

- Using motion node

❖ [4.4.3 Algorithmic animation]

5. Abstract data types



6. Object interfaces

❖ [6.1 Humanoid face]

```
interface HumanoidFace {
    Object          baseJoint          0          [skullBase]

    sequence<Object> face                []         [Indexed mesh object]
    sequence<integer> faceBindingCoordsIdx []         (0, \infty)
    sequence<integer> faceBindingNormalsIdx []         (0, \infty)
    sequence<integer> faceCoordsIdx      []         (0, \infty)
    sequence<integer> faceNormalsIdx     []         (0, \infty)

    sequence<Object> region              []         [Indexed mesh object]
    sequence<string>  regionName          required name
    sequence<integer> regionBoundaryIdx   []         (0, \infty)
    sequence<integer> regionInternalIdx   []         (0, \infty)
    sequence<integer> regionMarkerIdx     []         (0, \infty)
}
```


7. Conformance

Work in progress

- ❖ WD text preparation

- ❖ Examples

- ❖ Before going further,

- There may be another way to define facial animation in H-Anim
- Instead of defining a new HumanoidFace object out of a humanoid object, we consider a way to define fields related to facial animation inside the humanoid object.