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Recommender Systems supporting Decision Making through Analysis of User Emotions and Personality

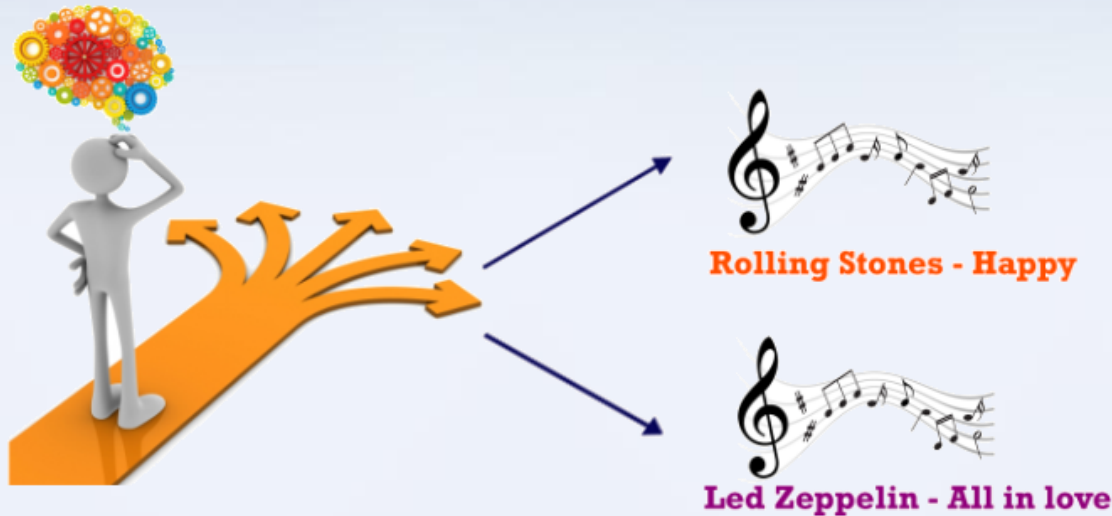
Speaker:

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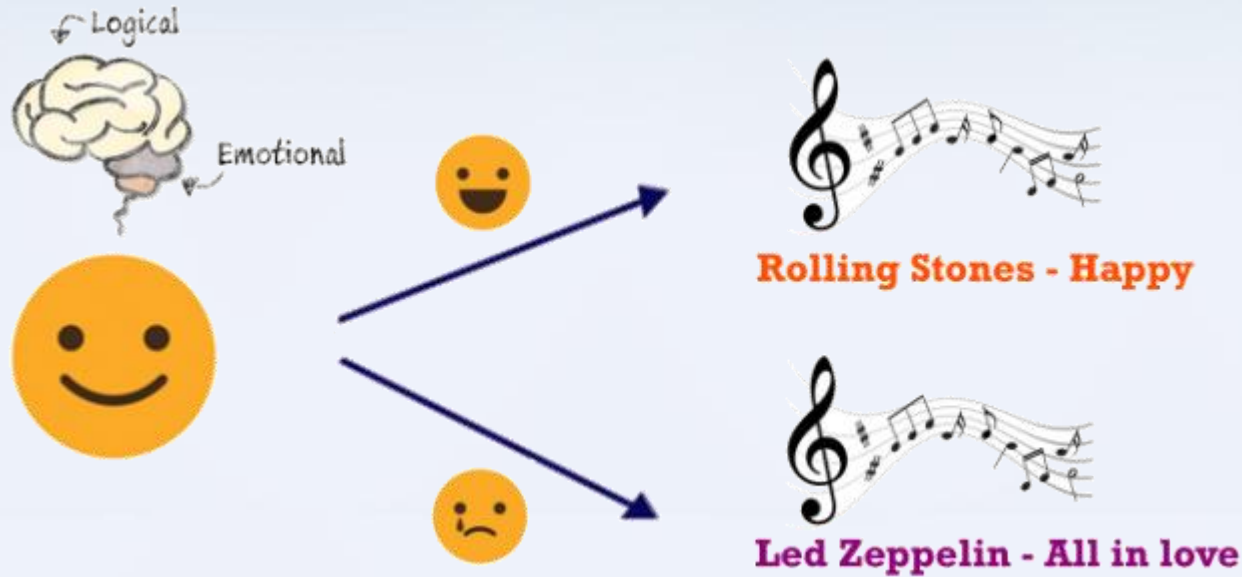
Decisions and emotions



A person facing a choosing problem has to ***consider different solutions*** and take a decision.

