Emotional Artificial Intelligence in Socio-Technical Systems

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GitHub

- **6 million** active users
- **20 million** active repositories
- **10 million** active issues
- **331 thousand** active organizations

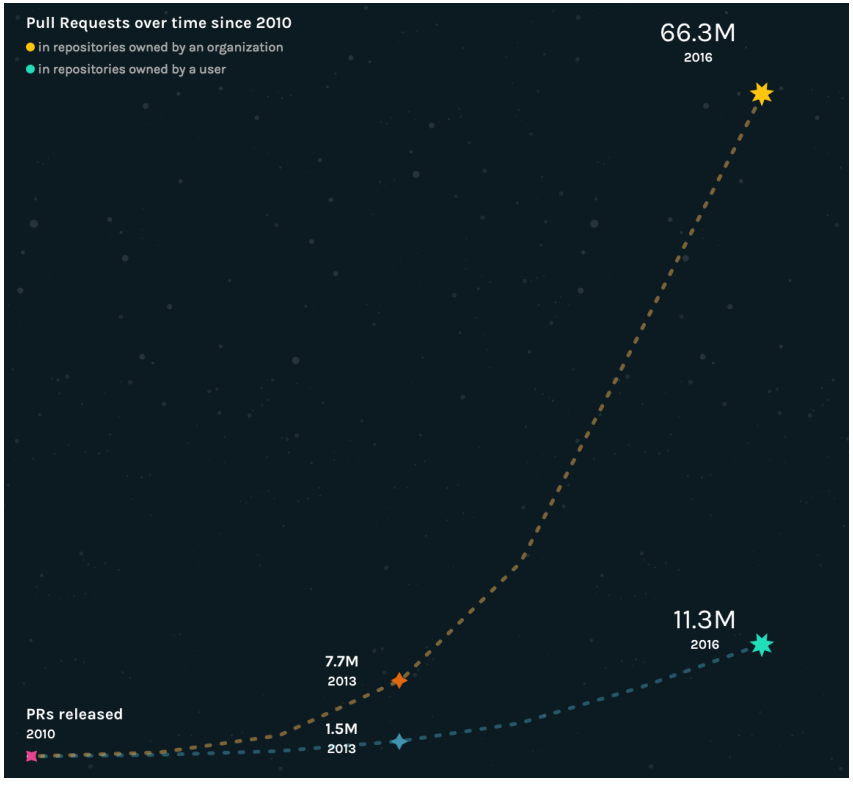
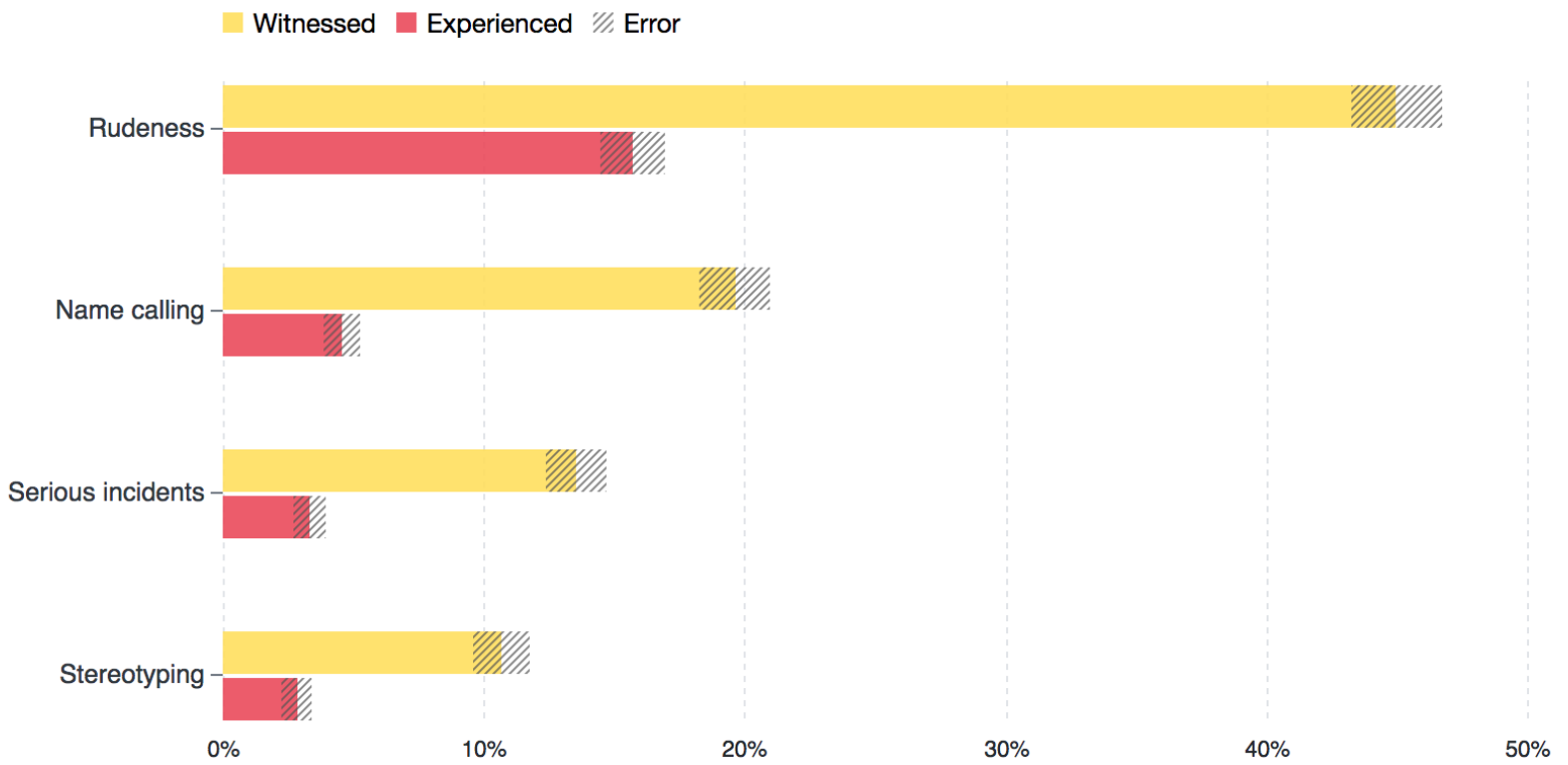


