Boredom and AI

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Outline

- Introduction
  - Definition
  - Psychology, Philosophy and Biological
- Does intelligence require boredom?
  - Boredom as awareness of self
- Modeling Boredom
  - Behavioral tests
  - Using AI
- Applications
- Future Directions

Definition

- Boredom is an emotional state experienced during periods lacking activity or when individuals are uninterested in the opportunities surrounding them.
- The first record of the word boredom is in the novel Bleak House by Charles Dickens, written in 1852

How people have described boredom:

- Boredom [is] the desire for desires
  - Leo Tolstoy, *Anna Karenina*
- A man can stand almost anything except a succession of ordinary days.
- Goethe, the great 18th century German poet, dramatist, and scientist, described boredom as "the mother of invention".
- Man is the only animal that can be bored.
  - Erich Fromm, *The Sane Society* (1955)

Psychology

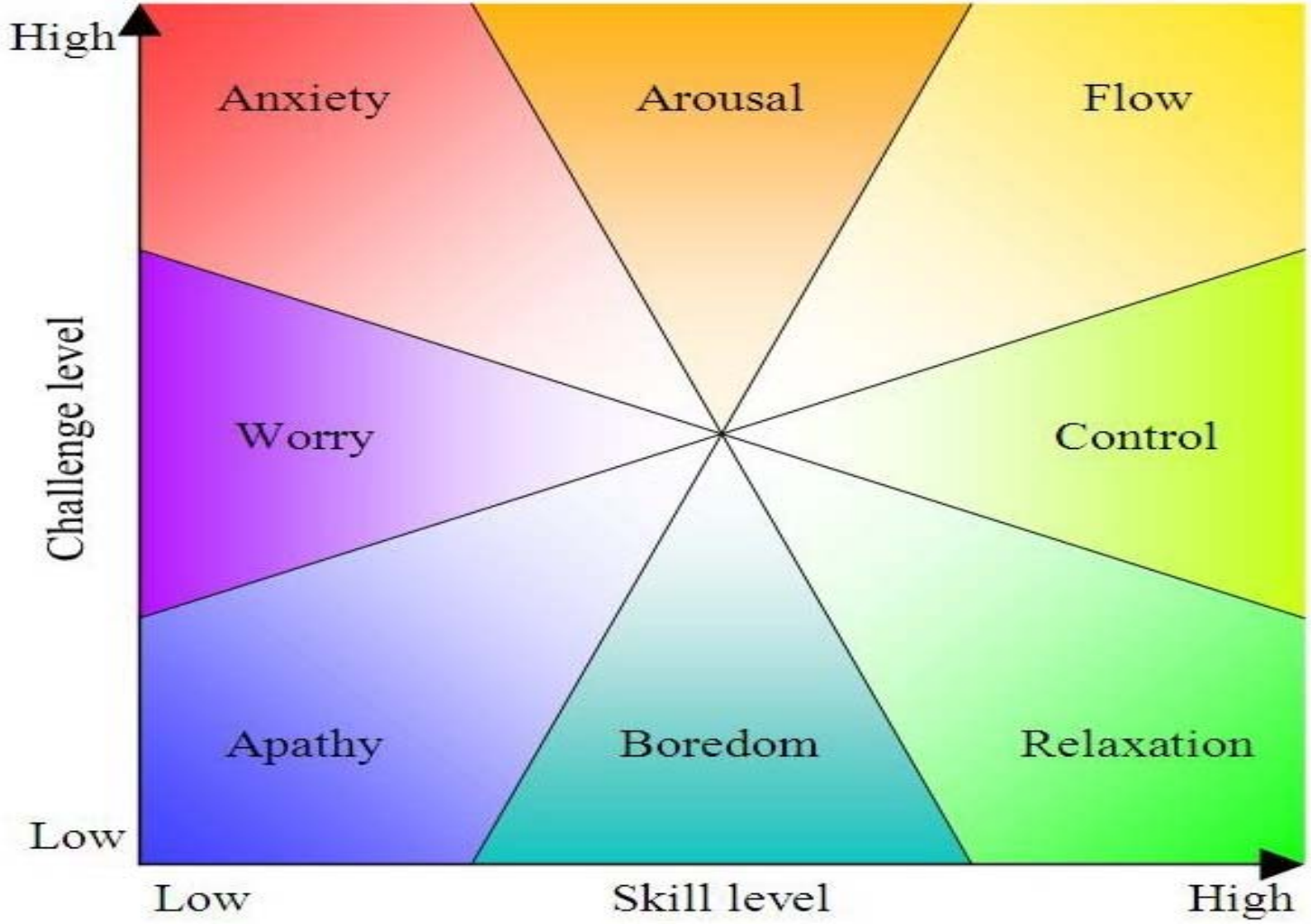
- Boredom is an unpleasant, transient affective state in which the individual feels a pervasive lack of interest and difficulty concentrating on the current activity.

