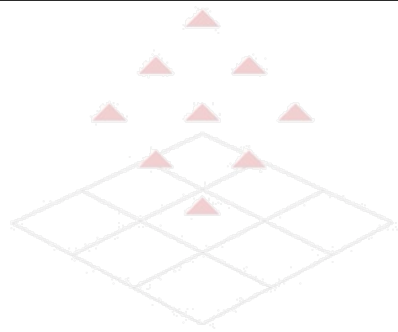AAAI Spring Symposium Series

Computational Phronesis as a Possible Path toward Machine Emotional Integrity

Michal Ptaszynski
Department of Computer Science, Kitami Institute of Technology

Computational Phronesis as a Possible Path toward **Machine Emotional Integrity**

Michal Ptaszynski
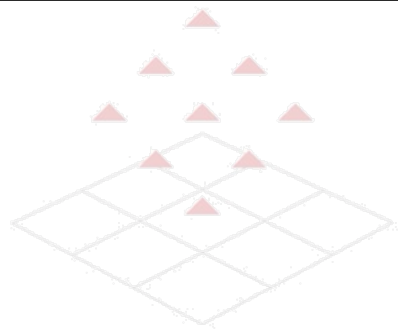Department of Computer Science, Kitami Institute of Technology

Computational Phronesis
as a Possible Path toward Machine Emotional Integrity

Michal Ptaszynski
Department of Computer Science,
Kitami Institute of Technology

Integrity

- **Integrity** (/ɪnˈtɛgrɪti/, noun)
  Definition from the Oxford dictionary

Integrity

- **The quality of <u>being honest</u> and having strong moral principle** (*a gentleman of complete integrity*)

Integrity

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- **The state of being <u>whole</u> and <u>undivided</u>** (*By invading Crimea Russia disturbed integrity of Ukraine*)

Integrity

- **The quality of <u>being honest</u> and having strong moral principle** (*a gentleman of complete integrity*)

- **The state of being <u>whole</u> and <u>undivided</u>** (*By invading Crimea Russia disturbed integrity of Ukraine*)

- **The condition of being <u>unified</u> or sound in construction** (*the structural integrity of the novel*)

Integrity

- **The quality of <u>being honest</u> and having strong moral principle** (*a gentleman of complete integrity*)

- **The state of being <u>whole</u> and <u>undivided</u>** (*By invading Crimea Russia disturbed integrity of Ukraine*)

- **The condition of being <u>unified</u> or sound in construction** (*the structural integrity of the novel*)

- **<u>Internal consistency</u> or lack of corruption in data** (*integrity checking*)

Integrity

- **Being honest, whole, undivided, unified, in state of internal consistency with oneself**

Emotional integrity

- **Being honest, whole, undivided, unified, in state of internal consistency with ones' emotions.**
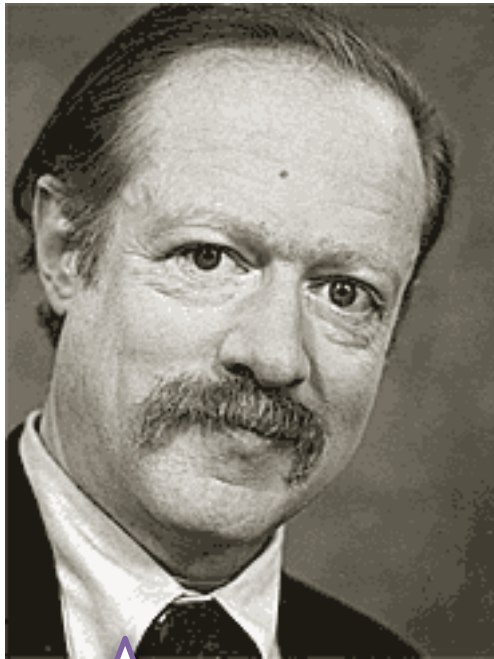
Emotional integrity

Bob Solomon (1942-2007)

To be in emotional integrity with oneself means to be able to use one's emotions to enhance one's life

Emotional integrity

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To be in emotional integrity with oneself means to be able to use one's emotions to enhance one's life

Emotions is what we **do**.

Use = be aware of and consciously live with one's own and others' emotions
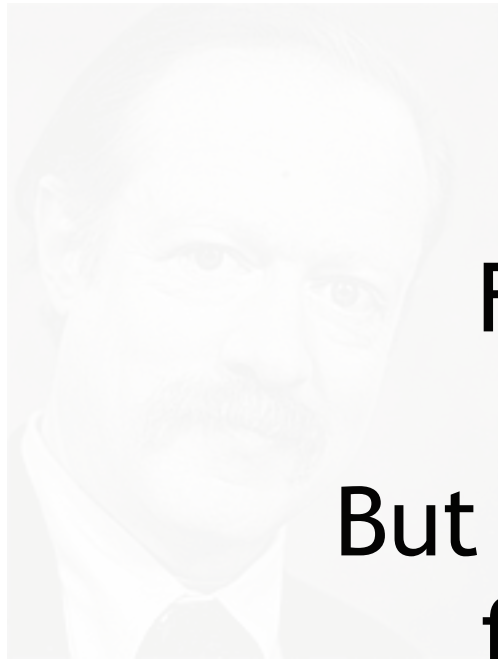
Emotional integrity

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To be in emotional integrity with oneself means to be able to use one's emotions to enhance one's life

Something like emotional enlightenment

Use = be aware of and consciously live with one's own and others' emotions
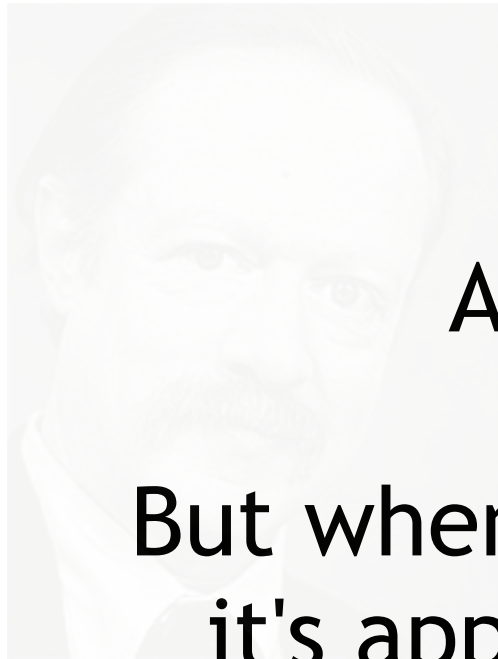
Emotional integrity

Fear - negative?

But helps us stay away from predators.

Emotional integrity

Anger - negative?