Fig2. - Negative behavior in open source

Source: opensourcesurvey.org



GitHub

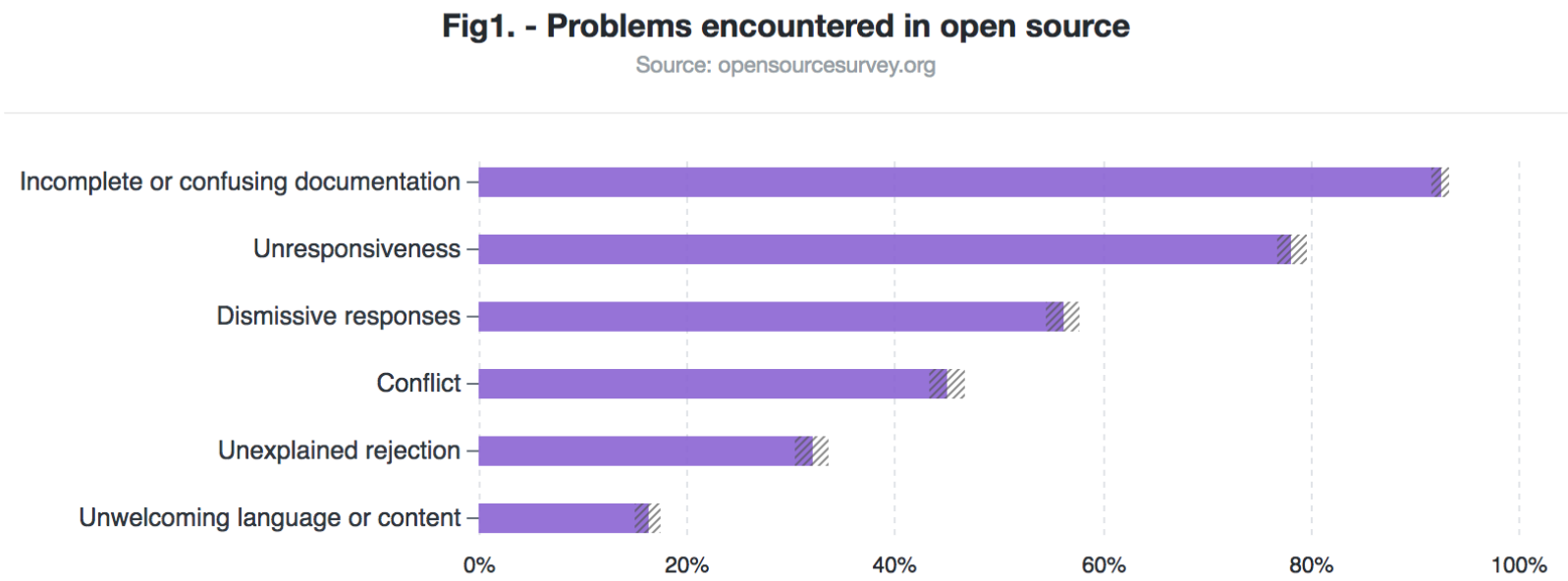


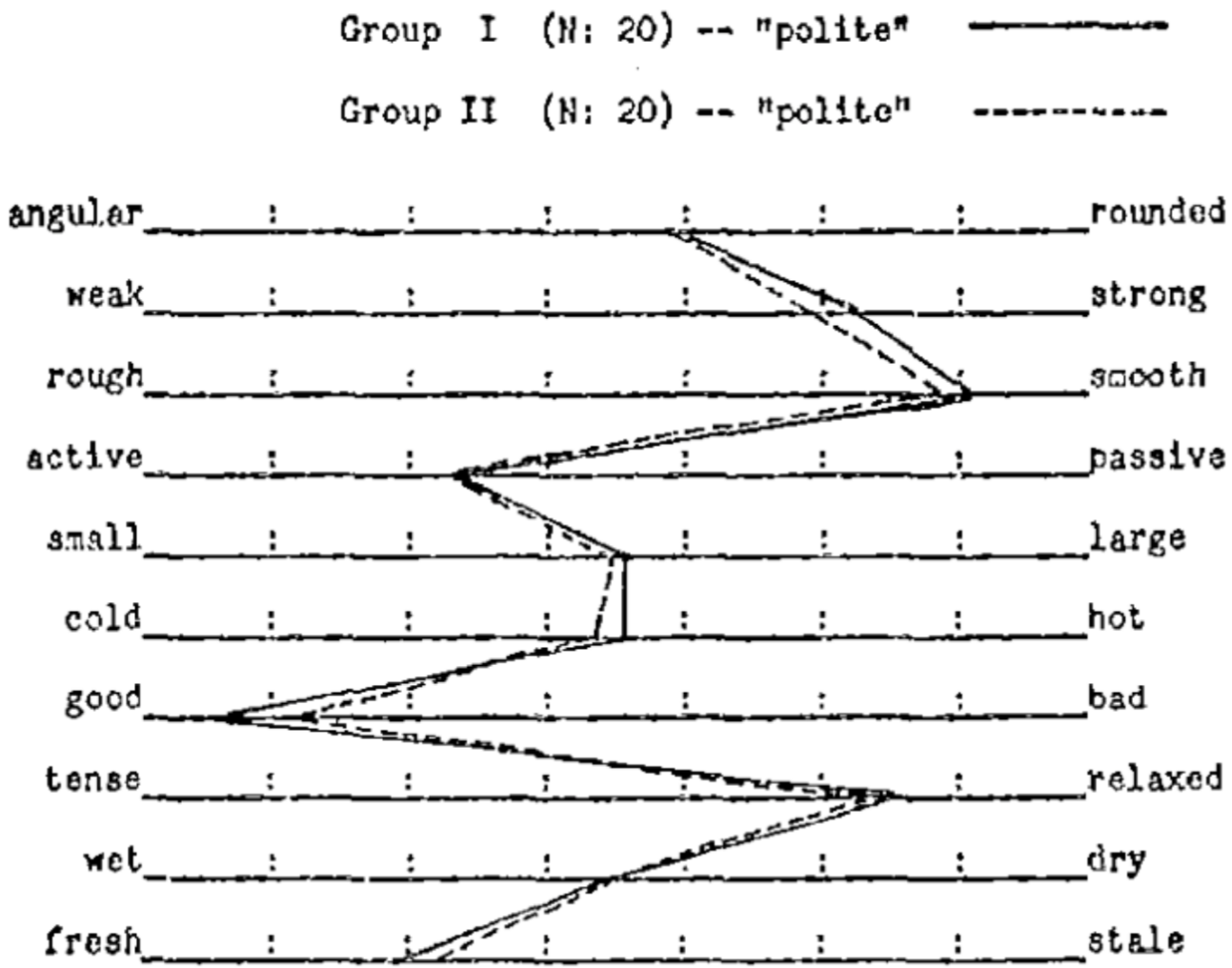
Fig1. - Problems encountered in open source
Source: opensourcesurvey.org
Incomplete or confusing documentation
Unresponsiveness
Dismissive responses
Conflict
Unexplained rejection