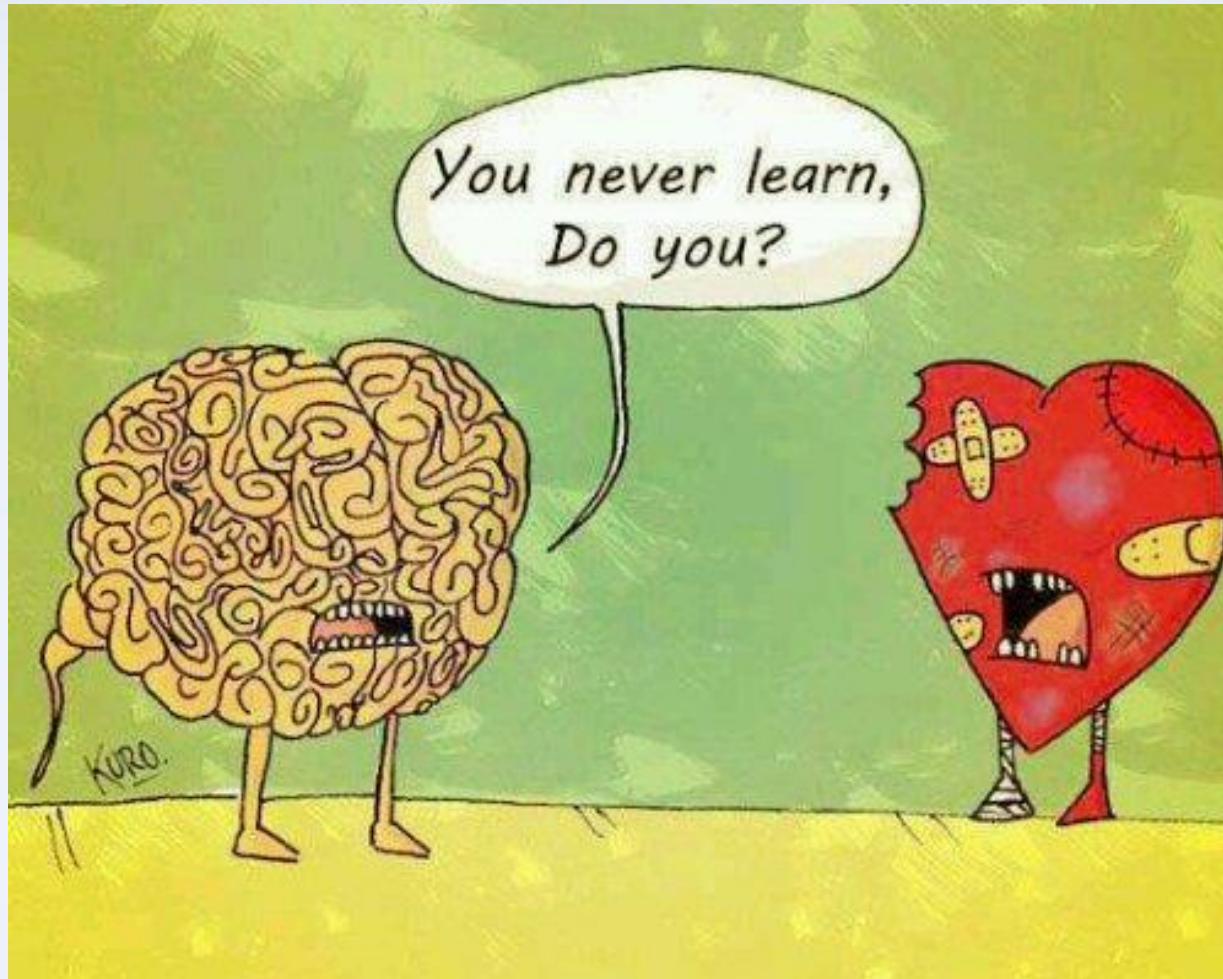
Traditional approaches of behavioural decision making, consider choosing as a rational cognitive process that **estimates** which of various alternative choices **would yield the most positive consequences**, which does ***not necessarily entail emotions***.

