Overview of Emotion Markup Language and its applications

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W3C EmotionML workshop
5-6 October 2010
Paris
Emotion Markup Language

(from the MMI Charter:)

- EmotionML will provide representations of emotions and related states for technological applications.
- EmotionML will serve as a "plug-in" language suitable for use in three different areas:
  - (1) manual annotation of data;
  - (2) automatic recognition of emotion-related states from user behavior; and
  - (3) generation of emotion-related system behavior.
Envisaged application areas (1)

- **Opinion mining / sentiment analysis in Web 2.0**
  - automatically track customer's attitude regarding a product across blogs

- **Affective monitoring**
  - ambient assisted living applications for the elderly
  - fear detection for surveillance purposes
  - using wearable sensors to test customer satisfaction

- **Character design and control**
  - for games and virtual worlds

- **Social robots**
  - such as guide robots engaging with visitors
Envisaged application areas (2)

- **Expressive speech synthesis**
  - generating synthetic speech with different emotions, such as happy or sad, friendly or apologetic

- **Emotion recognition**
  - e.g., for spotting angry customers in speech dialog systems

- **Support for people with disabilities**
  - such as educational programs for people with autism

All these applications exist today
  - some are on the market
  - others still in research labs
EmotionML: Basic idea

Since there is no single agreed emotion representation even in science, we must give our users a choice

- EmotionML provides support for representing different facets of emotions
  - categories
  - dimensions
  - appraisals
  - action tendencies

- EmotionML gives users a choice of emotion vocabularies
  - centrally defined “recommended” vocabularies
  - user-defined custom vocabularies
EmotionML: Brief history

2006-2008: Two Incubator groups laid the foundations
   - Emotion XG (use cases, requirements)
   - Emotion Markup Language XG (markup)

2009-present: Work towards a formal W3C Recommendation in the Multimodal WG
   - First Public Working Draft published on 29 October 2009
     - minor modifications from previous Final Incubator Report of EmotionML XG
     - trend towards simplification and ease of use
   - Second Working Draft published on 29 July 2010
     - preliminary list of emotion vocabularies
     - syntax aligned with W3C customs
EmotionML: Members involved

People active in the MMI EmotionML subgroup:
- DFKI (Marc Schröder)
- Loquendo (Paolo Baggia, Enrico Zovato)
- Deutsche Telekom (Felix Burkhardt)
- Fraunhofer (Christian Peter)
- Institut Telecom (Catherine Pelachaud)
- CNR (Alessandro Oltramari)
- NICTA (Rafael Calvo)
EmotionML syntax

(1) Representations of emotions

A single statement about an emotion is represented by:

<emotion>
  ...
</emotion>
EmotionML syntax

(1) Representations of emotions

- **Emotion categories**

  ```xml
  <emotion>
    <category name="satisfaction"/>
  </emotion>
  ```

- but what do we mean by “satisfaction”?  
  - emotion words can mean very different things in different contexts, e.g. “anger”
  - so we make explicit from which vocabulary we take the descriptor
EmotionML syntax

(1) Representations of emotions

Emotion categories

<emotion category-set="http://www.example.com/emotion/category/everyday-emotions.xml">
    <category name="satisfaction"/>
</emotion>

but what do we mean by “satisfaction”?  
- emotion words can mean very different things in different contexts, e.g. “anger”  
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EmotionML syntax

(1) Representations of emotions

Emotion dimensions, appraisals and action tendencies

- name

- scale values in range [0, 1]

```xml
<emotion>
  <dimension name="arousal" value="0.3"/>
  <dimension name="pleasure" value="0.9"/>
  <dimension name="dominance" value="0.8"/>
</emotion>

<emotion>
  <appraisal name="novelty" value="0.8"/>
  <appraisal name="intrinsic-pleasantness" value="0.2"/>
</emotion>

<emotion>
  <action-tendency name="approach" value="0.7"/>
  <action-tendency name="avoid" value="0.0"/>
  <action-tendency name="attending" value="0.7"/>
</emotion>
```
EmotionML syntax