Unwelcoming language or content
0%
20%
40%
60%
80%
100%

Computational Models

Overarching Goals:

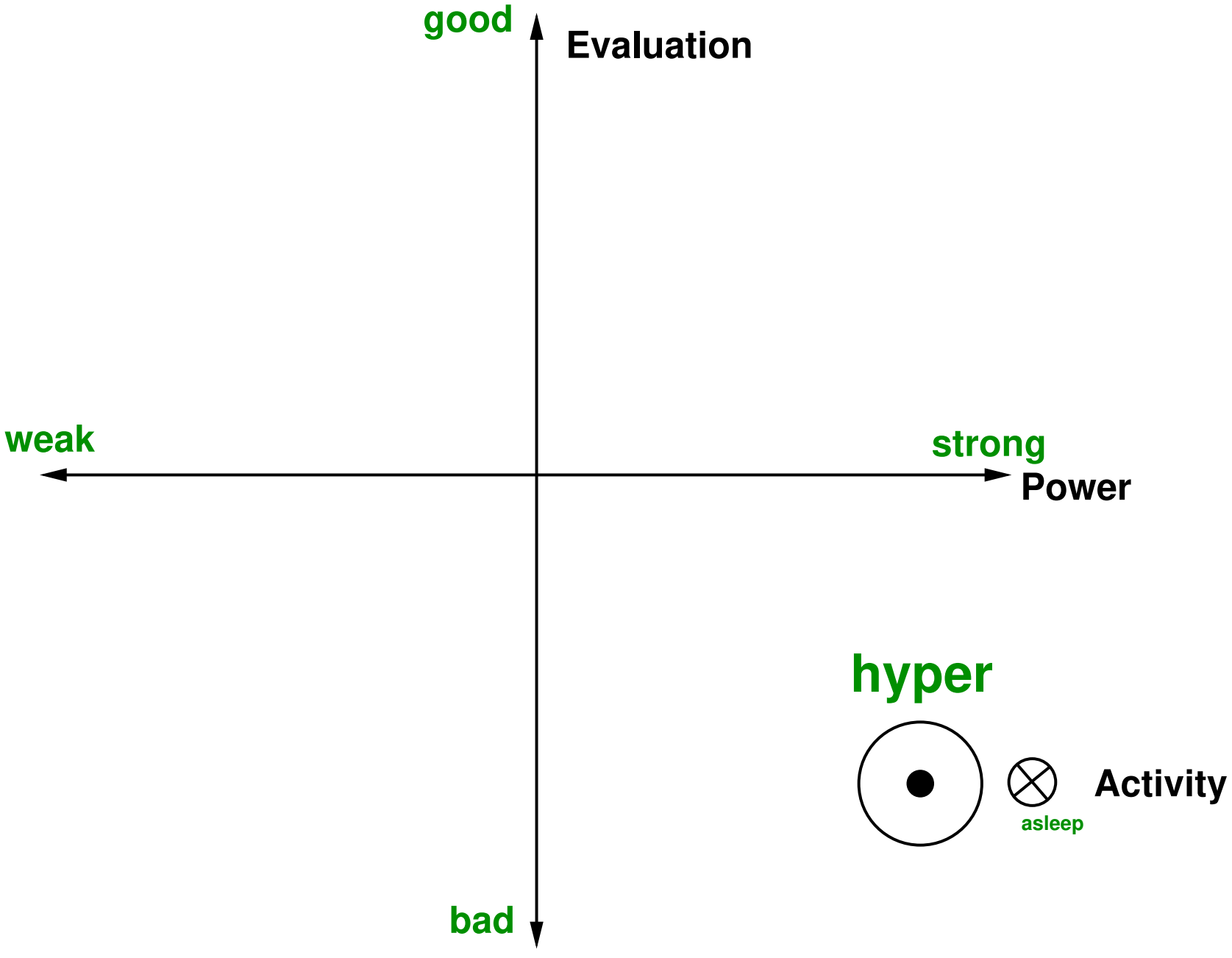
- **Understand** group behaviour with models that are:
  - **computational**
  - **social**
  - **cultural**
  - **emotional**
- **Build** artificial agents to help teams be:
  - **engaging**
  - **inclusive**
  - **effective**

