

Why is the theory of constructed emotion relevant in computer science?

Dr Kuldar Taveter and Tahira Iqbal

Institute of Computer Science, University of Tartu, Estonia

Outline

- Relevance of emotions
- Theories of emotion
- Theory of constructed emotion
- Emotional requirements
- Applications
- Answer
- Conclusions

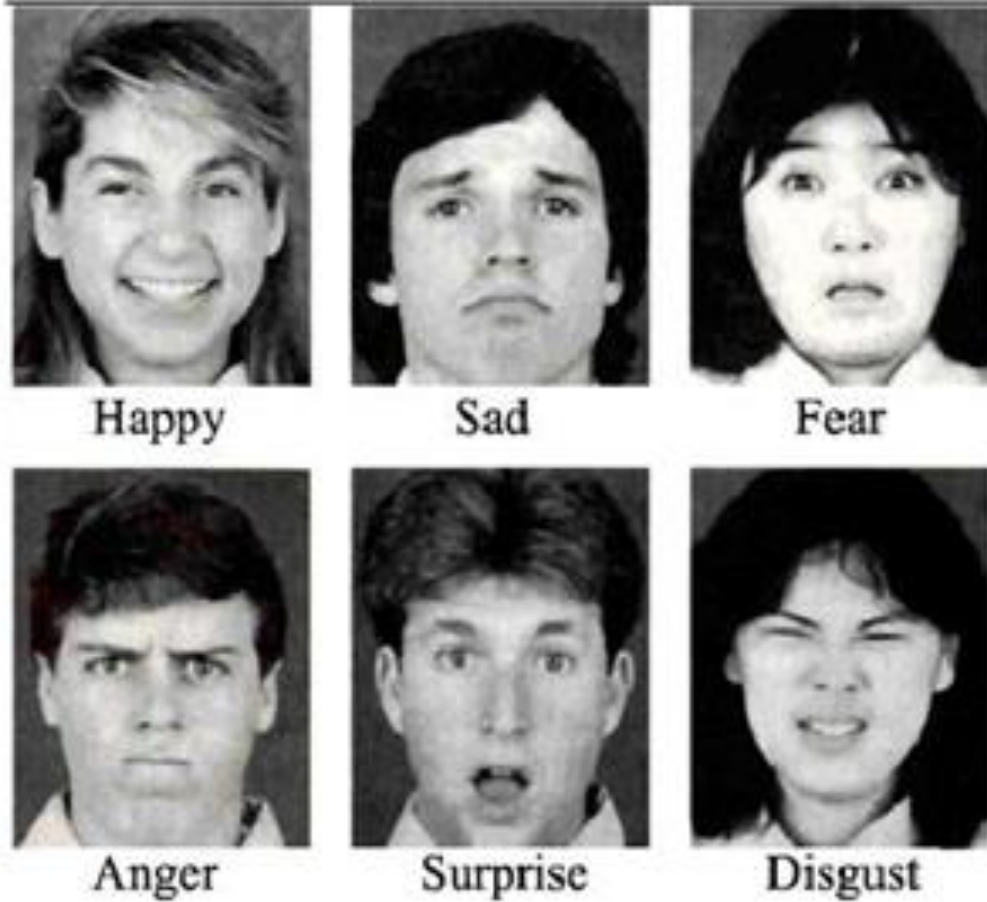
Relevance of emotions

- Elicitation and representation of emotional requirements
- Embedding emotions in software systems