- Positively, a response to a moderate challenge for which the subject has more than enough skill

- Boredom has been traditionally associated with clinical depression and attention disorders.

Mental State as a Function of Skill and Challenge Levels

- Mihaly Csikszentmihalyi



Philosophy

- **situational boredom**

- **chronic boredom**
  - existential boredom

Arthur Schopenhauer used the existence of boredom in an attempt to prove the vanity of human existence,

"...for if life, in the desire for which our essence and existence consists, possessed in itself a positive value and real content, there would be no such thing as boredom: mere existence would fulfill and satisfy us ” .

Default Network

- The bored brain : incredibly active, generates daydreams and engages in mental time travel.
- An elaborate electrical conversation between the front and rear parts of the mind.
- In humans: generates spontaneous thoughts during mind-wandering, believed to be an essential component of *creativity*.

Boredom and limits of AI

Can we build machines which can think?

Can we build machines which can think like human beings?

Can computers imitate human behaviour(intelligence)?

Can we identify an aspect of intelligence which seems to be really difficult for computers to achieve?

Can computers be creative?

Creativity: ability to produce unanalyzable leaps of imagination (“creative sparks”).

Is everyone creative or is it that only a few of us are?

"noncreative intelligence“- a flat-out contradiction in terms.

Still vague…

Creativity as a network of concepts

having creativity is an automatic consequence of having the proper representation of concepts in the mind.

concepts derive all their power from their connectivity to one another

Vaguely: concepts are the rules, facts and data available to an intelligent being.

What kind of objects have such a representation of concepts and what kinds do not?

Boring Multimedia ☺

Computer Bug

Playing Cat

Sphex

Sphexishness

Hofstadter{Metamagical Themas Questing for the Essence of Mind and Pattern(1982)}; Christopher von B'ulow(2003)
--Can't analyze its own behavior... Never gets bored!

What is the mantis lacking?
a general sensitivity to patterns, an ability to spot patterns of unanticipated types in unanticipated places at unanticipated times in unanticipated media.
(there's a pattern up there too... did you recognize it?)

Human Beings: "loop detector"
losing the disposition responsible for the loop.

Can we create antisphexish machines?

Does your computer get bored?

Requires “self-watching” at various levels of abstraction.

Should a computer yawn after every similar set of instructions it executes?

Watching one's own internal microscopic patterns is bound to be boring.

The computer needs to identify regular behavior due to huge patterns of activity at a higher level

Contd…

Self-watching : monitoring changes in “data structures” ,filtering and recording interesting aspects in *other* data structures(“watchers”).

Shouldn’t we set up a second level of data structures to monitor these “watchers”?

-Territory for infinite regress!

That’s not all! Shouldn’t we have a watcher for this infinite chain?

"Minds, Machines, and Gödel" -J.R. Lucas

Machines cannot think like humans!

Humans cannot get into an infinite loop but a machine will!