Osgood's Semantic Differential

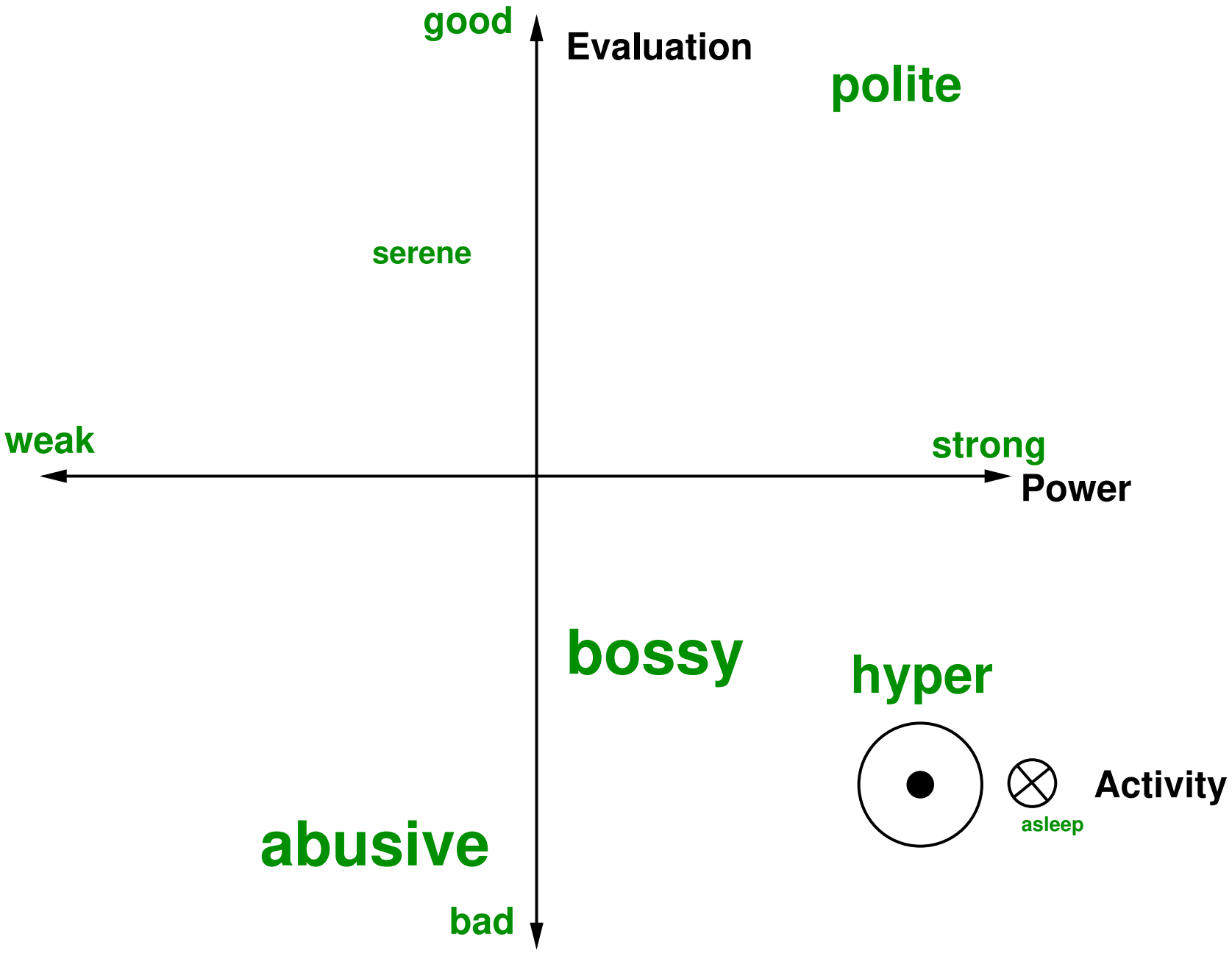


Charles E Osgood. The nature and measurement of meaning. *Psychological bulletin*, 49(3):197, 1952.