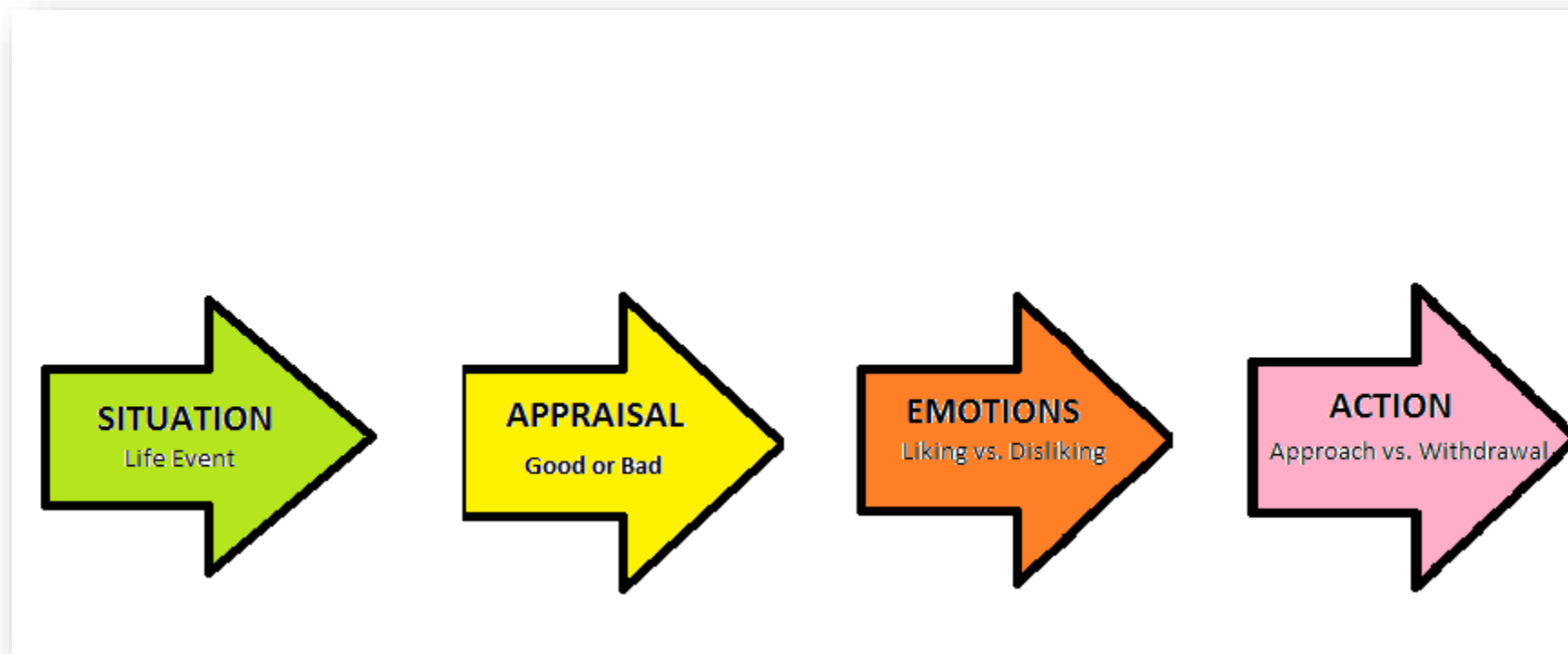
Theories of emotion

- Theories of basic emotion
- Appraisal theories of emotion
- Dimensional emotion theories