But when somebody insults you, it's appropriate to get angry.
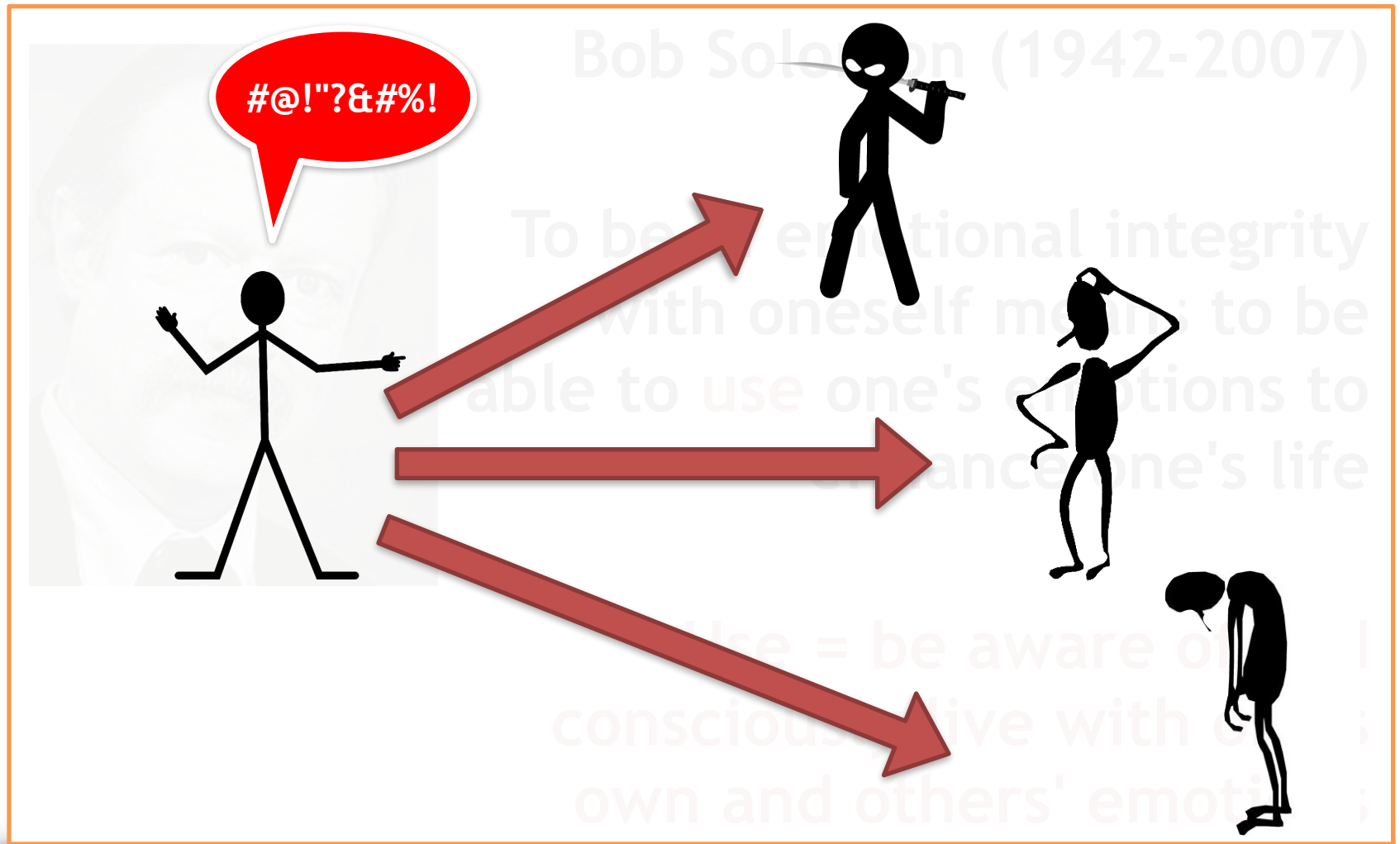
Emotional integrity

Emotional integrity

Emotional strategies

* Ability to **use** emotions according to situation (**context**)

Emotional integrity

- It would be great to have a computational model of emotional integrity
  - To study humans
  - Train robots to understand our real needs (and enhance our lives)

- But how?

Emotional integrity

- Need a framework to work on
- One general concept of "Intelligence" ? - too much.

Intelligence

Intelligence – one or many?

1983. Howard Gardner – "IQ tells you nothing!". [1]
(Theory of multiple intelligences)
There are many kinds of intelligence: logical,
linguistic, spatial, musical, kinesthetic, naturalist,
intrapersonal and interpersonal...

1990. Peter Salovey & John D. Mayer – **Emotional
Intelligence** [2]
The ability to recognize, monitor one's own and others'
emotions, to discriminate among them and to use this
information to guide one's thinking and actions.

1. Gardner, Howard (1983). Frames of mind: The theory of multiple intelligences. New York: Basic Books
2. Salovey, P. & Mayer, J.D. (1990) "Emotional intelligence" Imagination, Cognition, and Personality, 9, 185-211

Intelligence

Emotional Intelligence Framework

I Perception, appraisal, and expression of emotion
· Ability to recognize emotion in one's physical and psychological states, in other people and objects.

· Ability to discriminate between accurate and inaccurate, appropriate and inappropriate, honest and dishonest, expressions of emotions.

· Ability to express emotions accurately, and to express needs related to them.

II Emotional facilitation of thinking
· Ability to redirect and prioritize one's thinking based on the feelings associated with objects, events, and other people.

· Ability to generate or emulate vivid emotions to facilitate judgments and memories concerning feelings.

· Ability to capitalize on mood swings to take multiple points of view; ability to integrate these mood-induced perspectives.

· Ability to use emotional states to facilitate problem solving and creativity.

III Understanding and analyzing emotional information; employing emotional knowledge
· Ability to understand how different emotions are related.

· Ability to perceive the causes and consequences of emotions.

· Ability to interpret complex emotions, such as emotional blends and contradictory feeling states.

· Ability to understand and predict likely transitions between emotions.

IV Regulation of emotion
· Ability to be open to feelings, both those that are pleasant and those that are unpleasant.

· Ability to monitor and reflect on emotions.

· Ability to engage, prolong, or detach from an emotional state, depending upon its judged informativeness or utility.

· Ability to manage emotion in oneself and others.

John D. Mayer and Peter Salovey. *What is emotional intelligence?*, Emotional Development and Emotional Intelligence:3-31, 1997.

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22

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John D. Mayer and Peter Salovey. *What is emotional intelligence?*, Emotional Development and Emotional Intelligence:3-31, 1997.

recognize emotions

manage emotion in oneself and others.

After 20 years of Affective Computing we're still here!!

Emotional integrity assumes obtaining all abilities till the last one.

Intelligence

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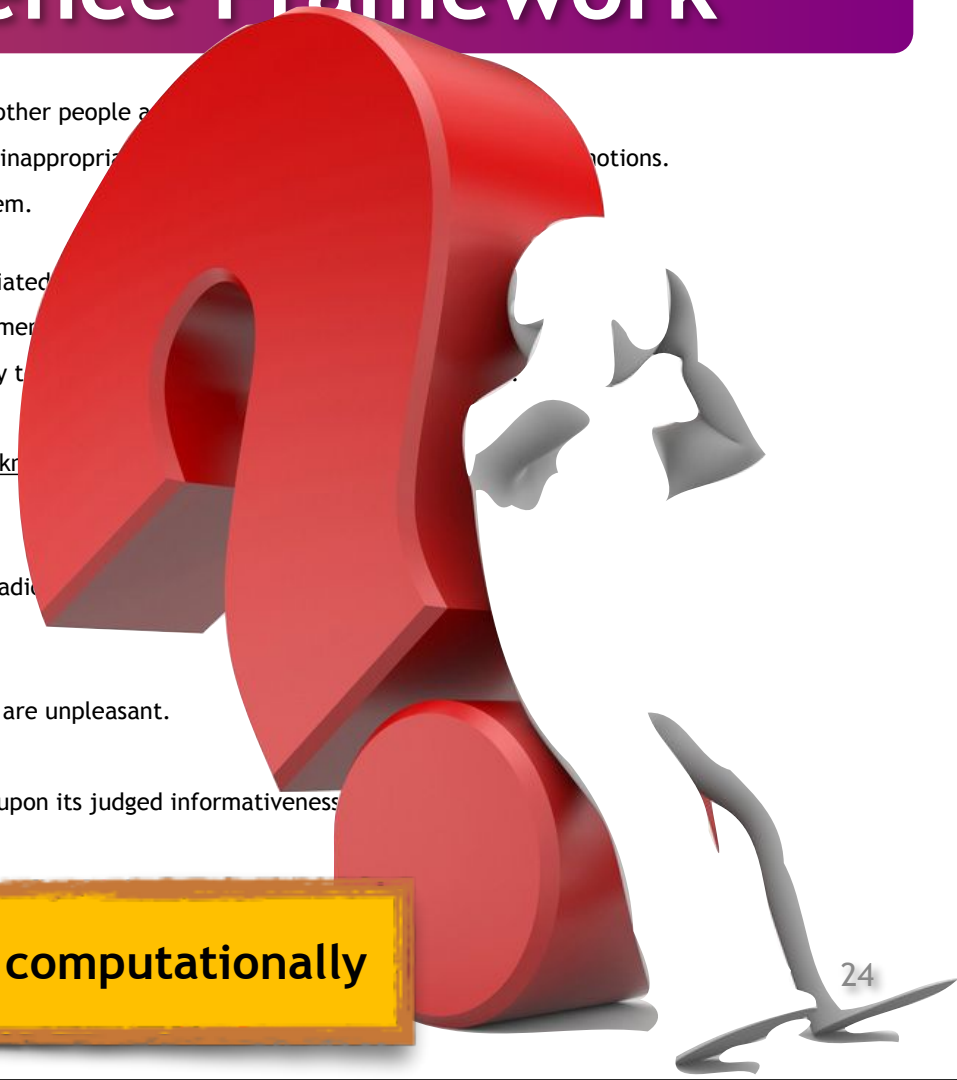· Ability to use emotional states to facilitate problem solving and creativity.