(1) Representations of emotions

Emotion dimensions, appraisals and action tendencies
- same principle: identify vocabulary used for descriptors

```
<emotion dimension-set="http://www.example.com/emotion/dimension/PAD.xml">
  <dimension name="arousal" value="0.3"/>
  <dimension name="pleasure" value="0.9"/>
  <dimension name="dominance" value="0.8"/>
</emotion>

<emotion appraisal-set="http://www.example.com/emotion/appraisal/scherer.xml">
  <appraisal name="novelty" value="0.8"/>
  <appraisal name="intrinsic-pleasantness" value="0.2"/>
</emotion>

<emotion action-tendency-set="http://www.example.com/emotion/action/frijda.xml">
  <action-tendency name="approach" value="0.7"/>
  <action-tendency name="avoid" value="0.0"/>
  <action-tendency name="attending" value="0.7"/>
</emotion>
```
EmotionML syntax

(1) Representations of emotions

Emotion representations can be combined into one tag as long as they describe various facets of the same emotion:

```xml
<emotion
category-set="http://www.example.com/emotion/category/everyday-emotions.xml"
dimension-set="http://www.example.com/emotion/dimension/PAD.xml"
appraisal-set="http://www.example.com/emotion/appraisal/scherer.xml"
action-tendency-set="http://www.example.com/emotion/action/frijda.xml">
  <category name="satisfaction"/>
  <dimension name="arousal" value="0.3"/>
  <dimension name="pleasure" value="0.9"/>
  <dimension name="dominance" value="0.8"/>
  <appraisal name="novelty" value="0.3"/>
  <appraisal name="intrinsic-pleasantness" value="0.9"/>
  <action-tendency name="approach" value="0.7"/>
  <action-tendency name="avoid" value="0.0"/>
  <action-tendency name="attending" value="0.4"/>
</emotion>
```
EmotionML syntax
(2) Vocabularies for representing emotions

- Preliminary list from scientific literature
  - One aim of this workshop: Feedback on our selection
    - what did we forget?
    - what is inappropriate/incomplete/redundant/...?
EmotionML syntax

(2) Vocabularies for representing emotions

- **Category vocabularies**
  - Ekman's "big six" basic emotions (6)
    - anger disgust fear happiness sadness surprise
  - Cowie et al. (1999)'s Everyday emotion vocabulary (17)
    - affectionate afraid amused angry bored confident content disappointed excited happy interested loving pleased relaxed sad satisfied worried
  - OCC categories (Ortony et al., 1988) (22)
    - admiration anger disappointment distress fear fears-confirmed gloating gratification gratitude happy-for hate hope joy love pity pride relief remorse reproach resentment satisfaction shame
  - “FSRE” categories (Fontaine et al., 2007) (24)
    - anger anxiety being-hurt compassion contempt contentment despair disappointment disgust fear guilt happiness hate interest irritation jealousy joy love pleasure pride sadness shame stress surprise
  - Frijda (1986)'s categories (12)
    - anger arrogance desire disgust enjoyment fear humility indifference interest resignation shock surprise
(2) Vocabularies for representing emotions

**Dimension vocabularies**
- Mehrabian (1996)'s PAD dimensions
  - pleasure arousal dominance
- FSRE dimensions (Fontaine et al., 2007)
  - valence potency arousal unpredictability
Appraisal vocabularies

- **OCC appraisals** (Ortony et al., 1988)
  - desirability praiseworthiness appealingness desirability-for-other deservingness liking likelihood effort realization strength-of-identification expectation-of-deviation familiarity

- **Scherer appraisals** (Scherer, 1986, 1999)
  - suddenness familiarity predictability intrinsic-pleasantness relevance-person relevance-relationship relevance-social-order outcome-probability consonant-with-expectation goal-conduciveness urgency agent-self agent-other agent-nature cause-intentional control power adjustment-possible norm-compatibility self-compatibility

- **EMA appraisals** (Gratch & Marsella, 2004)
  - relevance desirability agency blame likelihood unexpectedness urgency ego-involvement controllability changeability power adaptability
EmotionML syntax

(2) Vocabularies for representing emotions

💎 Action tendency vocabularies
- Frijda (1986)'s action tendencies
  - approach avoidance being-with attending rejecting nonattending agnostic interrupting dominating submitting
EmotionML syntax
(2) Vocabularies for representing emotions