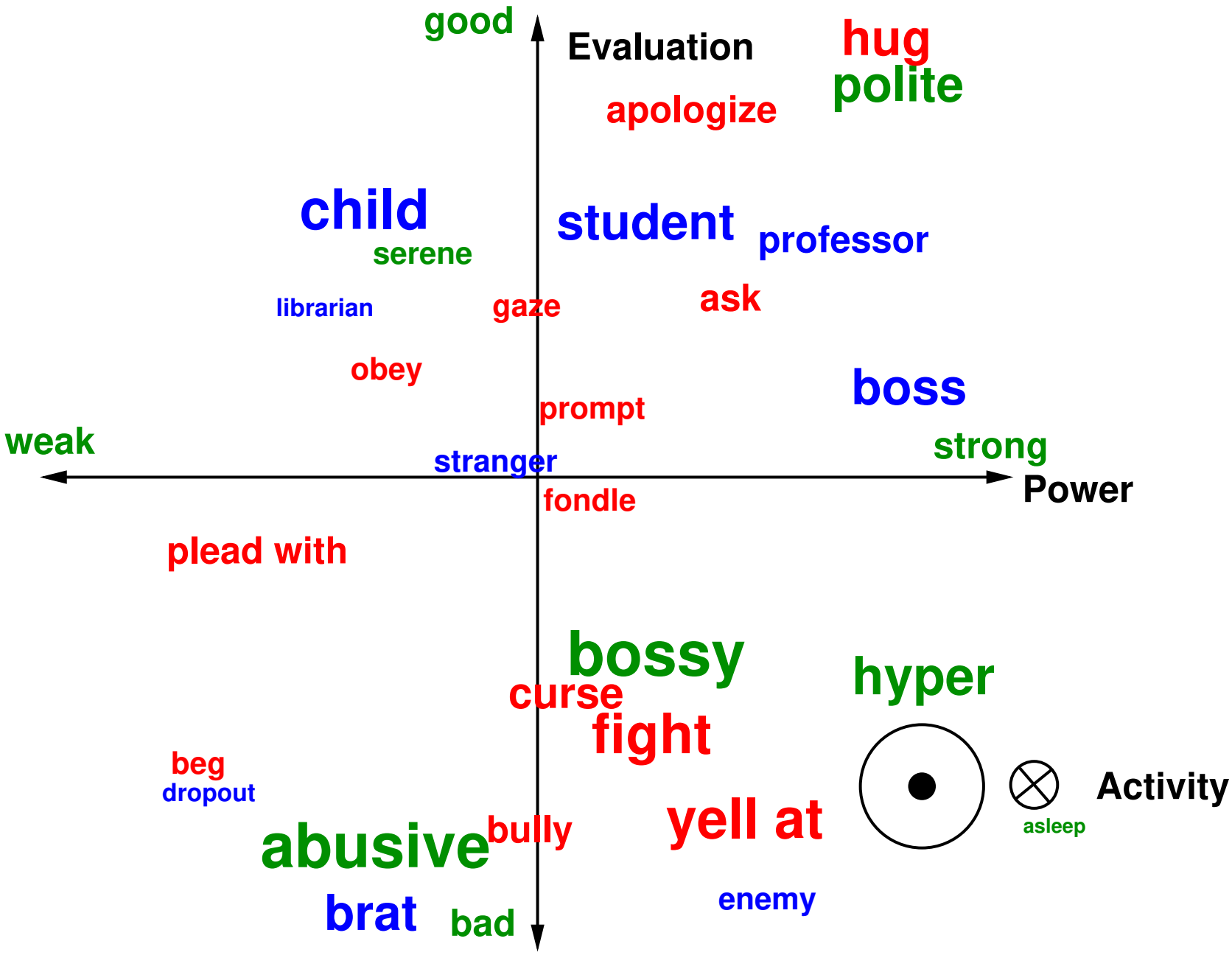
Fundamental Sentiments



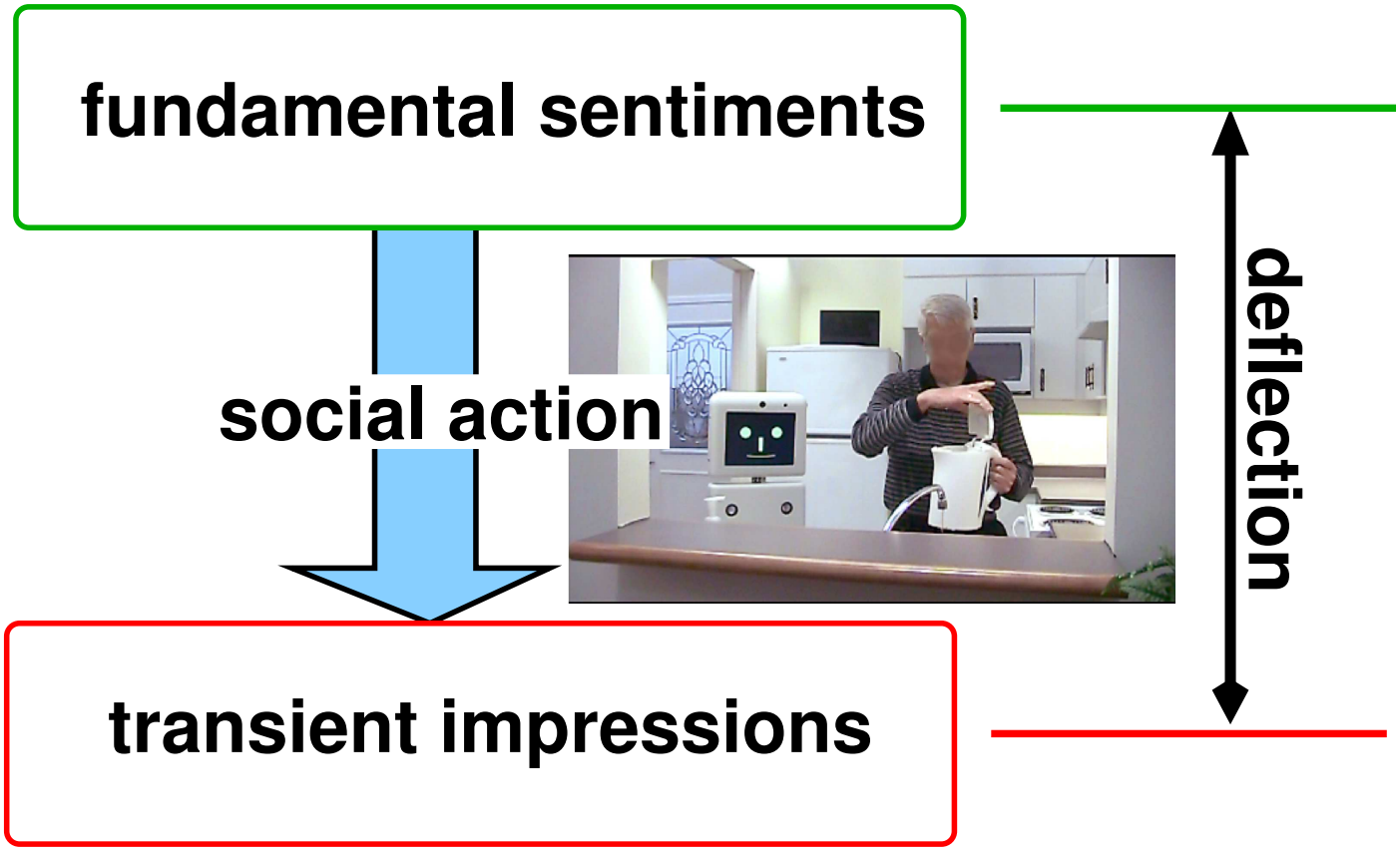
Fundamental Sentiments



Fundamental Sentiments



Affect Control Theory



- **Shared sentiments**
- Shared **emotional dynamics**
- Shared **consistency** $\rightarrow$ **Cooperation**
- David Heise. **Expressive Order: Confirming Sentiments in Social Actions**, Springer, 2007

THEMIS.COG: Social Programming Networks

Tobias Schröder
Potsdam

Kimberly B. Rogers
Dartmouth

Mei Nagappan
Waterloo

Support

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- American Alzheimer's Assoc.
- Research Institute for Aging
- AGEWELL Canadian NCE
- Trans-Atlantic Partnership (TAP)
- Cheriton Faculty Fellowship
- NSERC
- SSHRC
- CIHR
- MITACS
- CCNA

More Information:

- Bayesian Affect Control Theory: `bayesact.ca`
- Jesse Hoey: `jhoey@cs.uwaterloo.ca`