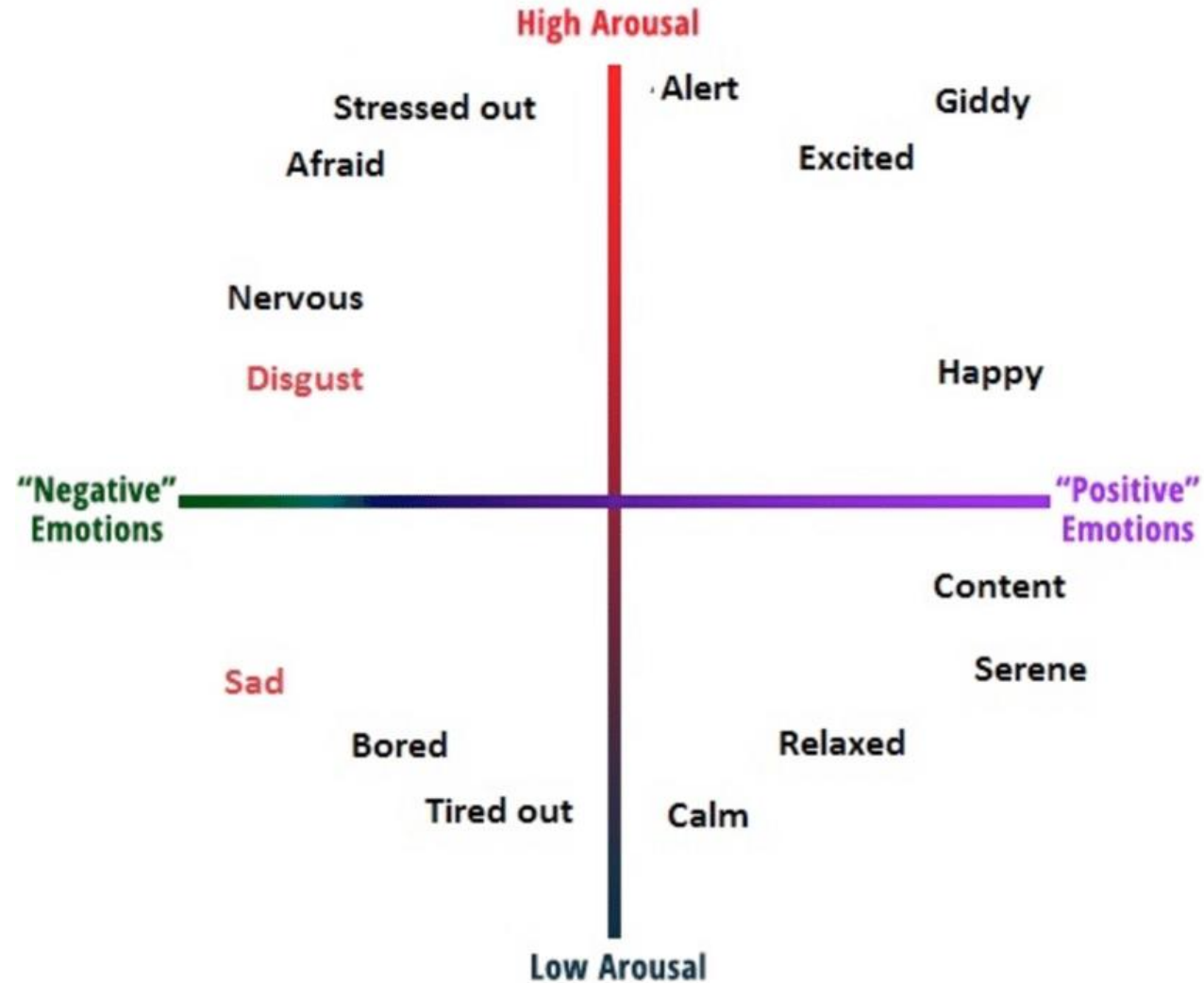
Theories of basic emotion



Appraisal theories of emotion



Dimensional emotion theories



Theory of constructed emotion

- Emotions are constructed in terms of affects in three contexts:
 - in-the-moment interactions
 - relationships
 - cultural contexts
- Emotions are constructed to maintain the body balance according to the:
 - situations
 - goals

Example: Romantic love

- Goal: Experience romantic love
- Emotions: *passionate, longing, lustful*
- Emotions are co-constructed – body balance of both sides of romantic love changes in a synchronised manner
- Co-construction is also important between humans and software



Example: *mono no aware* (物の哀れ)

- Goal: Experience the transience and impermanence of life
- Emotions: *feeling love, sadness, and being overwhelmed*
- Lisa Feldman Barrett: "*Emotions are not the reactions to the world; they are your constructions of the world.*"