Decisions and emotions



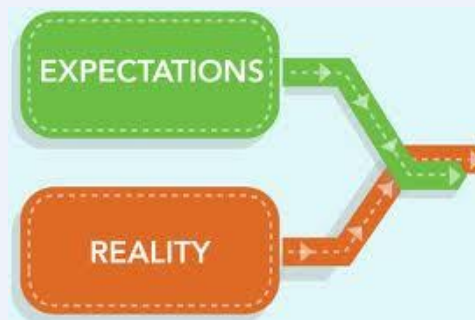
Users might evaluate the consequences of the possible **options** by **taking into account both positive and negative emotions** associated with them and then select those actions that **maximize positive emotions and minimize negative emotions**.

Decisions and emotions



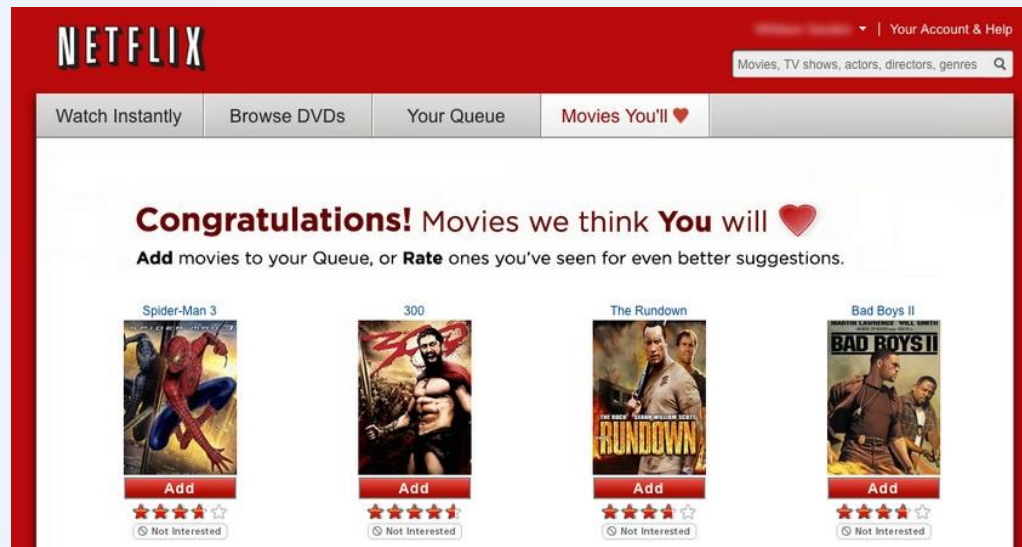
Influence of emotions

- Emotions are considered as external forces *influencing* an otherwise non-emotional process:
 - **Immediate emotions** are consequences of events that has recently affected the user. They are not directly connected with the decision but they influence the final choice.
 - **Expected emotions** are affects that the user supposed to prove as a consequence of the decision. She will choose the option that will maximize the positive expectations.



Recommender Systems

Recommender Systems (RSs) are tools which implements *information filtering strategies* to deal with information overload and to **support users into choosing tasks**, by taking into account their preferences and contexts of choosing. RSs can adopt **different filtering algorithms** based on: the item content (description), the user activity, the knowledge of context, but ***usually they do not consider emotions.***



Emotions and Recommender Systems

Relevance of affect in RSs was discussed in literature, that showed an increment of recommendation performance using emotions as a context in a context-aware RS or affective label associated to the recommender items.

Emotional feedback play **different roles** related to the acquisition of user preferences:

1. As a source of **affective metadata for item modelling** and building a preference model;
2. As an **implicit relevance feedback** for assessing user satisfaction.

In this work, we focus on the first issue: the idea is **to acquire affective features that might be exploited for user modelling.**

Study Purpose

Our work aims at defining a general framework in which emotions play a relevant role because they are embedded in the reasoning process.