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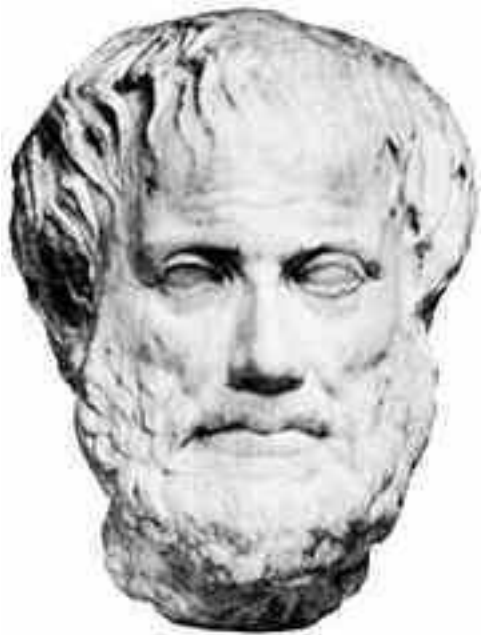**The abilities are difficult to formalize computationally**

Intelligence

- Need something else that would suffice

- When you start looking for answers you usually look at…

Intelligence
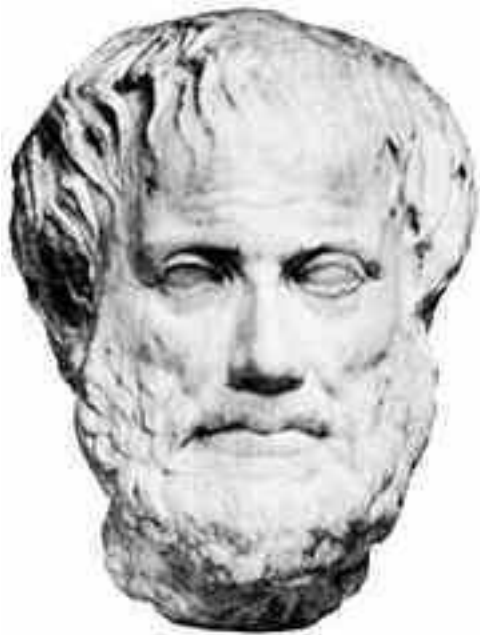
Ancient Greece

Aristotle

384 – 322 BCE

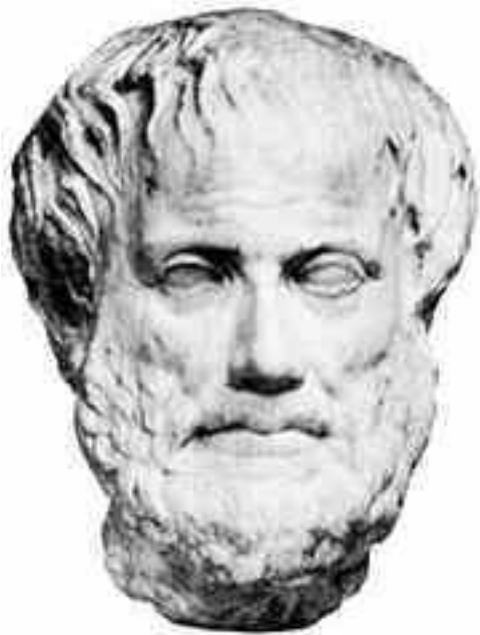**Know thyself!**

Intelligence

Aristotle

384 – 322 BCE

3 types of intelligence
- *Techne*: specific/expert knowledge
- *Sophia*: theoretical wisdom acquired by pure study/learning
- *Phronesis*: practical wisdom, practical judgment, prudence

Intelligence

3 types of intelligence

- **_Techne_**: knowledge
- **_Sophia_**: th acquired learning
- **_Phronesis_** wisdom, prudence

Purely computational (what computers do)

Non-computational (What computers don't)

What computers should do

Aristotle

384 – 322 BCE

Phronesis

- **good judgment**, knowledge on how to express oneself, towards whom to express oneself, in which situations, and when it is appropriate to express oneself.

Phronesis

- **good judgment**, knowledge on how to express oneself, towards whom to express oneself, in which situations, and when it is appropriate to express oneself.

And with regards to emotions...

Phronesis

- **good judgment**, knowledge on how to express ones emotions, towards whom they ought to be expressed, in which situations, and when it is appropriate to express them.

Phronesis

Research questions

1. Who expresses the emotion?

2. Why they express the emotion?

3. Is the expression of emotion appropriate to the situation/context?

4. Is the degree of expression appropriate to the situation/context?

5. If the expression is not appropriate, what would be the appropriate one?

Phronesis

Tasks

1. Determination of emotion subject;

2. Determination of emotion object;

3. Verification of contextual appropriateness of emotions;

4. Verification of appropriateness of the degree/intensity of the expressed emotion;

5. Emotion-related behavioral pattern modeling.

Phronesis

Tasks

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5. Emotion-related behavioral pattern modeling

We can do that!!

Phronesis

Tasks

- **Combinations of those tasks give emotional strategies**.

- **Good strategies give emotional integrity**.

35

Computational Phronesis

What we have done already?

1. Emotion subject;

2. Emotion object;

3. Verification of contextual appropriateness of emotions;

4. Verification of degree appropriateness;

5. Emotion-related behavioral patterns.

Computational Phronesis

What we have done already?

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1. - Dokoshi, H., Oyama, S., Kurihara, M., Ptaszynski, M., Rzepka, R., & Araki, K. (2011). Emotion estimation of actors and non-actors in text using web mining [in Japanese]. In Proceedings of the Hokkaido Symposium on Information Processing, (pp. 223-224).

2. - Ptaszynski, M., Dybala, P., Rzepka, R., Araki, K., & Momouchi, Y. (2012). Annotating affective information on 5.5 billion word corpus of Japanese blogs. In Proceedings of The Eighteenth Annual Meeting of The Association for Natural Language Processing (NLP-2012) (pp. 405-408).
   - Ptaszynski, M., Rzepka, R., Araki, K., & Momouchi, Y. (2012). A robust ontology of emotion objects. In Proceedings of The Eighteenth Annual Meeting of The Association for Natural Language Processing (NLP-2012) (pp. 719-722).

Computational Phronesis

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- Ptaszynski, M., Dybala, P., Shi, W., Rzepka, R., & Araki, K. (2009). Shifting valence helps verify contextual appropriateness of emotions. In Working Notes of Twenty-first International Joint Conference on Artificial Intelligence (IJCAI-09), (pp. 19-21).
- Ptaszynski, M., Dybala, P., Shi, W., Rzepka, R., & Araki, K. (2009). Conscience of blogs: Verifying contextual appropriateness of emotions basing on blog contents. In Proceedings of the Fourth Inter-national Conference on Computational Intelligence (CI 2009) (pp. 1-6).
- Ptaszynski, M., Dybala, P., Shi, W., Rzepka, R., & Araki, K. (2010). Contextual affect analysis: A system for verification of emotion appropriateness sup-ported with contextual valence shifters. International Journal of Biometrics, 2(2), 134-154. doi:10.1504/ IJBM.2010.031793.
- **Michal Ptaszynski, Michal Mazur, Pawel Dybala, Rafal Rzepka, Kenji Araki and Yoshio Momouchi. (2013). Towards Computational Fronesis: Verifying Contextual Appropriateness of Emotions, International Journal of Distance Education Technologies (IJDET), Vol. 11, No. 2, pp. 16-47.**

Context of Emotions

- Do we even need it? (And why?)

