User Experience: Beyond Cognition and Emotion …

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Interaction Paradigms in Computing

- **Personal computing**: 1960-2000
  - Man-machine-interaction

- **Cooperative computing**: 1980-2000
  - Computer-mediated-interaction

- **Social computing**: 2000-2020
  - Community-mediated-interaction

- **Cultural computing**: 2000-2020
  - Cross cultural-interaction
What is Culture?

Culture is the integration pattern of human behavior that includes:
- attitudes,
- norms,
- values,
- beliefs,
- actions,
- communications and language
- institutions of a race, ethnic, religious and/or social group.

The word *culture* comes from the Latin root *colere* (to inhabit, to cultivate, or to honor). In general, it refers to human *activity*; different definitions of culture reflect different theories for understanding, or criteria for valuing, human activity. Anthropologists use the term to refer to the universal human capacity to classify experiences, and to encode and communicate them symbolically. They regard this capacity as a defining feature of the genus Homo.
“It is not the consciousness of men that determines their being, but, on the contrary, their social being that determines their consciousness.”

Karl MARX [1818-1883]
Daniel Kahneman
Map of Bounded Rationality: A Perspective on Intuitive Judgement and Choice.
Nobel Prize Lecture, 8 December 2002
Waiming Mok’s interpretation of "Honest Signals" article by Alex (Sandy) Pentland and Tracy Heibeck in SMR, Fall 2008. There is no validation with authors. Interpretation has Copyright © 2008 by Waiming Mok.
After 1910 the discoveries of Carl Gustav Jung about the collective unconscious and the related archetypes were challenging. Jung dreamt a great deal about the dead, the land of the dead, and the rising of the dead. These represented the unconscious itself -- not the "little" personal unconscious that Freud made such a big deal out of, but a new collective unconscious of humanity itself, an unconscious that could contain all the dead, not just our personal ghosts. Jung began to see the mentally ill as people who are haunted by these ghosts, in an age where no-one is supposed to even believe in them. If we could only recapture our mythologies, we would understand these ghosts, become comfortable with the dead, and heal our mental illnesses.
The Hero's Journey

Joseph Campbell
[1904-1987]

ACT THREE: UNIFICATION

ACT ONE: SEPARATION

FOURTH THRESHOLD

Ordinary World and Call to Adventure/Hook/Bargain without Knowing or Refusal of the Call
Meeting the Mentor/Supernatural Aid/Meeting the White Spirit
Road of Trials/Tests:
- Whale's Belly
- Enemies
- Allies
- Obstacles

FIRST THRESHOLD

Crossing the First Threshold: Final Test/Plot Point #1 (p. 80-100)
Approach to the Inmost Cave
Heiros Gamos (Sacred Marriage)/Meeting the Shadow Self
- Wild Bride & Bridegroom
- Meeting the Goddess/God
- At-One-Ment with Father/Mother
- Finding Love in the Underworld

SECOND THRESHOLD

Elixir Theft/Ultimate Boon/Reward
Ordeal
- Dismemberment
- Wandering
- Harrowing of the Soul

Descend: The Abyss

ACENT: Magic Flight

REFUSAL OF THE RETURN/APOTHEOSIS/REALM OF THE WILD WOMAN OR MAN

ACROSSING THE SECOND THRUSHOLD: NEW RULES/MIDPOINT/REVERSAL (p. 200)

ACT TWO: SUPREME ORDEAL

THIRD THRESHOLD

Crossing the Third Threshold: Sacrifice (Action)/Plot Point #2 (p. 300)

Death of Dreams/Black Moment/Dark Night of the Soul (Realization)

World Navel

ORDINARY WORLD

WORLD NAVEL

SPECIAL WORLD

ACT THREE: UNIFICATION

World Dancer/Wrap-up:
- Master of Two Worlds
- Incorporation

Resurrection

Showdown/Catharsis/Climax

ASCENT: Magic Flight

How to design for the unconscious?

A collaborative project between two PhD students

Leonid IVONIN

- Processing of physiological signals and application of data mining methods
- Development of technical infrastructure for the experiments
- Sensing application (ArcheSense)

Huang-Ming CHANG

- Generation of ideas
- Statistical analysis
- Writing of articles
- Identification, selection, and preparation of audiovisual stimuli for elicitation of psychological states
- Selection of appropriate questionnaires
- Presenting application (ArcheBoard)
The State of the Art

1. Explicit Emotions (e.g. joy, anger, sadness, etc.)

2. Elicitation

3. Recognition

Mapping

Affective Stimuli

Emotional Responses
The State of the Art

The emotion of Joy
What induces emotions?