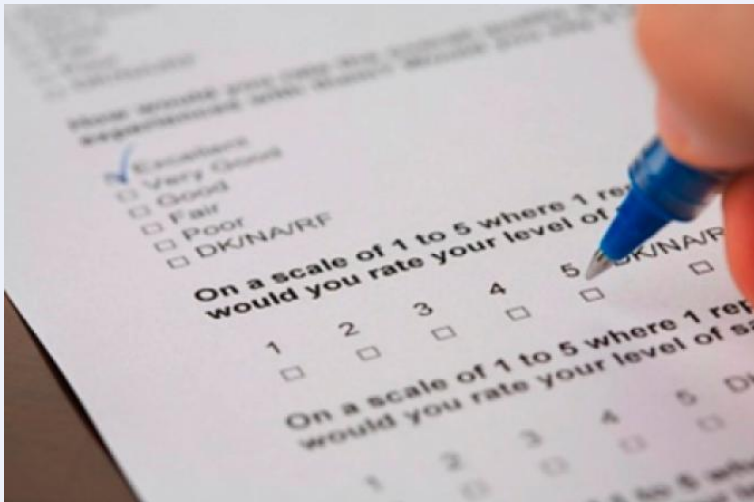
1. Which techniques are most suitable to **identify users' emotions** from their behaviour?
2. How to **define a computational model** of personality and emotions?
3. How to **include the emotional computational model in a recommendation process**?

Emotion Detection: hard task



Emotion Detection

Emotions during the decision process can be detected using implicit or explicit strategies.



Explicit Strategies

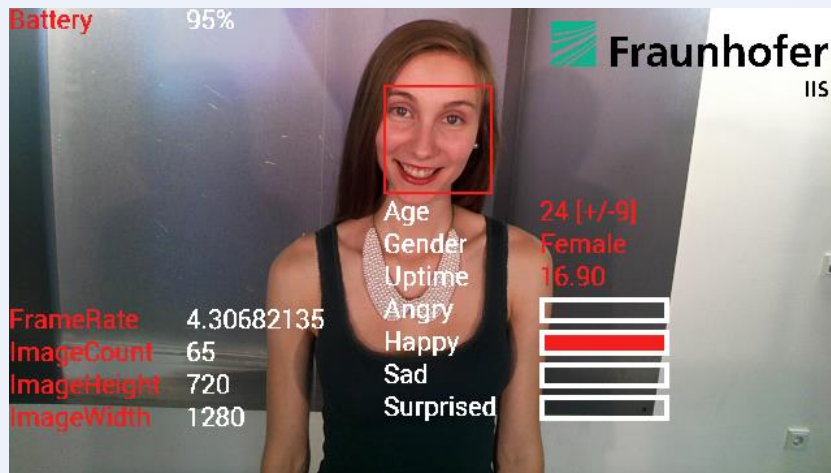
*Questionnaires** can be used to ask the user the emotions that she is feeling.

Users will check, from a list of Six-Ekman emotions*, which are the emotions that better describe their current feeling.

Emotion Detection

Often people are not able to explicate correctly emotions, and explicit strategies could not be enough to correct identify immediate emotions.

Implicit Strategies



<http://www.iis.fraunhofer.de/>

Poria* present a multi-modal framework that uses audio, video and text sources to identify user emotions and to map them into the Ekman's six emotions.

The results show that high precision can be achieved in the emotion detection task by combining different signals.

Emotion Detection and Text

Research on this topic showed that both user personality traits and user emotional state can be inferred by **adopting Natural Language Processing (NLP) techniques.**

Machine learning techniques have been also used for this purpose: one of the **most useful framework adopted is SNoW***, a general purpose multi-class classifier.

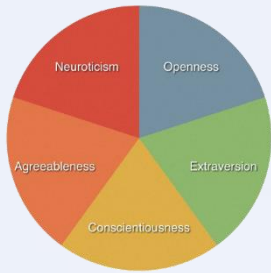
Strategies based on emotion lexicon are also popular.

They usually identify key terms in sentences and, then check the emotions associated to each word in an emotion-based lexicon.

In our proposal, we will evaluate different strategies for acquiring both emotions and personality traits.