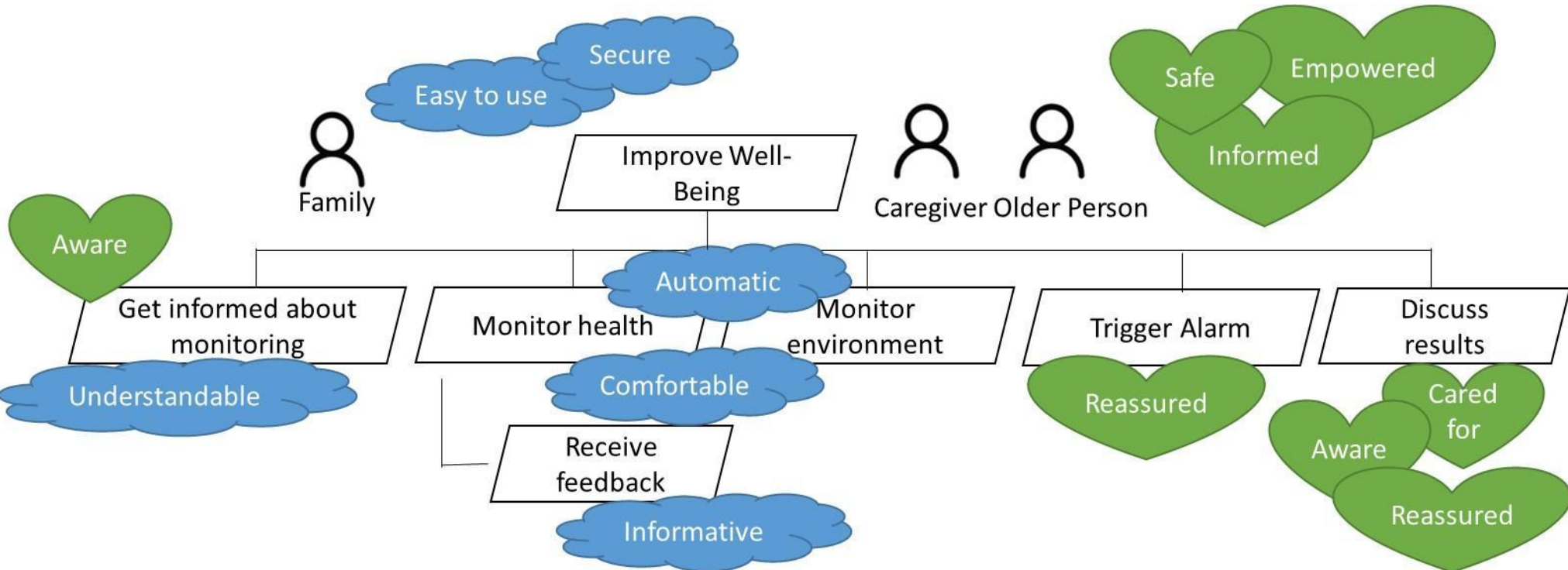
Emotion concepts

- Emotion concepts are probabilistically constructed based on previous experiences in particular situations
- Emotion concepts serve goals to be achieved

Emotion words

- Emotion concepts are referred to in the brain by emotion words
- Emotion words act as cues for retrieving situations from our *episodic memory*
- => Emotional requirements should be represented in terms of emotion concepts and emotion words

Emotional requirements (Pharaon project)



Emotion-aware software

- A general-purpose computational architecture for the theory of constructed emotion is hard to implement because of computational complexity [see, e.g., Kwisthout, J., & van Rooij, I. (2019). [Computational Resource Demands of a Predictive Bayesian Brain.](#) *Computational Brain & Behavior*, 3, 174-188]
- => An architecture implementing the theory of constructed emotion should be based on corpuses of emotion words and expressions

Emotional chatbot (Kirikal, 2020)

How did you sleep last night? Did you dream of anything?

> Awful. I had a bad dream. I also did not get much sleep and I woke up very tired.

Sorry to hear that

How did you wake up this morning? How did your morning go?

> Really bad, but luckily coffee saves the day. I love a good morning coffee and a peaceful sunrise. Today I got both!

Good to hear.

How was your workday? How did you feel throughout the day?

Your answer...