Context of Emotions

Typical errors of affect analysis systems.

- Facial expressions

- **Expression:**
  Eyebrows together, mouth open, finger pointing at listener;

- **Output**:
  User is *angry*;

Context of Emotions

- Facial expressions

Context:
1. Praise
2. Warning
3. Anger

Context of Emotions

- Facial expressions

- **Expression:**
  User is crying
  - (presence of tears and facial expression);

- **Output**:
  User is *sad*;
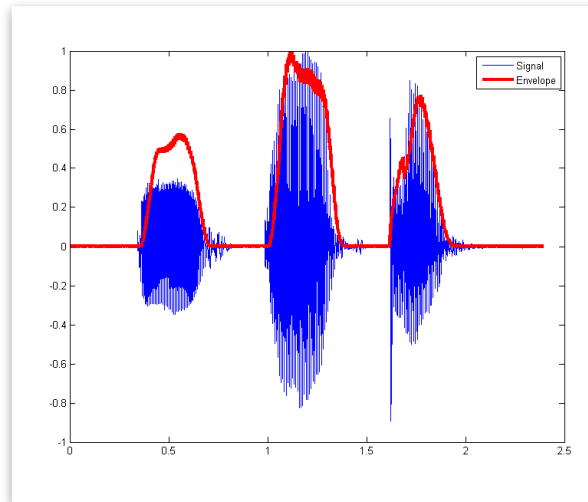
Context of Emotions

- Facial expressions

- **Context**: The user is cutting an onion in the kitchen;

- Assumption: User is *sad*;

Context of Emotions

- Speech signals

- **Expression:**
  User speaks with a loud voice;

- **Output:**
  User is angry;

Context of Emotions

- Speech signals

  Context: The user listening to the music with her headphones on and cannot hear well;

Context of Emotions

- Physiological signals

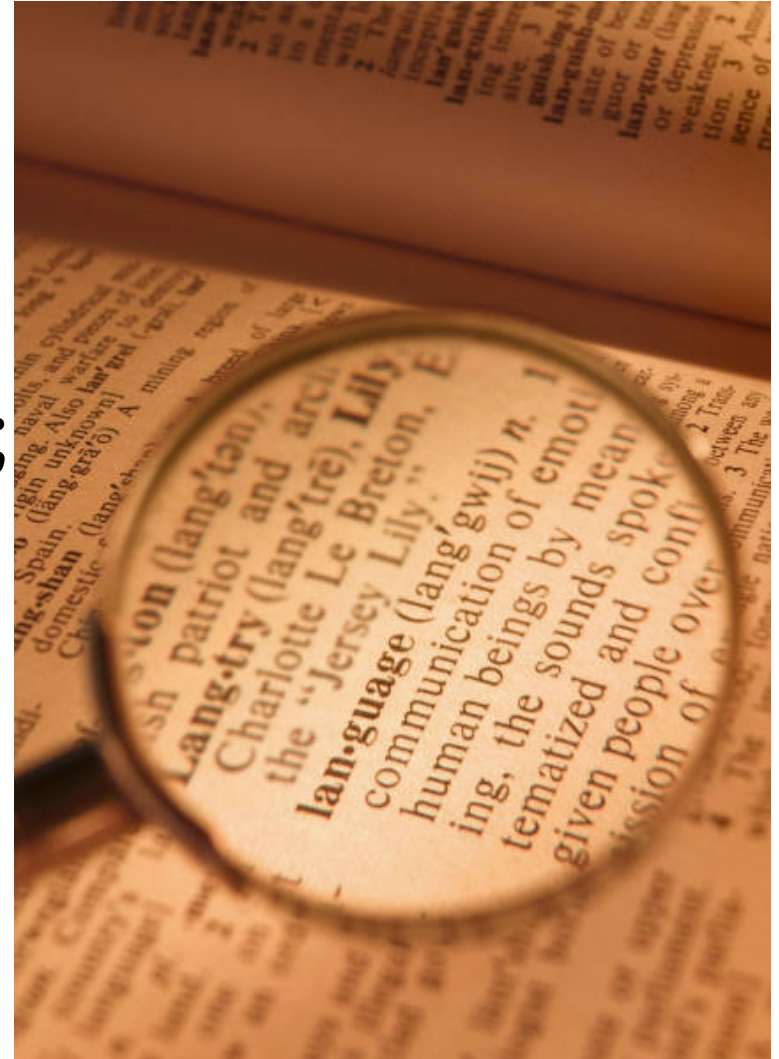- **Expression**: User has a high blood pressure;
- **Output**: User is excited;

Context of Emotions

- Physiological signals

- Expression: User has a high blood pressure;

- Assumption: User is excited;

Context: The user has a hypertension or arrhythmia;

Context of Emotions

- Language

- **Expression**: User has used the word "happy";

- **Output**: User is happy;

Context of Emotions

- Language

Context:

1. "I'm not happy"

Context of Emotions

- Language

Context:

Expression: User has used the word "happy";

Assumption: User is happy;

1. "I'm not happy"

2. "I'm so happy that bastard was hit by a car!"
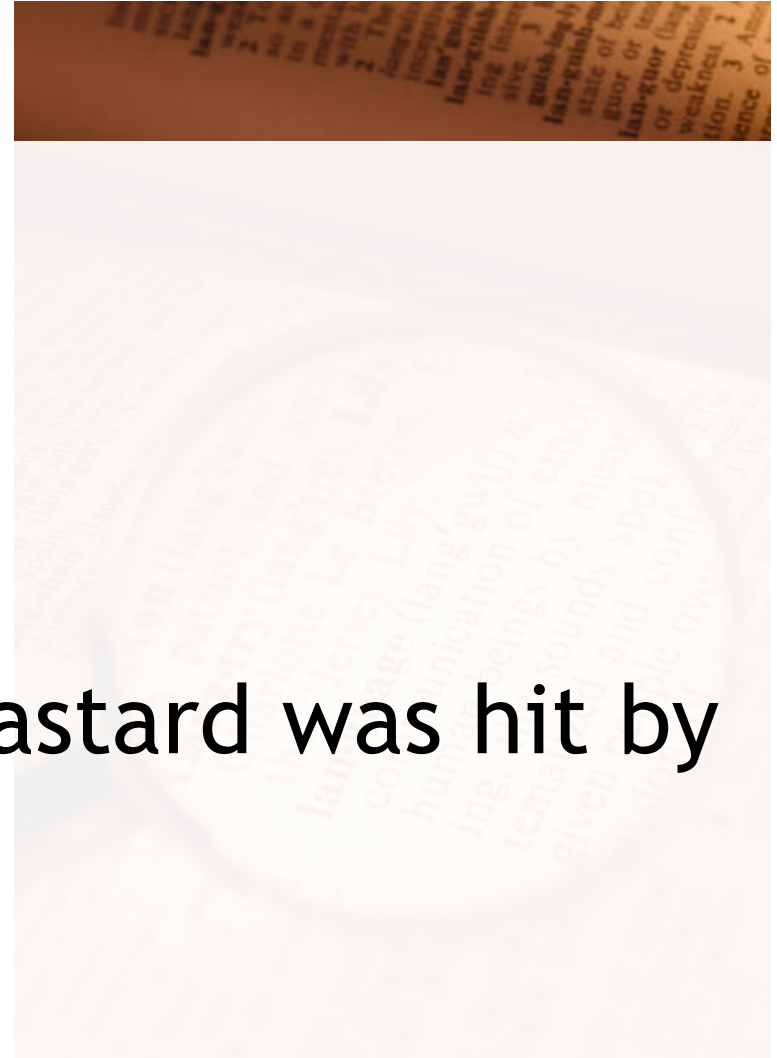
Contextual Appropriateness of Emotions

Contextual Appropriateness of Emotions

Typical affect analysis systems provide information on the expression of emotion in utterance.