Knowledge Chain: A conscious being knows something, knows that he knows it, and that he knows that he knows that he knows it, and so on.

Argument against AI: A machine can be made in a manner of speaking to "consider" its performance, but it cannot take this "into account" without thereby becoming a different machine, namely the "old machine with a new part added".

Conclusion: perfectly antisphexish machines are impossible

Remember the Halting Problem?
Is there any program inspecting other programs before they run predicting termination?

Closely related (diagonalization…)

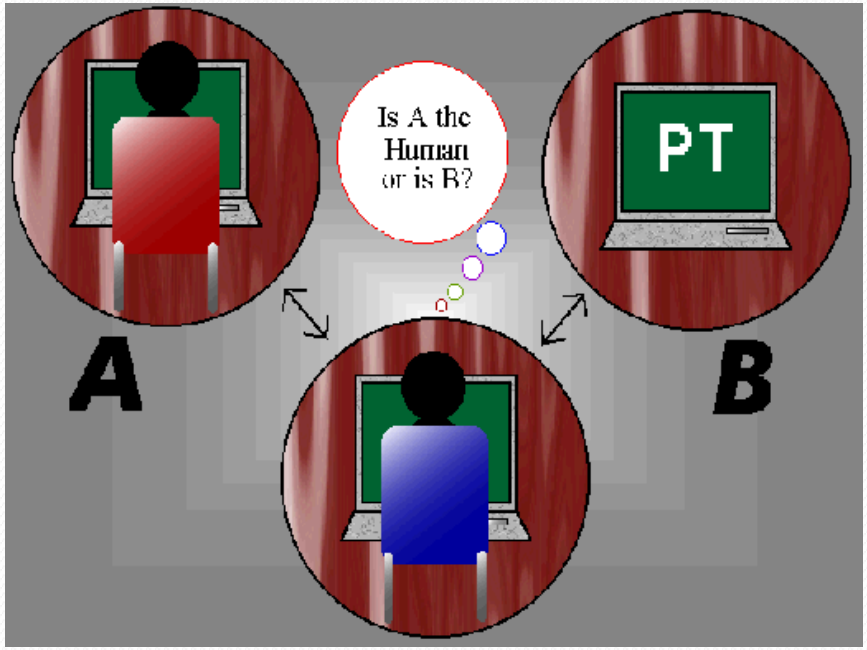
Difference between the two problems(AI survives):

a self-watching program(for AI): not really so concerned with the mathematical perfection but with likelihood of survival in a complex world;

It seems that self watching is essential for an AI program (e.g. “learning”) but perfect self watching is something one cannot achieve. We have to settle with some approximation that works.

Turing Test

- A human judge engages in a natural language conversation with one human and one machine, each of which tries to appear human. All participants are placed in isolated locations
- If the judge cannot reliably tell the machine from the human, the machine is said to have passed the test.



Measuring Boredom

- Non-verbal tests: Audio-visual feedback techniques
  - Facial expression
  - Sitting position
    - Pressure map on chair
    - Head height
    - Leaning / slouching
  - Resistance across points on skin
  - Heart beat
  - Blood pressure
  - Audio feedback