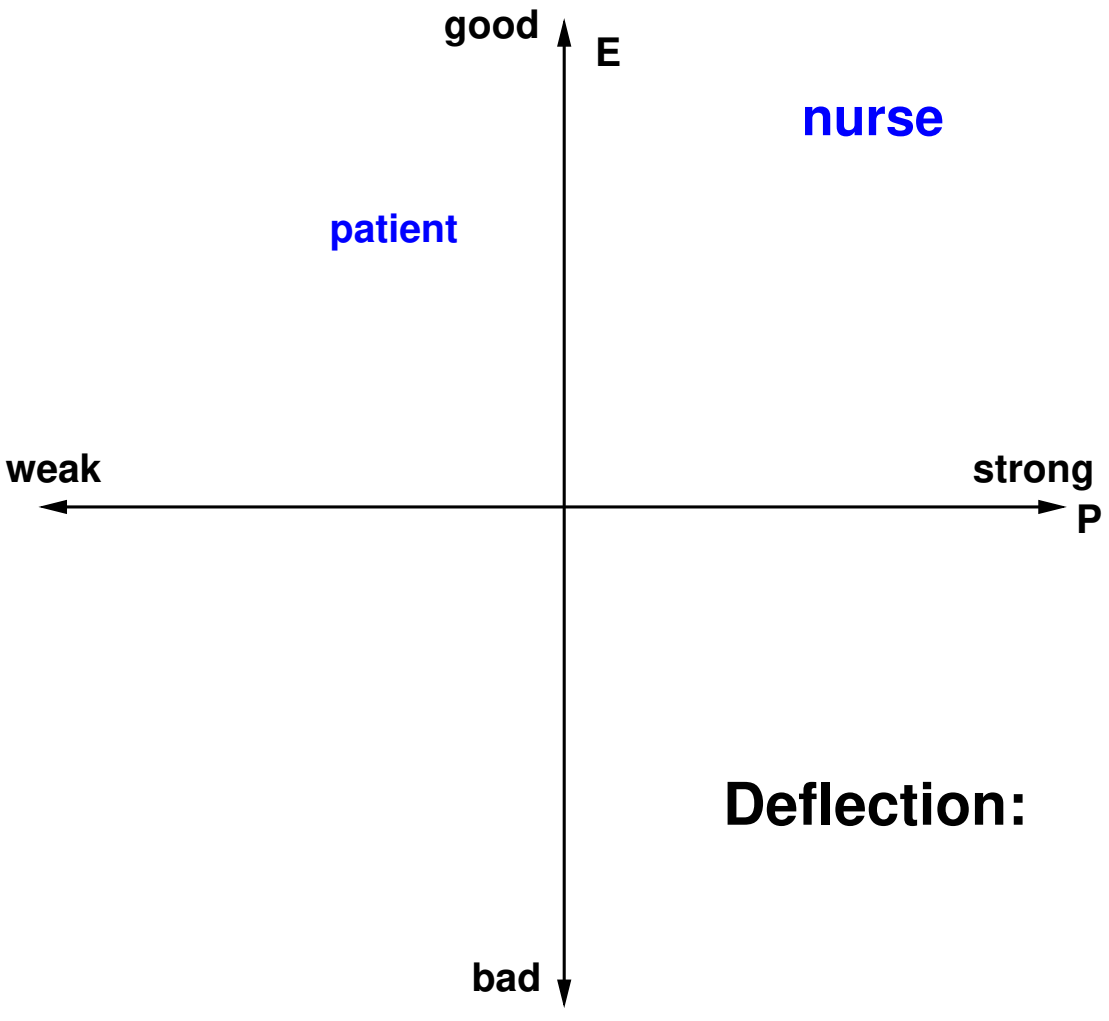
Affect Control Theory

- Actor-Behaviour-Object
- fundamental sentiments: $\mathbf{F} \in [-4.3, 4.3]^9$
- transient impressions: $\mathbf{T} \in [-4.3, 4.3]^9$
- prediction $\mathbf{T}_{t+1} = \boldsymbol{M}\mathscr{G}(\mathbf{F}_t, \mathbf{T}_t)$ **measured empirically**
- deflection $D = \sum_i w_i(\mathrm{f}_i - \tau_i)^2$
- **Affect Control Principle**: actors work to experience transient impressions that are consistent with their fundamental sentiments
- Emotion $\epsilon \propto \mathbf{f} - \boldsymbol{\tau}$

Bayesian Affect Control Theory

- identities and behaviours as probability distributions
- external goals and planning

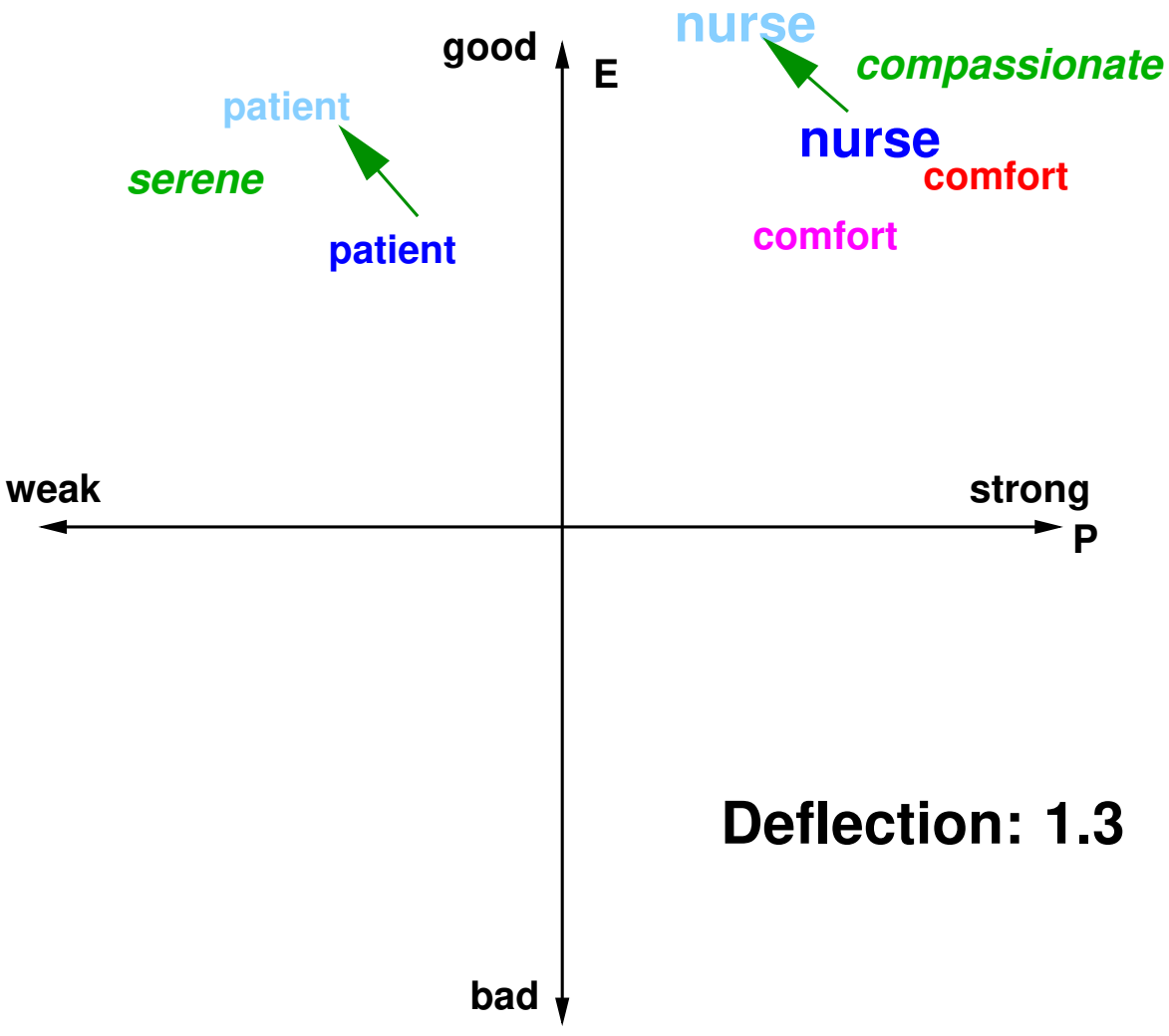
Affect Control Theory



Deflection:

	nurse	**patient**
F:	$[2.9, 1.5, 0.2]$	$[1.1, -0.8, -0.9]$

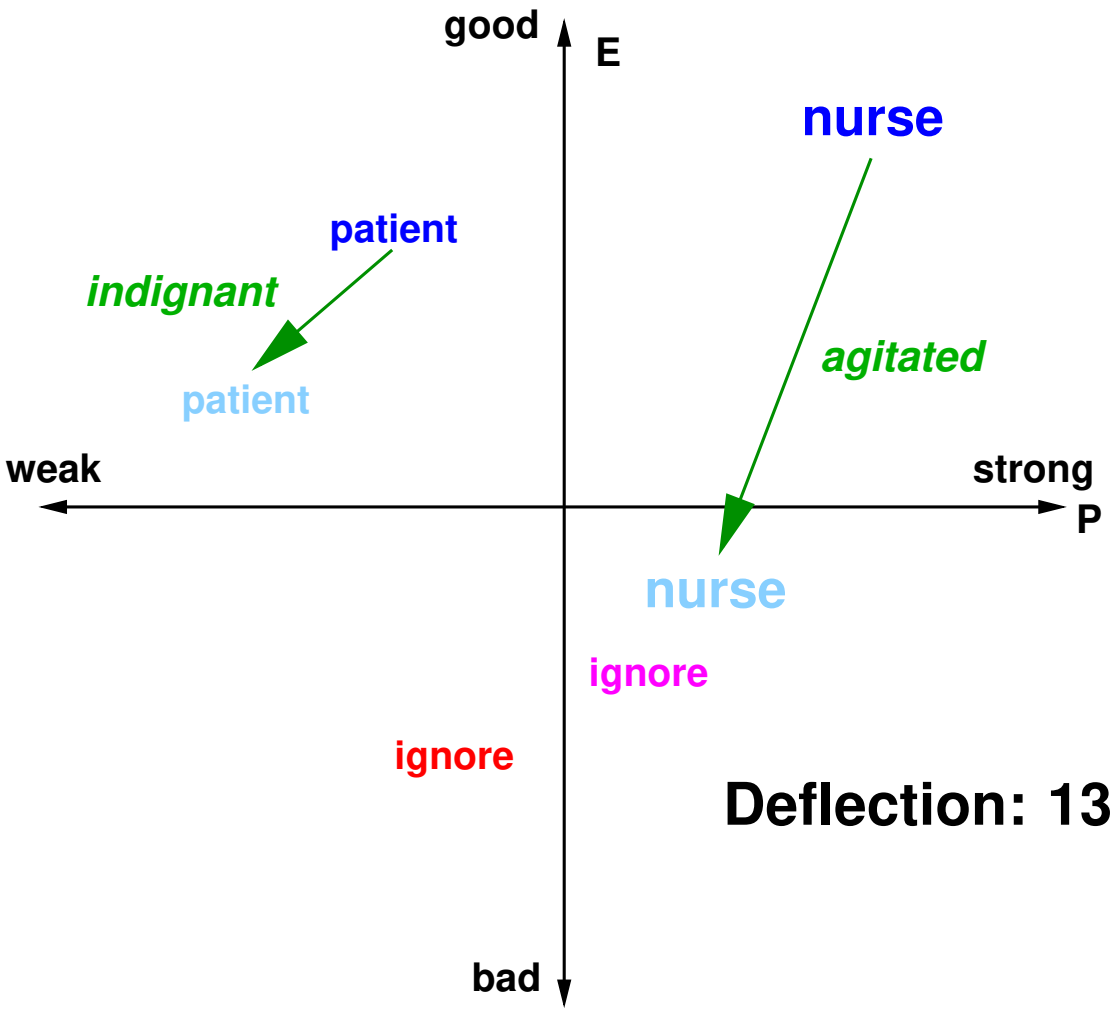
Affect Control Theory



Deflection: 1.3

	nurse	**comforts**	**patient**
F:	$[2.9, 1.5, 0.2]$	$[2.8, 2.1, 0.1]$	$[0.9, -0.7, -1.1]$
T:	$[3.3, 1.2, 0.3]$	$[2.3, 1.4, 0.4]$	$[1.4, -0.9, -0.7]$

Affect Control Theory



Deflection: 13.4

	nurse	**ignores**	**patient**
F:	$[2.9, 1.5, 0.2]$	$[-1.9, -0.3, -0.9]$	$[0.9, -0.7, -1.1]$
T:	$[-0.5, 0.9, 0.3]$	$[-1.2, 0.4, -0.4]$	$[0.4, -1.4, -0.8]$

GitHub annotations

Github pull request comments[1] annotated for

- type of behaviour portrayed in the sentence: 12 IPA categories[2]
  - Shows Solidarity
  - Shows tension release
  - Agrees
  - Gives Suggestion
  - Gives opinion
  - Gives orientation
  - Asks for orientation
  - Asks for opinion
  - Asks for suggestion
  - Disagrees
  - Shows Tension
  - Shows Antagonism
- Emotion displayed by the person writing the comment
  - Thanks
  - Sorry
  - Calm
  - Nervous
  - Careless
  - Cautious
  - Aggressive
  - Defensive
  - Happy
  - Angry

[1] Georgios Gousios. The ghtorrent dataset and tool suite. MSR13

[2] Bales 1950

Examples of GitHub data

Comment	IPA	Emotion
I'm responsible for this.,Sorry.	shows tension	sorry, nervous
Limitation?,I would call that a show-stopper.	gives opinion, disagrees, shows antagnism	agressive, defensive
Great that you harmonized these,params to the python-layer style.	shows solidarity, agrees	thanks happy
Sorry.,I started this file version by copying the Airy and forgot to edit this description.	gives orientation	sorry, careless
Wow, what a shame. Then I suggest we push this feature in to 2.1 instead of 2.0.2 since we can't make it non-kludgy while retaining binary compat.	gives opinion, gives orientation	cautious, angry

Cheriton's Three Laws of Automation

1. Everything that can be automated will be automated
2. Everything can be automated
3. Humans become (even) less competent at a task when it can be automated, making automation urgent.

Emotions: the new AI

- Artificial Intelligence:
  intelligence = **rationality**
- We now know that **emotions** are *necessary* for intelligence
- A *low road* gives **"heuristic"** social intelligence
- Encode a **social order** that allows us to work in a society

With infinite resources,
are emotions necessary?