– "Oh, I'm so happy!" [joy, happiness]

– "Oh, I'm so depressed..." [depression]

Contextual Appropriateness of Emotions

As long as the sentence is not too sophisticated, it's ok.

– "Oh, I'm so happy (because) I passed the exam!"

[joy, happiness]

– "Oh, I'm is so depressed (because) my girlfriend left…"

[depression]

Contextual Appropriateness of Emotions

When the context gets convoluted it gets messy.

– "Oh, I'm so happy (because) I passed the exam!"

[joy, happiness]

– "Oh, I'm so happy (because) that bastard was hit by a car!"

[joy, happiness]

– "Oh, I'm is so depressed (because) my girlfriend left…"

[depression]

– "Oh, I'm so depressed (because) the Valentine's Day is coming…"   [depression]

Contextual Appropriateness of Emotions

When the context gets convoluted it gets messy.

- "Oh, I'm so happy (because) I passed the exam!" **Appropriate**
                                          [joy, happiness]
- "Oh, I'm so happy (because) that bastard was hit b... **Inappropriate**
                                          [joy, happiness]

- "Oh, I'm is so depressed (because) my girlfriend left... **Appropriate**
                                          [depression]
- "Oh, I'm so depressed (because) the Valentine's Da **Inappropriate**
  coming..."   [depression]

Contextual Appropriateness of Emotions

Lets take a closer look at how context is realized in emotional sentences.

– 試験に合格してうれしい！ [joy, happiness]

"Oh, I'm so happy (because) I passed the exam!"

[Expression of emotion] [causal form] [**cause of emotion**]

cause of emotion = context of expression of emotion
makes the expression either Appropriate or Inappropriate

"Oh, I'm is so depressed (because) my girlfriend left…"

– バレンタイン・デーが来るから悲しいね… [depre…]

"Oh, I'm so depressed (because) the Valentine's Day is coming…"

Appropriate

Inappropriate

Contextual Appropriateness of Emotions

Appropriate

– "Oh, I'm so happy (because) I passed the exam!" [joy, happiness], 試験に合格してうれしい！

[Expression of emotion] [causal form] [**cause of emotion**]

cause of emotion = context of **expression of emotion**

makes the expression either Appropriate or Inappropriate

Original utterance	Aa, pasokon ga kowarete shimatta…(Oh no, the PC has broken…)					
longest n-gram (here: hexagram)	Aa [interjection]	pasokon [noun]	ga [particle]	kowareru [verb]	te [verb connector]	shimau [perfect form]
pentagram	pasokon ga koware te shimau					
tetragram	Aa, pasokon ga kowareru					
trigrams	pasokon ga kowareru			koware te shimau		

Contextual Appropriateness of Emotions

"…(because) I passed the exam!"

"I'm so happy…"
"I'm so glad…"
"He looked so happy…"
"My mom was so happy…"

emotive expression DB

WEB MINING

context of expression of emotion

		Original n-gram	pasokon ga koware te shimau
n-gram phrase ad-justing (morpheme modification)		/ -te /	pasokon ga koware te shima- tte
		/ -to /	pasokon ga koware te shimau to
		/ -node /	pasokon ga koware te shimau node
		/ -kara /	pasokon ga koware te shimau kara
		...	...

morphemes of causality:
-te, -to, -node, -kara, -tara

Contextual Appropriateness of Emotions

"…(because) I passed the exam!"

"I'm so happy…"
"I'm so glad…"
"He looked so happy…"
"My mom was so happy…"

emotive expression DB

WEB MINING

List of emotions appearing most often = appropriate / natural/ for this context

context of expression of emotion

Sentence: *Aa, pasokon ga kowarete shimatta…* (Oh no, the PC has broken…)		
Extracted emotion type	**Type extracted / all extracted types**	**Ratio**
[fear]	28/133	0.210526315789474
[sorrow, sadness]	26/133	0.195488721804511
[dislike, detestation]	16/133	0.120300751879699
[liking, fondness]	14/133	0.105263157894737
[relief]	12/133	0.090225563909774
[excitement]	11/133	0.082706766917293
[joy, delight]	10/133	0.075187969924812
[surprise, amazement]	9/133	0.067669172932330
[anger]	5/133	0.037593984962406
[shame, shyness, bashfulness]	2/133	0.015037593984962

Contextual Appropriateness of Emotions

"…(because) I passed the exam!"

"I'm so happy…"
"I'm so glad…"
"He looked so happy…"
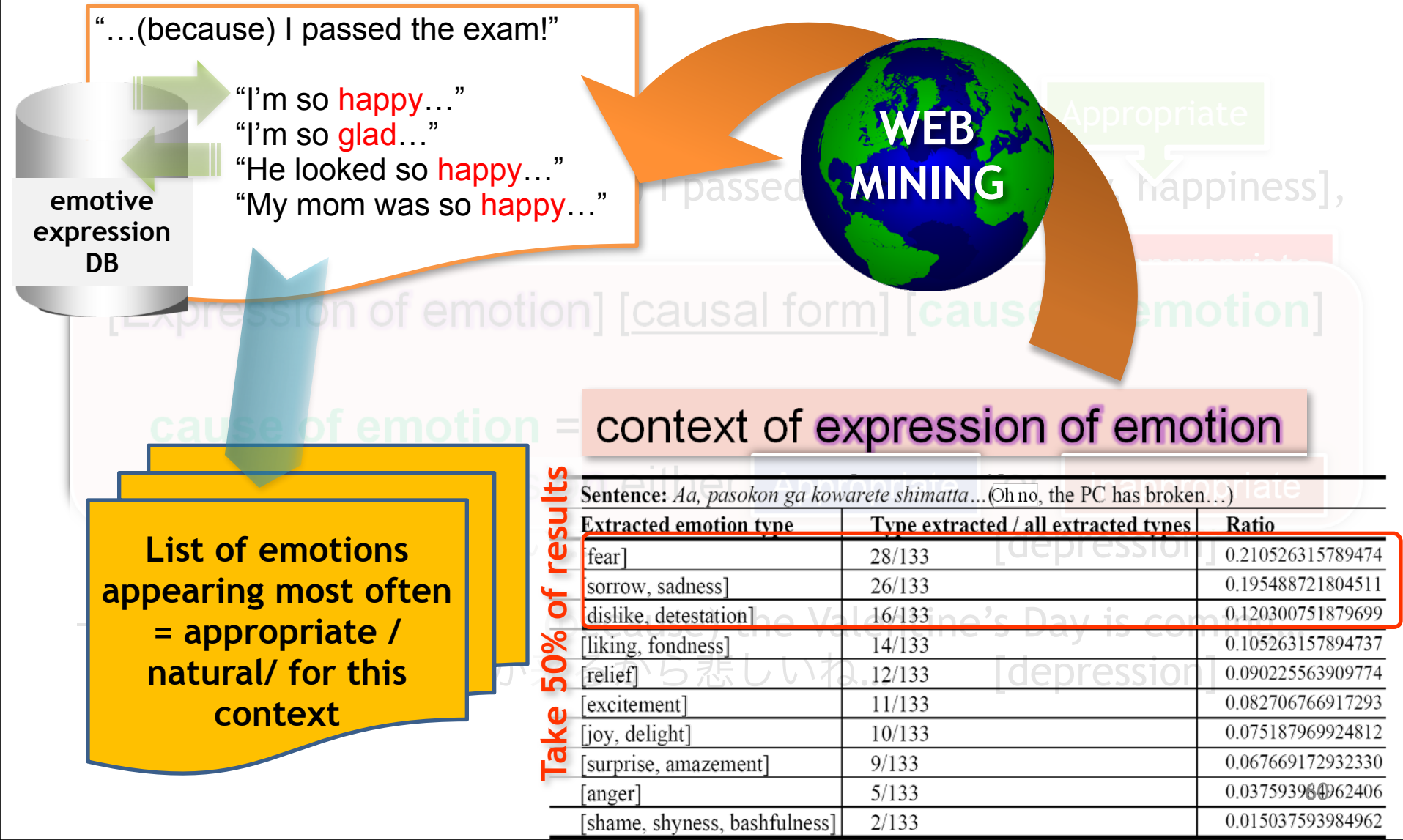"My mom was so happy…"

emotive expression DB

WEB MINING

List of emotions appearing most often = appropriate / natural/ for this context

context of expression of emotion

Take 50% of results

Sentence: *Aa, pasokon ga kowarete shimatta…*(Oh no, the PC has broken…)

