3D Facial Analysis for the Objective Identification of FASD Associated Facial Dysmorphology

Michael Suttie, PhD
Prof Peter Hammond
Project Objectives

• Enhance the understanding of dysmorphology in alcohol exposed populations who do not exhibit criteria eligible for a FAS diagnosis

• Enhance the understanding of facial dysmorphology across different Ethnicities

• Develop a screening tool utilising 3D facial images to support accurate identification of FASD associated features
Analysis Overview

Timing of Exposure Mouse Study
(Lipinski et al. 2012)

Cape Coloured
(l. 2013)

African American (ongoing)
5yr-18yr

2D

Prenatal

0 – 4yrs

5 – 18yrs

Adult

Neonatal face and transfontanel
US Brighton UK (recruitment phase)

Caucasian vs Cape Coloured
Ethnic Differences
5yr-18yr (Suttie et al. 2016)

Caucasian Face-Brain
5yr-17yr (Suttie et al. 2017)
Static 3D Facial Photogrammetry
Hypoplastic midface
Flat nasal bridge
Long philtrum
Anteverted nares
Retrognathia
Mean FAS Differences

Cape Coloured  N=22

Caucasian     N=35

African American N=20
Control-FAS Discrimination Testing

<table>
<thead>
<tr>
<th>Feature</th>
<th>Cape Coloured</th>
<th>Caucasian</th>
<th>African American</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes</td>
<td>95%</td>
<td>93%</td>
<td>84%</td>
</tr>
<tr>
<td>Philtrum</td>
<td>76%</td>
<td>90%</td>
<td>79%</td>
</tr>
<tr>
<td>Mandible</td>
<td>93%</td>
<td>88%</td>
<td>92%</td>
</tr>
<tr>
<td>Malar</td>
<td>95%</td>
<td>91%</td>
<td>86%</td>
</tr>
<tr>
<td>Nose</td>
<td>89%</td>
<td>95%</td>
<td>91%</td>
</tr>
<tr>
<td>Upper Lip Vermillion</td>
<td>84%</td>
<td>73%</td>
<td>82%</td>
</tr>
<tr>
<td>Profile</td>
<td>96%</td>
<td>86%</td>
<td>90%</td>
</tr>
</tbody>
</table>
Cape Coloured children with FASD

(Suttie et al, Pediatrics, 2013)
Facial signature graphs (Hammond & Suttie, 2012)
Clinical Translation: FaceScreen

- Philtrum: Control → FAS
- Face on Control → FAS
- PFL %ile
Clinical Report

Report for 3D file: pat_1.obj
Report Date: 21/11/2017

Scan Date: 21/11/2017
Date of birth: 21/11/2002
Age: 15.0
Gender: male
PFL: 24.78
PFL Percentile: 4.91
PFL Z-Score: 1.67
Race: Caucasian

PFL:
PFL Measure: 24.78mm
Z-Score: 1.67
Percentile: 4.91

Philtrum Analysis

<table>
<thead>
<tr>
<th>Philtrum Volume</th>
<th>0.48 cc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Philtrum Length</td>
<td>13.20mm</td>
</tr>
<tr>
<td>Philtrum Width/Height Index</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Classification Testing

- Eyes: Value: -0.66, StdError: +/- 0.11
- Face: Value: 0.37, StdError: +/- 0.07
- Molar: Value: -0.27, StdError: +/- 0.05
- Nose: Value: 0.90, StdError: +/- 0.07
Emerging Tech
FaceScreen Application
- In depth assessment of facial dysmorphology
- Report generation
- Requires user placement of landmark points

End Goal:
FaceScreen Upload Portal
- No user interaction
- 3D Image upload -> FASD report
- Technical milestones
Acknowledgements

Peter Hammond
Ruobing Huang
Neil Aiton
Alison Noble

Sandra Jacobson
J L. Jacobson

CIFASD:
Ed Riley, SDSU/NIAAA
Leah Wetherill
Tatiana Faroud
Sarah Mattson
Ken Jones
Clare Coles
Jeff Wozniak

UK National FASD Clinic:
Raja Mukherjee