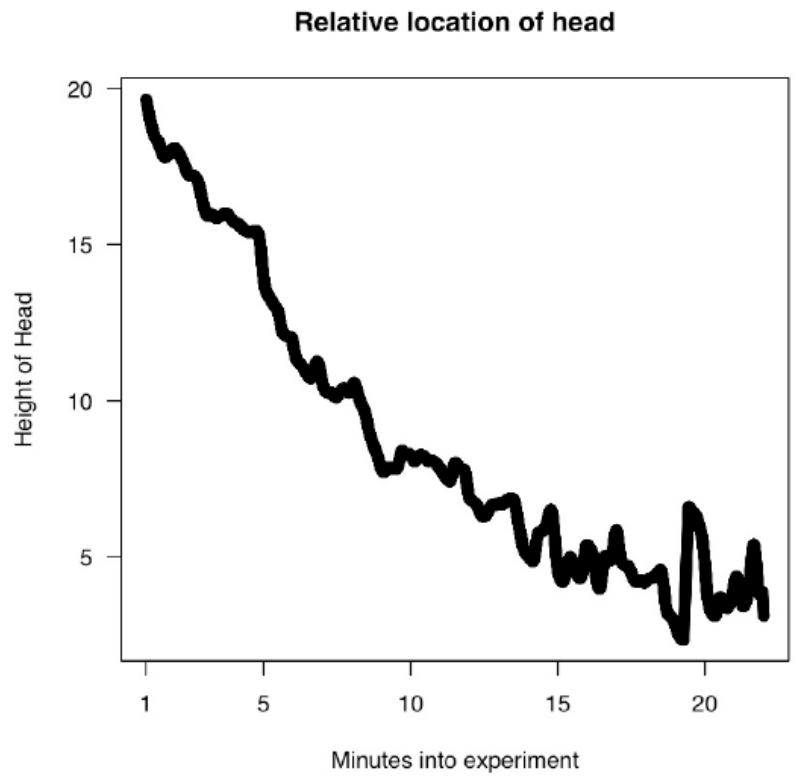


Figure 1. Head height over time

Processing audio-visual feedback

- Computational techniques used:
  - Hidden Markov models
  - Feed-forward neural networks
  - Support vector machines
  - Fuzzy ARTMAP network

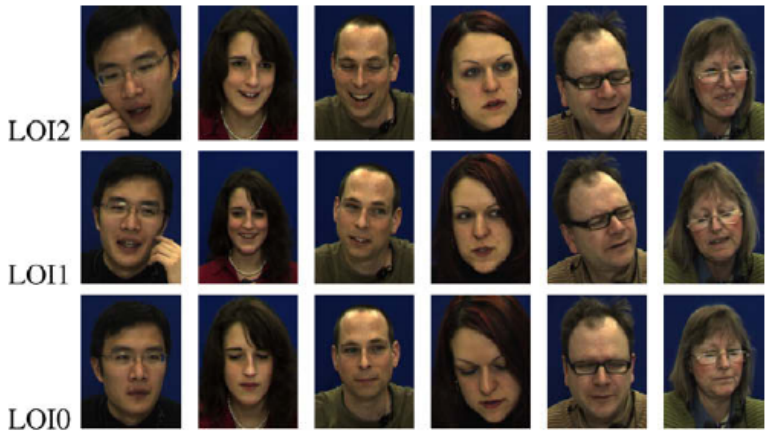


Fig. 4. Example video frames (for better illustration limited to the facial region here) for Level of Interest 0–2 taken from the *AVIC* database. Two subjects in gender balance were chosen from each of the three age groups.