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Contextual Appropriateness of Emotions

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emotive expression DB

WEB MINING

context of expression of emotion

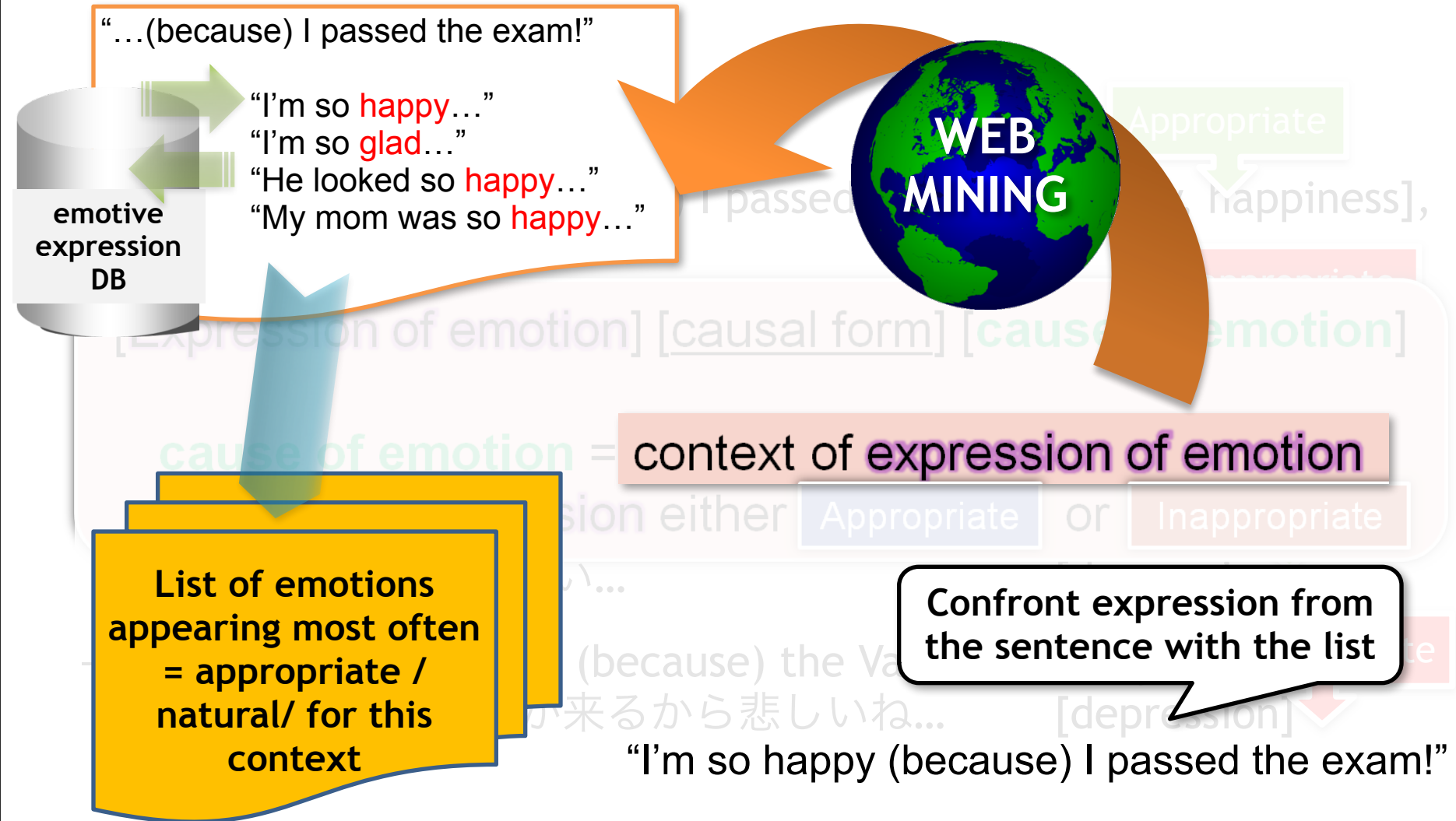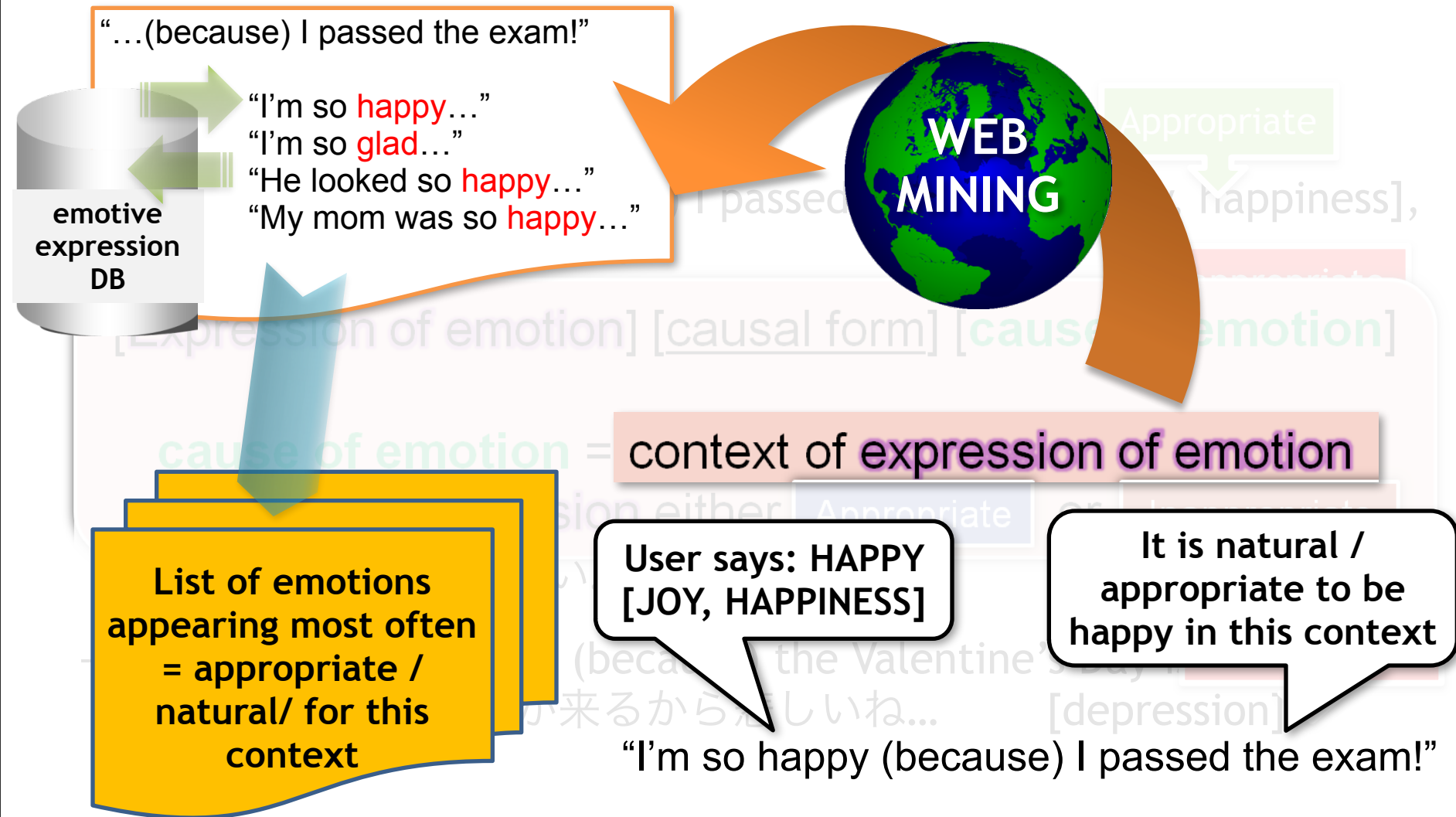List of emotions appearing most often = appropriate / natural/ for this context

