Facial Expressions and Animation
Facial Expressions and Animation

- Theory behind Facial Expressions
- Execution in Animation
- Prof. Paul Ekman
  - Universality in Facial Expressions?
Facial Expressions and Animation
Facial Expressions and Animation
Paul Ekman

- Professor of Psychology
- Expert in facial expression recognition
- Categorizing different emotions
Paul Ekman

- Nurture vs Nature
- Are facial expressions universally recognizable?
- Ekman’s proof
  - Blind people
  - Indigenous cultures
Facial Action Coding System

- Method for measuring and describing facial behaviors
  - By Paul Ekman and W.V. Friesen in the 1970s
  - Determining how the contraction of each facial muscle (singly and in combination with other muscles) changes the appearance of the face
  - Identifying the specific changes that occurred with muscular contractions and how best to differentiate one from another

- Goal: To create a reliable means for skilled human scorers to determine the category or categories in which to fit each facial behavior

- FACS scores are descriptive only, and provide no implications about the meaning of the behavior
FACS Categories and Actions

Original Action Units – Part 1

Original Action Units – Part 2

Original Action Units – Part 3

Original Action Units - Part 4

Original Action Units – Part 5
Categories of Facial Expressions

- Facial Expression Categories:
  - Sadness and agony
  - Anger
  - Surprise and Fear
  - Disgust and Contempt
  - Happiness

- “No single facial expression can be relied upon always to be present when an emotion is felt”
Sadness and Agony

- Often invokes similar feelings of sadness
- Rarely voluntary
- Hard to mimic
- Consists of a combination of conflicting actions
Recognizing Sadness

- **Mouth**
  - Corner of lips pulled down
  - Raised cheeks
  - Possibly dropped jaw (for agony and crying)

- **Eyes**
  - Upper eyelids drop
  - Inner corners of eyebrows raised and brought together
Sadness
Anger

- Unlike sadness:
  - Looking at anger does not invoke it
  - Easier to mimic

FACIAL EXPRESSION
Recognizing Anger

- Jaw tightly clenched
- If teeth exposed, mouth has rectangular shape
- Thinning of lips
  - Subtle but frequent
  - Earliest sign
- Lower jaw can be forward
Recognizing Anger

FACIAL EXPRESSION
Recognizing Anger

- Glaring eyes
  - Raised upper eyelids
  - Possibly tensed lower eye lids

- Muscle of difficulty
  - Tighten up area around eyes
  - Mental and physical difficulty cause it to contract

- Eyebrows lowered and brought together
Anger
Surprise and Fear

- Fear has been studied more than any other emotion
- Hard to distinguish the surprise and fear
- Surprise is a temporary expression, which often converts into other expressions
Recognizing Fear

- **Eyes**
  - Upper eyelids raised as high as possible
  - Tensed lower eyelids
  - Eyebrows raised and slightly closer together
  - Eyes staring straight ahead

- **Mouth**
  - Lips stretched horizontally
  - Possibly dropped jaw
Surprise and Fear
Disgust and Contempt

- Subtly different from anger
- Rarely photographed in comparison to the other emotions
- Paul Rozin
- Interpersonal triggers:
  - Strange, deceased, misfortunate, morally tainted
Recognizing Disgust and Contempt

- Active muscles around nose
- Eyes can be relaxed comparatively to anger
- Can be limited to one side of the face
  - Feeling of imbalance
- Lowered eyebrows
- Raised upper lip
- Combinations:
  - Disgust and anger
  - Contempt and smile
Disgust and Contempt
Happiness

- More general term
  - Describes a state of mind
- Emotions invoked differ from all the other facial expression categories
- 16 Categories of enjoyable emotions
Recognizing Happiness

- Duchenne Smile
  - Orbicularis oculi
  - Can not be voluntary

- Fake smiles
Happiness
Cross-Cultural Facial Expression

- Cüceloglu’s experiment (1970)
  - 60 line drawings of facial elements
  - Showed to students in US, Japan and Turkey
  - Concluded that facial codes are common to different cultures
Universality of Facial Expressions

- Ekman and Friesen’s experiment (1971)
  - Over 3000 still photographs
  - Showed to 4 different language groups
  - Proved that facial expressions are universal

<table>
<thead>
<tr>
<th>Expression</th>
<th>Japan</th>
<th>Brazil</th>
<th>Chile</th>
<th>Argentina</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happiness</td>
<td>87</td>
<td>97</td>
<td>90</td>
<td>94</td>
<td>97</td>
</tr>
<tr>
<td>Fear</td>
<td>71</td>
<td>77</td>
<td>78</td>
<td>68</td>
<td>88</td>
</tr>
<tr>
<td>Surprise</td>
<td>87</td>
<td>82</td>
<td>88</td>
<td>93</td>
<td>91</td>
</tr>
<tr>
<td>Anger</td>
<td>63</td>
<td>82</td>
<td>76</td>
<td>72</td>
<td>69</td>
</tr>
<tr>
<td>Disgust/Contempt</td>
<td>82</td>
<td>86</td>
<td>85</td>
<td>79</td>
<td>82</td>
</tr>
<tr>
<td>Sadness</td>
<td>74</td>
<td>82</td>
<td>90</td>
<td>85</td>
<td>73</td>
</tr>
<tr>
<td>Number of Observers</td>
<td>29</td>
<td>40</td>
<td>119</td>
<td>168</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>United States (N=99)</td>
<td>Brazil (N=40)</td>
<td>Chile (N=119)</td>
<td>Argentina (N=168)</td>
<td>Japan (N=29)</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------------</td>
<td>---------------</td>
<td>---------------</td>
<td>--------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>happiness</td>
<td>97%</td>
<td>95%</td>
<td>98%</td>
<td>98%</td>
<td>100%</td>
</tr>
<tr>
<td>disgust</td>
<td>92%</td>
<td>97%</td>
<td>92%</td>
<td>92%</td>
<td>90%</td>
</tr>
<tr>
<td>surprise</td>
<td>95%</td>
<td>87%</td>
<td>93%</td>
<td>95%</td>
<td>100%</td>
</tr>
<tr>
<td>sadness</td>
<td>84%</td>
<td>59%</td>
<td>88%</td>
<td>78%</td>
<td>62%</td>
</tr>
<tr>
<td>anger</td>
<td>67%</td>
<td>90%</td>
<td>94%</td>
<td>90%</td>
<td>90%</td>
</tr>
<tr>
<td>fear</td>
<td>85%</td>
<td>67%</td>
<td>68%</td>
<td>54%</td>
<td>66%</td>
</tr>
</tbody>
</table>
Sadness in Animation

- Upper eyelids drop
- Inner corners of eyebrows raised and brought together
- Raised cheeks

FACIAL EXPRESSION
Anger in Animation

- Jaw tightly clenched
- If teeth exposed, mouth has rectangular shape
- Glaring eyes
- Raising of upper eyelid
- Eyebrows lowered and brought together

FACIAL EXPRESSION
Fear in Animation

- Upper eyelids raised as high as possible
- Tensed lower eyelids
- Stretch lips horizontally
- Dropped jaw
- Eyebrows raised and close together

FACIAL EXPRESSION
Disgust in Animation

- Active muscles around nose
- Eyes can be relaxed
- Can be limited to one side of the face

FACIAL EXPRESSION
Happiness in Animation

- Most frequently observed in animations
- <> Fake smiles
Animating Facial Expressions

- Anthropomorphism
Animating Facial Expressions

- Voice as preprocess or post-process?
- Exaggeration in facial features