Vocabulary definitions in XML:

<!-- Ekman's bix six -->
<vocabulary type="category" id="big6">
  <item name="anger"/>
  <item name="disgust"/>
  <item name="fear"/>
  <item name="happiness"/>
  <item name="sadness"/>
  <item name="surprise"/>
</vocabulary>

<!-- FSRE dimensions -->
<vocabulary type="dimension" id="fsre-dimensions">
  <item name="valence" scale="bipolar"/>
  <item name="potency" scale="bipolar"/>
  <item name="arousal" scale="bipolar"/>
  <item name="unpredictability" scale="bipolar"/>
</vocabulary>
EmotionML syntax

(3) Meta-information

An emotion representation can have a confidence:

```xml
<emotion category-set="http://www.example.com/emotion/category/everyday-emotions.xml">
  <category name="satisfaction" confidence="0.9"/>
</emotion>

<emotion dimension-set="http://www.example.com/emotion/dimension/PAD.xml">
  <dimension name="arousal" value="0.3" confidence="0.6"/>
  <dimension name="pleasure" value="0.9" confidence="0.3"/>
  <dimension name="dominance" value="0.8" confidence="0.2"/>
</emotion>
```
EmotionML syntax
(3) Meta-information

An emotion can be expressed through a list of modalities:

```
<emotion category-set="http://www.example.com/emotion/category/everyday-emotions.xml"
    modality="face voice">
    <category name="satisfaction"/>
</emotion>
```
EmotionML syntax

(3) Meta-information

An emotion can carry arbitrary meta-data:

<emotion category-set="http://www.example.com/emotion/category/everyday-emotions.xml">
  <info>...</info>
  <category name="satisfaction"/>
</emotion>
EmotionML syntax

(4) Reference and time

Emotions are related to the world in various ways. EmotionML distinguishes four types of reference:

- **expressedBy**: observable behaviour (incl. physiology) expressing the behaviour
- **experiencedBy**: the subject who “has” the emotion
- **triggeredBy**: emotion-eliciting event that caused the emotional reaction
- **targetedAt**: object towards the emotional reaction or action tendency is oriented

Reference mechanism uses Media Fragment URIs incl. possibility to point to a section in a video/audio file:

```xml
<emotion category-set="http://www.example.com/emotion/category/everyday-emotions.xml">
  <reference uri="http://www.example.com/data/video/v1.avi?t=2.13" role="expressedBy"/>
  <reference uri="http://www.example.com/events/e12.xml" role="triggeredBy"/>
  <category name="satisfaction"/>
</emotion>
```
EmotionML syntax
(4) Reference and time

Emotions can have an absolute start and end time counting in milliseconds since 1970

<emotion category-set="http://www.example.com/emotion/category/everyday-emotions.xml"
    start="1268647200" end="1268647330">
    <category name="satisfaction"/>
</emotion>
(5) Traces

- Represent the time course of a scale value as a sequence of samples
- Can be used for any scale value

```xml
<emotion appraisal-set="http://www.example.com/emotion/appraisal/scherer.xml">
  <appraisal name="novelty">
    <trace freq="10Hz" samples="0.1 0.1 0.1 0.1 0.1 0.7 0.8 0.8 0.8 0.8 0.4"/>
  </appraisal>
</emotion>
```
Open issues (1): Emotion vocabularies

How can the current selection of “recommended” emotion vocabularies be improved?
Open issues (2): Intensity

Currently separate `<intensity>` element
- but maybe intensity is needed only in conjunction with categories?
Open issues (3): Confidence

Currently individual confidence for every `<category>`, `<dimension>` etc.

- maybe a single confidence for `<emotion>` is enough?
Open issues (4): Modality

Currently modality lists only where the emotion was expressed: face, voice, body, text, ...

Cannot encode the sensor by which modality was observed, e.g. visual vs. infrared camera
Open issues (5): Neutral point on scale

Currently, all scale values are in the range $[0, 1]$, including both unipolar and bipolar scales.

- Can we assume the “neutral point” from the type of scale?
  - unipolar scale: neutral = 0
  - bipolar scale: neutral = 0.5
Open issues (6): EmotionML and HTML5

Can we think of example use cases how EmotionML might be used with HTML5?