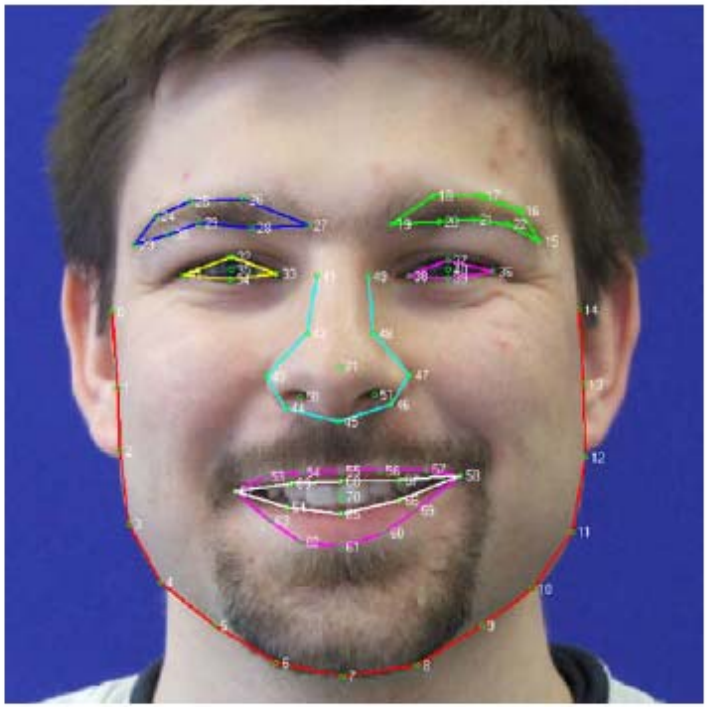


Fig. 5. 2D annotation of a face with 72 landmarks.

Measuring Boredom in Humans

Boredom Proneness Scale
Cognitive scale proposed in 1986 by Farmer, R. & Sundberg, N. D.

This has been widely studied to obtain variation of proneness to boredom across gender, age, race, work, personality, etc.

Relevance of this scale has been highly studied and various modifications have been suggested.
Instead of one-dimensional bipolar scale: 5 dimensions can be extracted from the survey:

- External Stimulation, Internal Stimulation, Constraints, Affective Response, and Perception of Time

Other proposed scales:
- EASI-III Temperament Survey
- 36-point Academic Boredom scale

Some results

Table 1. Correlations of boredom proneness, dogmatism, and EASI-III subscales

	2	3	4	5	6	7	8	9	10	11	12
1. BP	33**	20*	33**	01	−03	00	−30**	26**	−02	08	36**
2. Dogmatism	—	17	26**	−06	15	21*	−09	12	−16	00	15
3. E-General		—	50**	39**	27**	08	−05	37**	−05	08	10
4. E-Fear			—	06	20*	−15	−39**	24*	−30**	−15	27**
5. E-Anger				—	13	13	−02	33**	09	15	−09
6. A-Tempo					—	10	−01	34**	−06	02	−05
7. A-Vigor						—	12	07	16	28**	−05
8. Sociability							—	08	18	26**	−21*
9. I-Inhibitory								—	08	12	07
10. I-Decision Time									—	27**	18
11. I-Sensation Seeking										—	16
12. I-Persistence											—

*$P < 0.05$, **$P < 0.01$; $df = 113$.Decimal points are omitted. E = Emotionality, A = Activity, I = Impulsivity.