Confront expression from the sentence with the list

"I'm so happy (because) I passed the exam!"

Contextual Appropriateness of Emotions

"…(because) I passed the exam!"

"I'm so happy…"
"I'm so glad…"
"He looked so happy…"
"My mom was so happy…"

emotive expression DB

WEB MINING

context of expression of emotion

List of emotions appearing most often = appropriate / natural/ for this context

User says: HAPPY [JOY, HAPPINESS]

It is natural / appropriate to be happy in this context

"I'm so happy (because) I passed the exam!"

Contextual Appropriateness of Emotions

Negative	Positive
Appropriate User: I hate him for making a fool of me in front of everyone. ML-Ask:dislike; Web mining:anger, dislike Agent: Yeah, you have a reason to be angry. [empathy]	User: I'm so happy I passed the exam! ML-Ask:joy; Web mining:joy, excitement Agent: Yeah! That's great! [sympathy]
Inappropriate User: I'm so depressed because St. Valentines day is coming. ML-Ask:dislike, depression; Web mining:excitement, joy Agent: You should be happy! [consolation]	User: I'd be happy if that bastard was hit by a car! ML-Ask:joy; Web mining:fear, sadness Agent: Are you sure this is what you really feel? [counsel]

Every emotion can be either appropriate or not

Contextual Appropriateness of Emotions
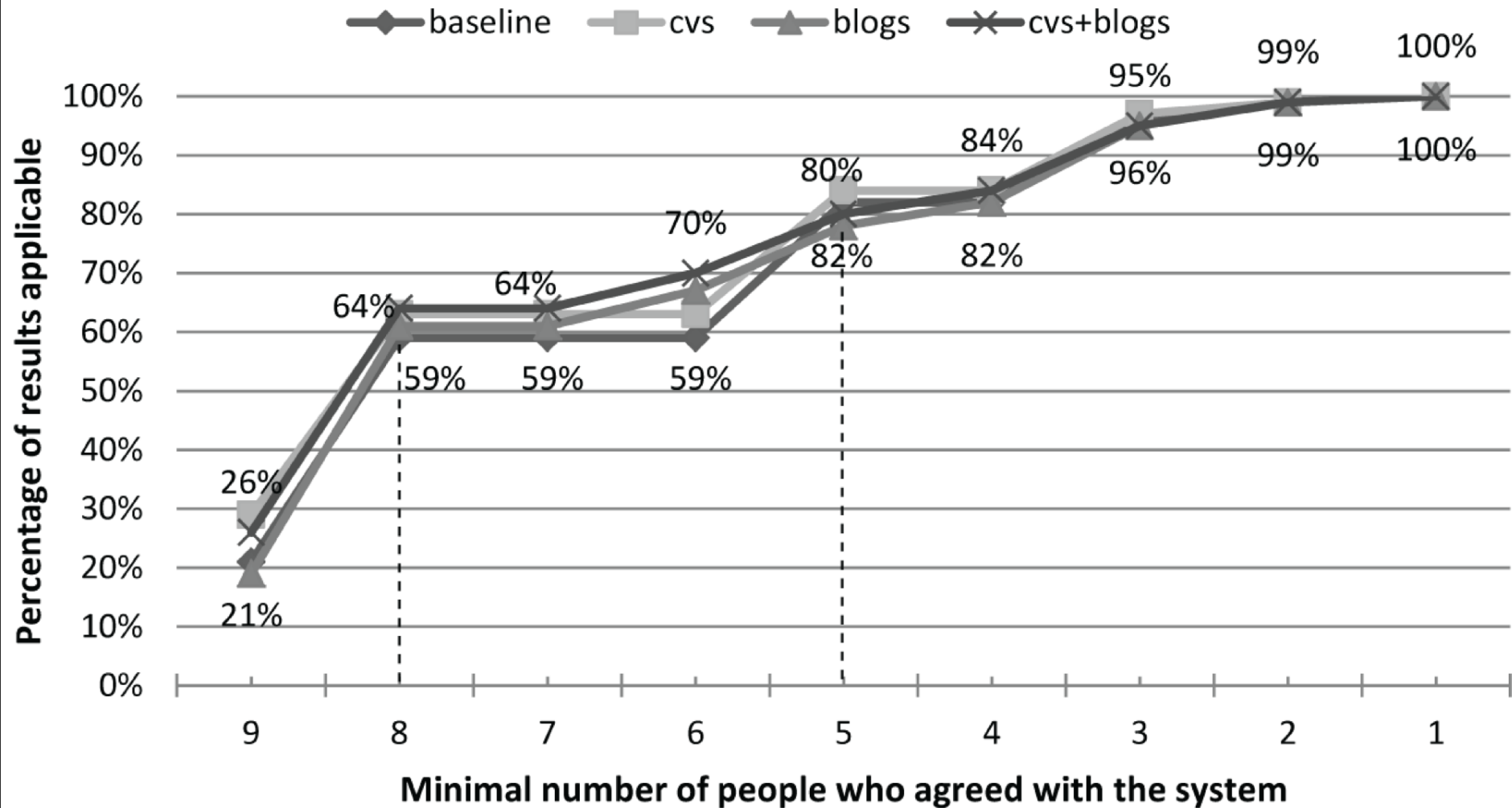
Versions of the System	Baseline vs CVS	Baseline vs Blogs	CVS vs CVS+Blogs	Baseline vs CVS+Blogs
Statistical Significance (p Value)	0.1599 (p>5%)	0.0274 (p<5%)	0.0274 (p<5%)	**0.0119 (p<5%)**