Affective profile

$$AP = \{ P T, H C, C E \}$$



Personality

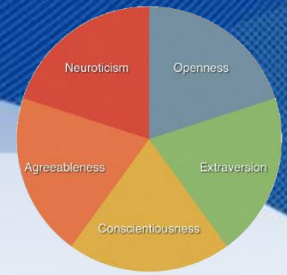


Historical Cases
with Emotions



Context and
experience

The user **affective profile** is an **extension** of the standard user profile used by RSs. **It will be used by the RS to adapt its computational process** and to generate recommendations according to emotions



Personality traits

Personality Profiling Systems Inc. Summary Report – Sarah Jones									
	1	2	3	4	5	6	7	8	
Reserved						•			Outgoing
Less intelligent					•				More intelligent
Affected by feelings						•			Emotionally Stable
Submissive					•				Dominant
Serious				•					Happy-go-lucky
Expedient						•			Conscientious
Timid							•		Venturesome
Tough-minded				•					Sensitive
Trusting		•							Suspicious
Practical					•				Imaginative
Forthright						•			Shrewd
Self-assured				•					Apprehensive
Conservative	•								Experimenting
Group dependent				•					Self-sufficient
Uncontrolled					•				Controlled
Relaxed	•								Tense



A 44-Item Big Five Inventory questionnaire proposed by John and Srivastava (1999) could be used to get the user personality traits.

Another techniques that can be adopted is the automatic extraction of personality traits from Social network as showed by Golbeck (2011)



Historical Cases

An historical decision case describes accurately the decision making task and emotions felt by the users.

Emotion-aware RSs have to identify immediate emotions and forecast expected emotions.

- The decision task can be divided in three stages in according to *Tkalckic: early, consuming and exit

During all the decision, strategies of emotion identification from video, audio source will be stored. The process will be supported from strategies of emotion extract from Social Network posts, while an additional emotional value could be gathered from user asking her the emotion felt at decision time.



Historical Cases

A case contains early stage emotions, consuming stage emotions, exit stage emotions, and a description of the task.

The description of the task is defined by:

- **Context of decision**
- **Problem** and elements among which choosing, decision taken
- **Explicating feedbacks** in a scale from 1 to 10 to describe the utility of suggestions (1 not useful, 10 extremely useful).

The historical case **could be enriched with more features**, for example a description of interaction between user and system, but we decide to simplify the situation for realizing a preliminary working framework.



Context and expertise

The context is characterized by **explicit features that describe user preferences in a specific domain.**

The expertise of user in the specific domain is the number of decisions taken in this domain, starting from an initial value obtained from a user ability questionnaire.

The available contexts of applications will be defined a priori in a list of chooses because we do not focus on the context detection strategies.