- Perceptual Quality
  Black, White
- Physical Content
  Dove
- Symbolic meaning
  Peace, Spirit, etc.

Hypothesis: Psychological states related to archetypal stimuli would lead to different patterns of physiological activations.

- **Number of participants:**
  - 34

- **Two types of stimuli:**
  - Visual (pictures)
  - Auditory (sounds)

- **Five categories of stimuli:**
  - Archetypal
  - Positive-relaxing
  - Positive-arousing
  - Neutral
  - Negative

- **Six stimuli per category**

- **Physiological data:**
  - Heart Rate
  - Galvanic Skin Response
  - Skin Temperature

Examples of visual stimuli

The findings indicated a **significant relationship** between the categories of stimuli (including archetypal) and physiological signals.
Study 2 - method

**Hypothesis:** Various archetypal experiences lead to recognizable patterns of physiological activations that could be differentiated using computational intelligence algorithms.

- **Number of participants:**
  - 36
- **Two types of stimuli:**
  - Film clips with explicit emotions
  - Film clips with archetypal experiences
- **Five categories of explicit stimuli:**
  - Neutral
  - Amusement
  - Fear
  - Joy
  - Sadness
- **Physiological data:**
  - ECG (HR + HRV)
  - Skin conductance (response + level)
  - Respiration
  - Skin temperature
- **Duration of each stimulus:**
  - Approximately 5 minutes
- **Self-report ratings after every stimulus**
- **Eight categories of archetypal stimuli:**
  - Anima
  - Animus
  - Hero departure
  - Hero initiation
  - Hero return
  - Mentor
  - Mother
  - Shadow
Dynamic patterns of the heart rate responses of the participants to the film clips presentations.

The mean values and 95% confidence intervals of the HR are represented with the bold lines and the vertical bars for each of the psychological condition.

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## Classification Performance Achieved with Different Methods

<table>
<thead>
<tr>
<th></th>
<th>kNN</th>
<th>SVM</th>
<th>Naïve Bayes</th>
<th>LDA</th>
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</thead>
<tbody>
<tr>
<td><strong>Archetypal experiences</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Classification rate</td>
<td>78</td>
<td>82</td>
<td>85.5</td>
<td>83</td>
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<tr>
<td>Cross-validated classification rate</td>
<td>74</td>
<td>75.5</td>
<td>79.5</td>
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<tr>
<td><strong>Explicit emotions</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Classification rate</td>
<td>77.6</td>
<td>75.2</td>
<td>78.4</td>
<td>77.6</td>
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<tr>
<td>Cross-validated classification rate</td>
<td>72</td>
<td>71.2</td>
<td>74.4</td>
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<tr>
<td><strong>Archetypal experiences and explicit emotions</strong></td>
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<td></td>
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<tr>
<td>Classification rate</td>
<td>62.8</td>
<td>55.7</td>
<td>72.6</td>
<td>69.8</td>
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<tr>
<td>Cross-validated classification rate</td>
<td>49.8</td>
<td>68.3</td>
<td>57.2</td>
<td>61.2</td>
</tr>
</tbody>
</table>

**Classification methods:** k-nearest neighborhood (kNN), support vector machine (SVM), naïve Bayes, and linear discriminant analysis (LDA), Only the best accuracy is reported.
**ArcheSense** is a tool for evaluation of human experience with products or media based on physiological data of people.

More information about ArcheSense can be found at [http://hxresearch.org](http://hxresearch.org).
Study 3 - method

**Hypothesis:** Various archetypal experiences lead to recognizable patterns of physiological activations that could be differentiated using computational intelligence algorithms.

- **Number of subjects:**
  - 23
- **Two types of stimuli:**
  - Film clips with explicit emotions
  - Film clips with archetypal experiences
- **Five categories of explicit stimuli:**
  - Neutral
  - Active-pleasant
  - Active-unpleasant
  - Passive-pleasant
  - Passive-unpleasant
- **Physiological data:**
  - ECG (HR + HRV)
  - Skin conductance (response + level)
- **Duration of each stimulus:**
  - Approximately 1 minute
- **Number of stimuli per category:** 3
- **Self-report ratings after every stimulus**

- **Seven categories of archetypal stimuli:**
  - Anima
  - Hero departure
  - Hero initiation
  - Hero rebirth
  - Hero return
  - Mentor
  - Mother
  - Shadow
Rain drops down

Reborn from Fire
Reborn from Fire and Thunder Strom

“God is in the rain.”
Comparison of the classification accuracy achieved using the self-report questionnaires and the physiological data (between-subject classification).