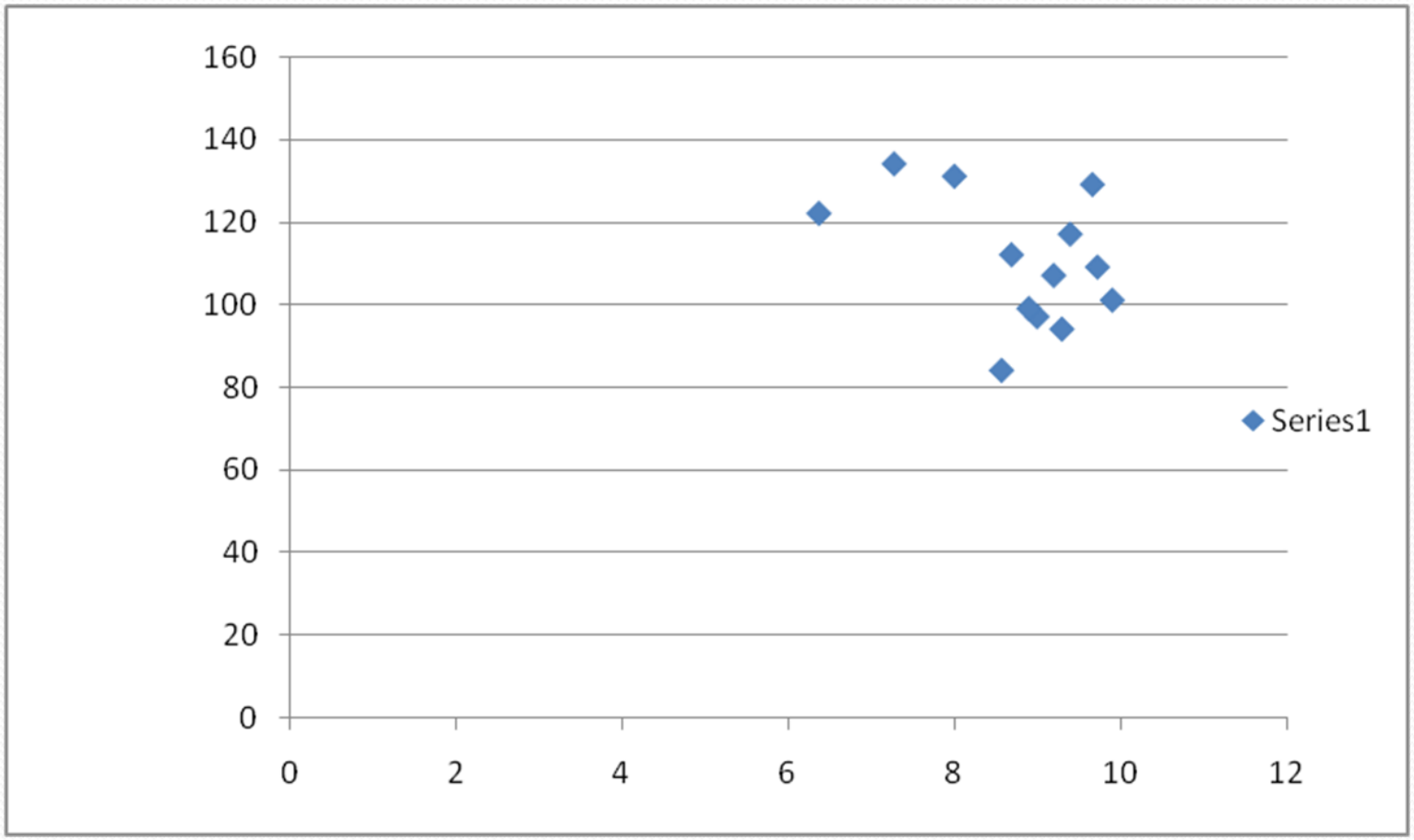
Table 2
Correlations between the HEXACO-PI scales and the Boredom Proneness scales

HEXACO-PI scale	Boredom Proneness scale		
	BPS Total	External Stimulation	Internal Stimulation
Honesty/Humility	−.31*	−.26*	.13
Emotionality	−.07	−.24*	.02
Extraversion	−.28*	−.11	.34*
Agreeableness	−.17*	−.12	.05
Conscientiousness	−.53*	−.33*	.44*
Openness to Experience	−.16*	.09	.36*

Note. $N = 316$, *$p < 0.01$. External Stimulation scores contribute positively, and Internal Stimulation scores contribute negatively, to the BPS Total score.

Data for our class

- BP Vs CPI



Non-rigid scales:

Difficult to design and heavy computation.

- Modeling boredom and flow using web activity of users:
  - Type of activity:
    - Information retrieval
    - Creating webpages
    - Communication: Social/personal (email/chatting)
    - Playing games
  - Response time/ immediate feedback
  - Design of websites most visited
  - Clear goals

Applications

- Academic boredom:
  - Intelligent tutoring systems
    - Systems with adaptive strategies based on audio-visual feedback from students
  - Predicting dropouts from e-courses
    - Time invariant vs. Time variant parameters
- Work environment boredom:
  - Detecting boredom before significant drop in performance is observed
  - Self-organizing task allocation among agents
    - 2 agent experiment

Future Directions

Should a system stop a computation if it notices a pattern?

Or perhaps use a pattern to speed up computation?

Eg. Learning rate in typical AI systems

Stop when not making progress

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