Contextual Appropriateness of Emotions

Emotional Intelligence Framework

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· Ability to generate or emulate vivid emotions to facilitate judgments and mem
· Ability to capitalize on mood swings to take multiple points of view; ability t
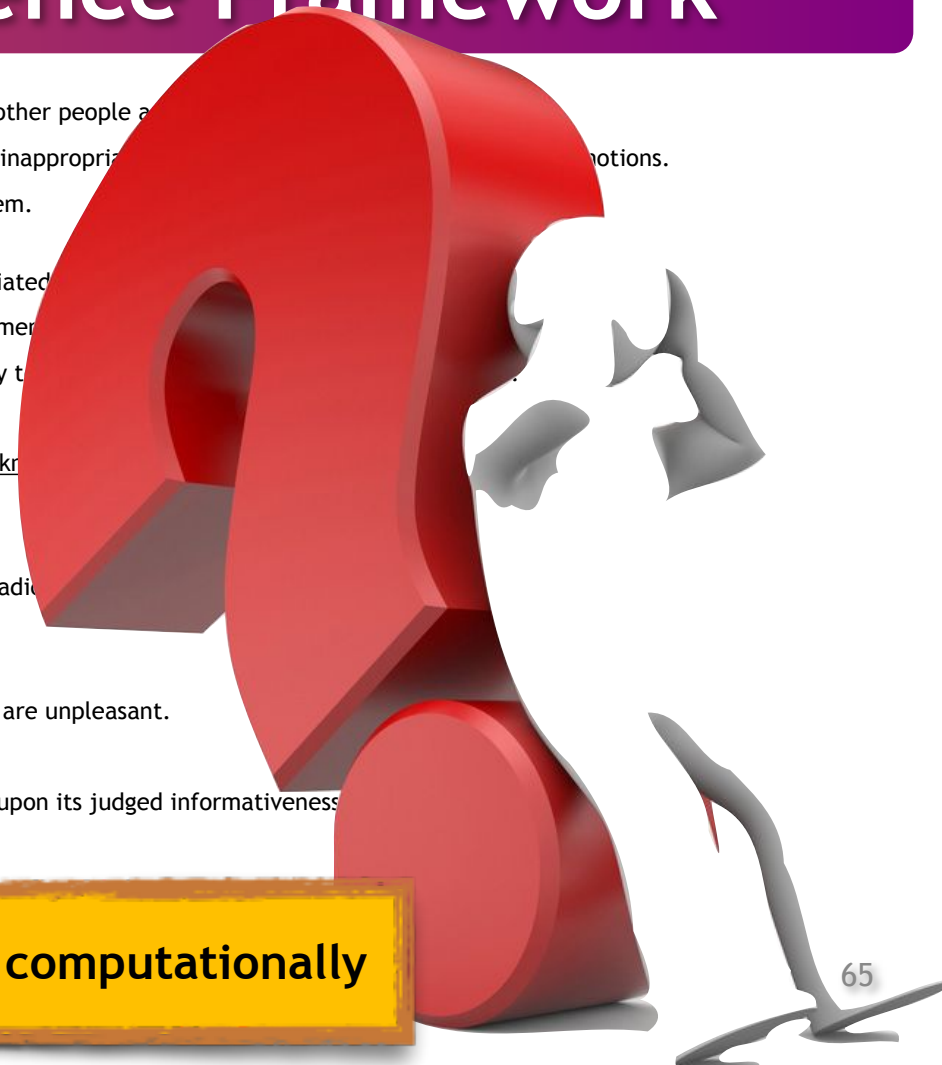· Ability to use emotional states to facilitate problem solving and creativity.

III Understanding and analyzing emotional information; employing emotional kn
· Ability to understand how different emotions are related.
· Ability to perceive the causes and consequences of emotions.
· Ability to interpret complex emotions, such as emotional blends and contradi
· Ability to understand and predict likely transitions between emotions.

IV Regulation of emotion
· Ability to be open to feelings, both those that are pleasant and those that are unpleasant.
· Ability to monitor and reflect on emotions.
· Ability to engage, prolong, or detach from an emotional state, depending upon its judged informativeness
· Ability to manage emotion in oneself and others.

The abilities are difficult to formalize computationally

Contextual Appropriateness of Emotions

Emotional Intelligence Framework

I Perception, appraisal, and expression of emotion
- Ability to recognize emotion in one's physical and psychological states, in other people and objects.
- Ability to discriminate between accurate and inaccurate, appropriate and inappropriate, honest and dishonest, expressions of emotions.
- Ability to express emotions accurately, and to express needs related to them.

II Emotional facilitation of thinking
- Ability to redirect and prioritize one's thinking based on the feelings associated with

discriminate between [...] appropriate and inappropriate [...] expressions of emotions

We've done only a half-step further in Emotional Intelligence...

- Ability to perceive the causes and consequences of emotions.
- Ability to interpret complex emotions, such as emotional blends and contradictory feeling states.
- Ability to understand and predict likely transitions between emotions.

IV Regulation of emotion
- Ability to be open to feelings, both those that are pleasant and those that are unpleasant.
- Ability to monitor and reflect on emotions.
- Ability to engage, prolong, or detach from an emotional state, depending upon its judged informativeness or utility.
- Ability to manage emotion in oneself and others.

John D. Mayer and Peter Salovey. *What is emotional intelligence?*, Emotional Development and Emotional Intelligence:3-31, 1997.

Computational Phronesis

What we have done already?

1. emotion subject;

2. emotion object;

3. Verification of contextual appropriateness of emotions;

4. Verification of degree appropriateness;

5. behavioral pattern (reaction)

Computational Phronesis

What we have done already?

1. emotion subject;
2. emotion object;
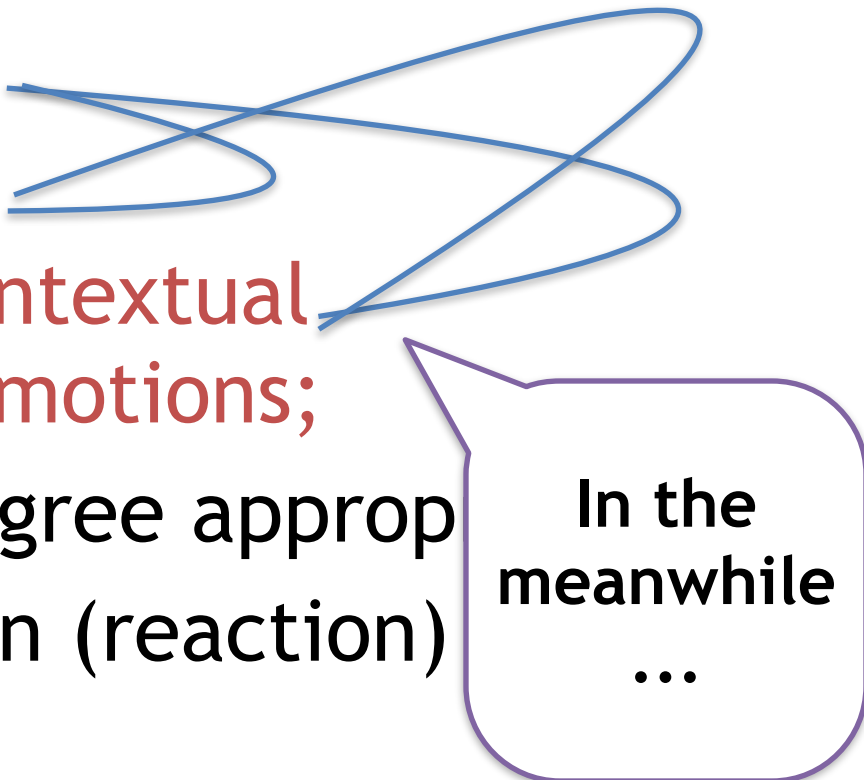3. Verification of contextual appropriateness of emotions;

That's what we still have to do…

4. Verification of degree appropriateness;
5. behavioral pattern (reaction)

Computational Phronesis

What we have done already?

1. emotion subject;
2. emotion object;
3. Verification of contextual appropriateness of emotions;
4. Verification of degree approp
5. behavioral pattern (reaction)

In the meanwhile ...

Computational Phronesis

What we have done already?

1. emotion subject;

2. emotion object;

3. Verification of contextual appropriateness (emotions)

4. Verification of degree of approp

5. behavioral pattern (reaction)

In the meanwhile...

A long way toward machine emotional integrity...

Computational Phronesis

What we have done already?

1. emotion subject;

2. emotion object;

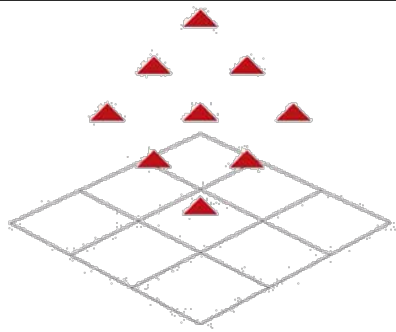3. Verification of contextual appropriateness of emotions;

4. Verification of degree approp

5. behavioral pattern (reaction)

In the meanwhile ...

But it seems at last we know the direction.

Thank you for your attention!

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