SEND

Applications

- Applications for older adults
- Applications for mental health
- Serious games
- Interactive digital narratives (IDNs)

Applications for older adults (Pharaon and SHELDON projects)

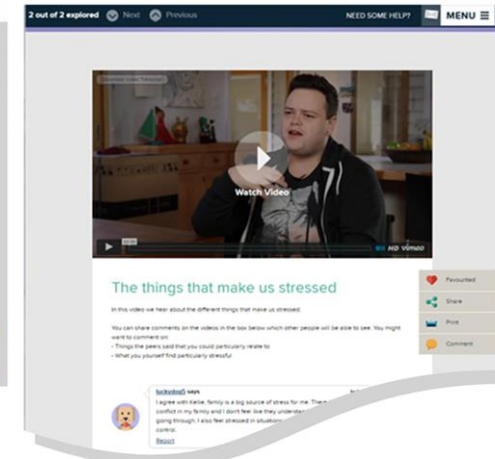
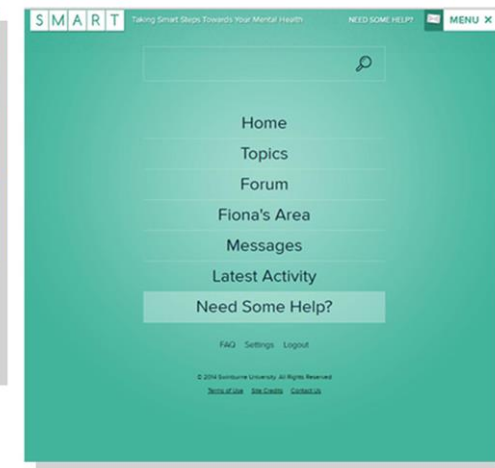
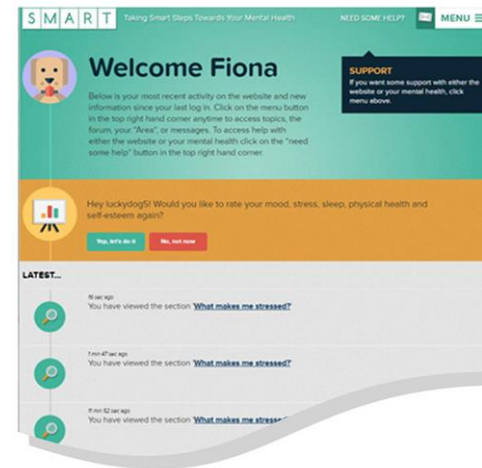
State of the Art Report for Smart
Habitat for Older Persons

April 2019



Applications for mental health

- Example from: Neil, T., et al. (2016). [Promoting personal recovery in people with persisting psychotic disorders: Development and pilot study of a novel digital intervention.](#) *Frontiers in Psychiatry*, 7, 196.



Serious games: Aspergion (Marshall, 2018)



Interactive Digital Narratives: Princess Maker



References

- Taveter, K.; Iqbal, T. (2021). [Theory of Constructed Emotion Meets RE. *Fourth International Workshop on Affective Computing for Requirements Engineering \(AffectRE'21\)*](#), 21 September 2021, IEEE 29th International Requirements Engineering Conference Workshops (REW), pp. 383-386. IEEE.
- Taveter, K. & Lewandowska-Tomaszczyk, B. (2021). *Applying the theory of constructed emotion to the design and implementation of Interactive Digital Narratives*. Presentation at the workshop “Language & Emotion”. Proceedings of the [Conference Interlingual and Intercultural Contacts and Contrasts – Approaches and Practice](#) (C&C 2021), Springer (forthcoming).
- Kirikal, A. (2020). [Computational simulation of how emotions are processed in our brain according to the theory of constructed emotion](#). M.Sc. Thesis, Institute of Computer Science, University of Tartu.
- Zimmer, N. & Taveter, K. (2021). *Socio-Technical Simulation and Experimentation of Airline Operations Control*. Working paper, submitted to the [International Conference on Autonomous Agents and Multi-Agent Systems 2022](#).

Answer

- Theory of constructed emotion is relevant in computer science because:
 - It provides a solid foundation for elicitation and representation of emotional requirements based on goals, and emotion words and expressions
 - It provides a solid foundation for engineering emotion-aware software by relying on situation-based computational architectures that are based on corpuses of emotion words and expressions

Conclusions

- Design of a software should be related to the situations where the software is meant to be used
- Emotional requirements should be treated as first-class citizens, separately from non-functional requirements
- Algorithms based on corpuses of emotion words and expressions provide practical solutions