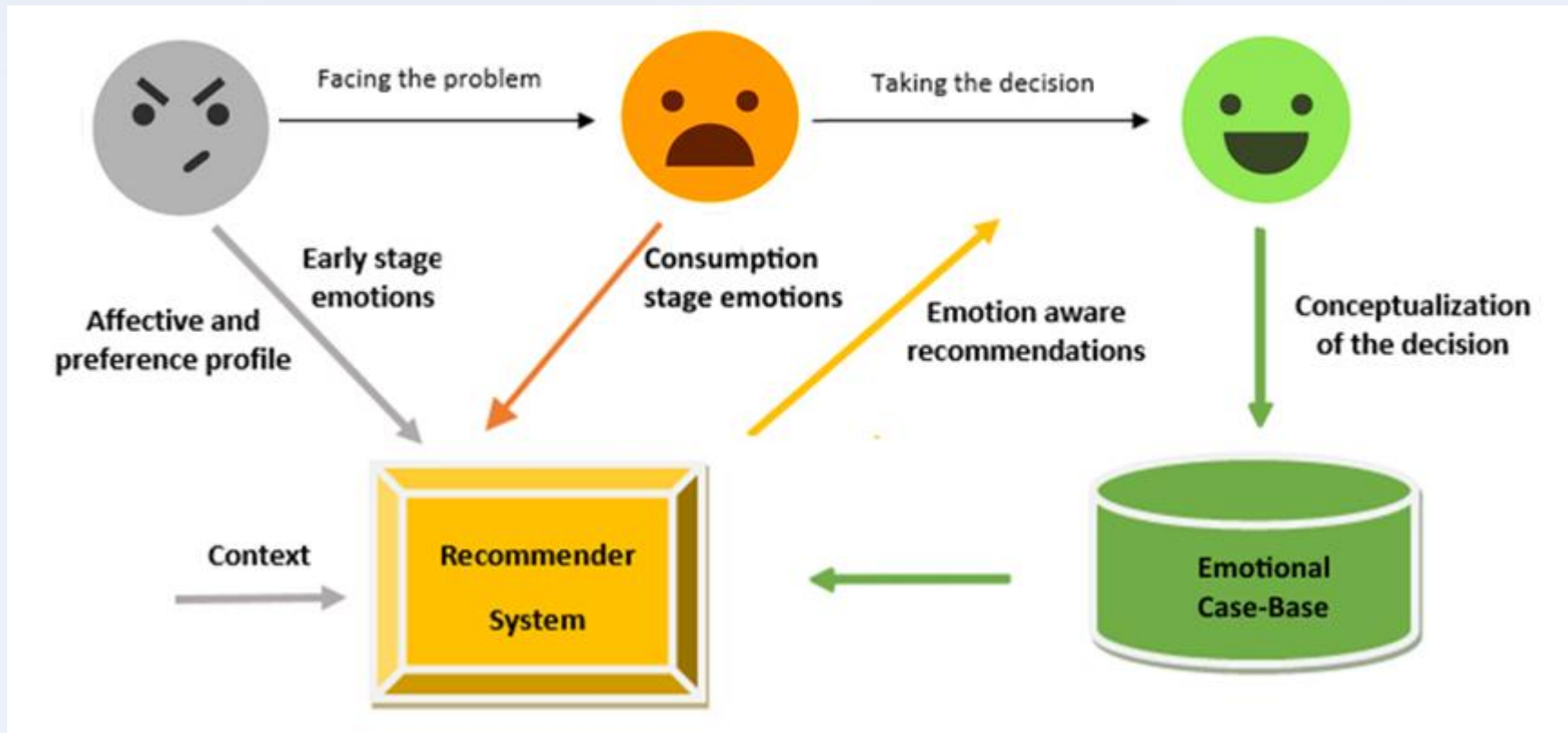
Emotional-Recommender System

The idea is to collapse all the information acquired about the emotional state of the user and her personality **into an affective profile** which stores both rational and irrational data about user decisions.

The affective profile is a knowledge base that allows the RS to reason about past user's choices, emotions felt during the decision process, contexts in which decisions were taken.

An Emotion-aware RS will exploit case base reasoning to solve new problems by adapting past solutions in similar context, and **taking into account the emotional state of the user**, as well as personality traits.

Emotional-Recommender System



Emotional-Recommender System Pipeline

1. The Recommender has to **identify users similar to the active user** (the one for which suggestion must be provided).

Similarity measures, like cosine similarity, are used on vectors obtained combining personality features and preference features in the specific context.

2. This **set of users**, including the active **user**, is used to **identify decisions taken in the past** that **match the problem**, the **active user emotional state**, and must have **positive exit stage emotions** or positive user feedback.

Emotional-Recommender System Pipeline

3. From the historical cases detected, **candidate solutions are extracted and adapted** (eg. filtered or ranked, adapted for increase serendipity) according to the context of the problem. **The obtained recommendations are proposed to the active user.**
4. **The decision** taken, the problem, **the emotional state** of the user, and a feedback of the utility of recommendations **are stored in the Emotional Case-Base, and are reused** for future recommendations.

Adapting candidate solutions

Different strategies are available to adapt, rank or filter the solutions:

1. **Rank the solutions** in according to **user preferences in the specific emotional state** to increase the utility of suggestions
2. Using the **expertise of the user in the specific domain** is possible to rank recommendations to support users with low experience. Less risky solutions be suggested first than others.
3. **Rank the solutions** in according to **the influence of emotional features on the user based on the risk that the decision involves.**

For example Schlosser describes the role of emotions in risky and uncertain domains, where emotions influence the ability to consider all the relevant aspect of the decision and the quantity and quality of information interpreted.*

*What a feeling: the role of immediate and anticipated emotions in risky decisions. Journal of Behavioral Decision Making 26.1. Pages: 13-30, 2013

Cold start

If poor data are available for the proposed computation pipeline, an **inference from personality traits** in the specific domain could be **used to choose possible candidate solutions**.

For example, for people with an high value of "**Openness**", **uncommon** solutions can be selected as a candidate recommendations.

Where will I take inference rules?

- Psychological literature
- Recent studies in Recommender Systems and Emotions
- ...



Remarks and Ongoing Work

Systems that support the decision making task, currently take into account emotions in a limited way, while **we have proposed a solution able to embed emotions and personality traits into the recommendation process.**

And now...