<table>
<thead>
<tr>
<th>Categories of the film clips</th>
<th>Number of states</th>
<th>Self-reports</th>
<th>Physiological data</th>
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<tbody>
<tr>
<td>Anima, hero departure, hero initiation, hero rebirth, hero return, mentor, shadow</td>
<td>7</td>
<td>28.0</td>
<td>36.7</td>
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<tr>
<td>Anima, hero departure, mentor, shadow</td>
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<td>42.0</td>
<td>53.3</td>
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<tr>
<td>Anima, hero initiation, mentor, shadow</td>
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<td>43.1</td>
<td>57.1</td>
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<tr>
<td>Anima, hero rebirth, mentor, shadow</td>
<td>4</td>
<td>38.4</td>
<td>52.9</td>
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<tr>
<td>Anima, hero return, mentor shadow</td>
<td>4</td>
<td>40.6</td>
<td>56.1</td>
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<tr>
<td>Active-pleasant, active-unpleasant, neutral, passive-pleasant, passive-unpleasant</td>
<td>5</td>
<td>50.4</td>
<td>50.7</td>
</tr>
<tr>
<td>Active-unpleasant, neutral, passive-pleasant, passive-unpleasant</td>
<td>4</td>
<td>64.9</td>
<td>57.2</td>
</tr>
</tbody>
</table>

**Archetypes**

**Classification methods:** k-nearest neighborhood (kNN), support vector machine (SVM), naïve Bayes, linear discriminant analysis (LDA), and Adaptive Boosting with decision trees (AdaBoost). Only the best accuracy is reported.
Overview

Study #1:  
• ‘Exploratory’ study  
• Pictures and sounds (presentation for 6 sec)  
• 1 archetype, 4 explicit emotions  
• Between-subject design  
• Statistically significant results  
• 23.3% classification accuracy (5 classes)

Study #2:  
• Film clips (length 5 min)  
• 8 archetypes, 5 explicit emotions  
• 1 stimuli per class  
• Between-subject design  
• Statistically significant results  
• 79.5% classification accuracy (8 classes)

Study #3:  
• Film clips (length 1 min)  
• 7 archetypes, 5 explicit emotions  
• 3 stimuli per class  
• Between-subject and within-subject designs  
• Statistically significant results  
• 57.1% classification accuracy (4 classes, between-subject), 70.3% classification accuracy (7 classes, within-subject)
## Performance of Predictive Models

### Classification Rate in General

<table>
<thead>
<tr>
<th>Recognition Technique</th>
<th>Affective Stimuli</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Archetypal Symbols</td>
</tr>
<tr>
<td><strong>Self-report Data (Conscious)</strong></td>
<td>Poor</td>
</tr>
<tr>
<td><strong>Physiological Data (Unconscious)</strong></td>
<td>Good</td>
</tr>
</tbody>
</table>

State of the Art

### Emotion toward Archetypal Symbols

- Implicit Emotion
Three main conclusions can be drawn:

(1) Conscious and unconscious reactions are different.

(2) The unconscious is sensitive to archetypes.

(3) The unconsciousness is at least important as the consciousness.
Thank you for your attention.

A door goes open to a new world…
Chang H.M., Ivonin L., Díaz M., Catalá A., Chen W., Rauterberg M. (2014). Enacting archetypes in movies: Grounding the unconscious mind in emotion-driven media. *Digital Creativity* (published online) [IF=0.370] [SJR].

Chang HM., Ivonin L., Díaz M., Català A., Chen W., Rauterberg M. (2014). Unspoken emotions in movies: The basis of emotion-driven storytelling systems. *Informatik-Spektrum*, vol. 37, no. 6, pp. 539-546 (online) [IF=0.148] [SJR].

Ivonin L., Chang HM., Díaz M., Català A., Chen W., Rauterberg M. (2014). Beyond cognition and affect: Sensing the unconscious. *Behaviour & Information Technology* (published online) [IF=0.856] [SJR].


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