

QMUL Cognitive Science & Computational Linguistics

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Cognitive Science at QMUL

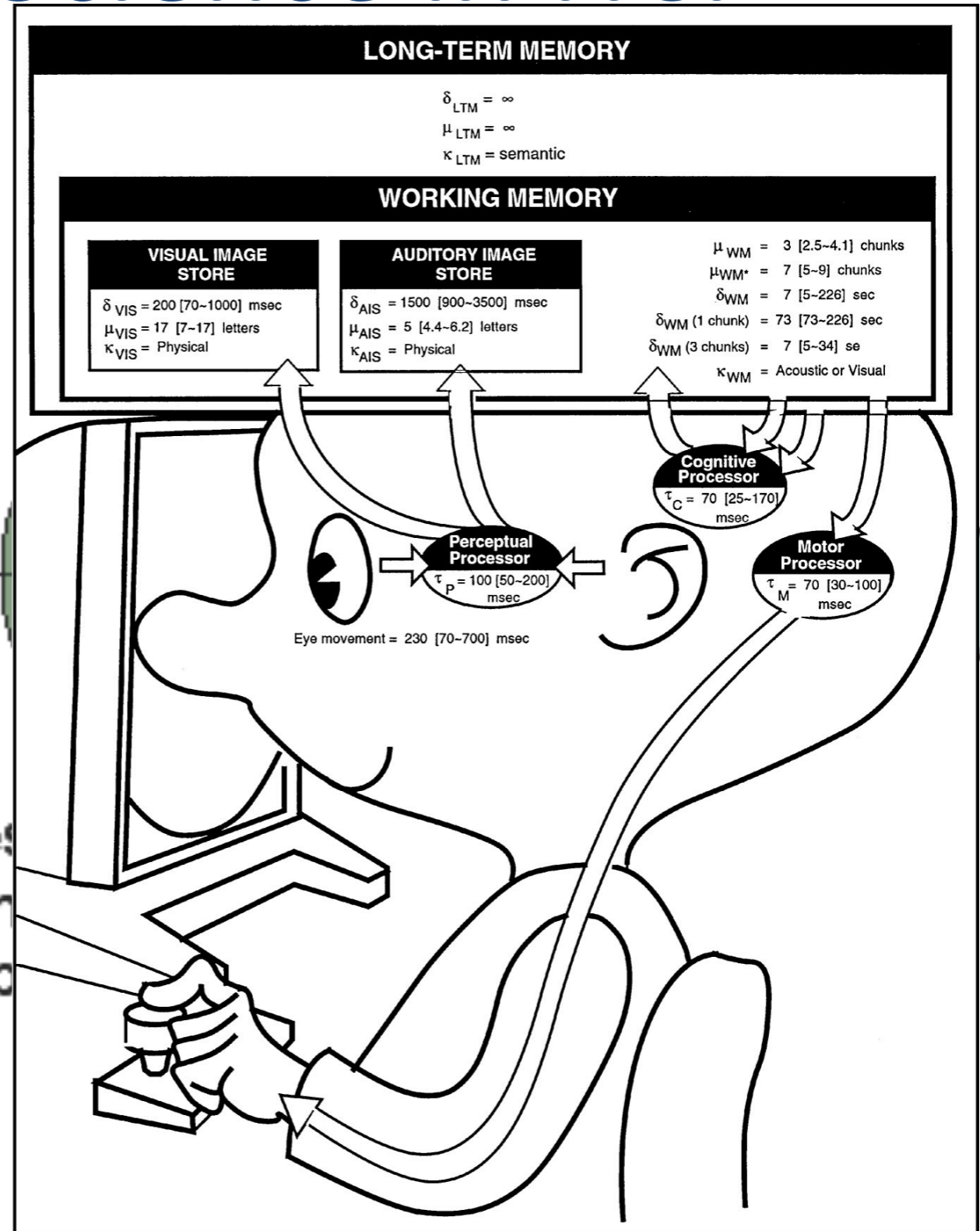
“human cognition, action and interaction on scales ranging from individual experience, through interactions between individuals to the languages, cultures and dynamics of societies.”

Cognitive Science in HCI

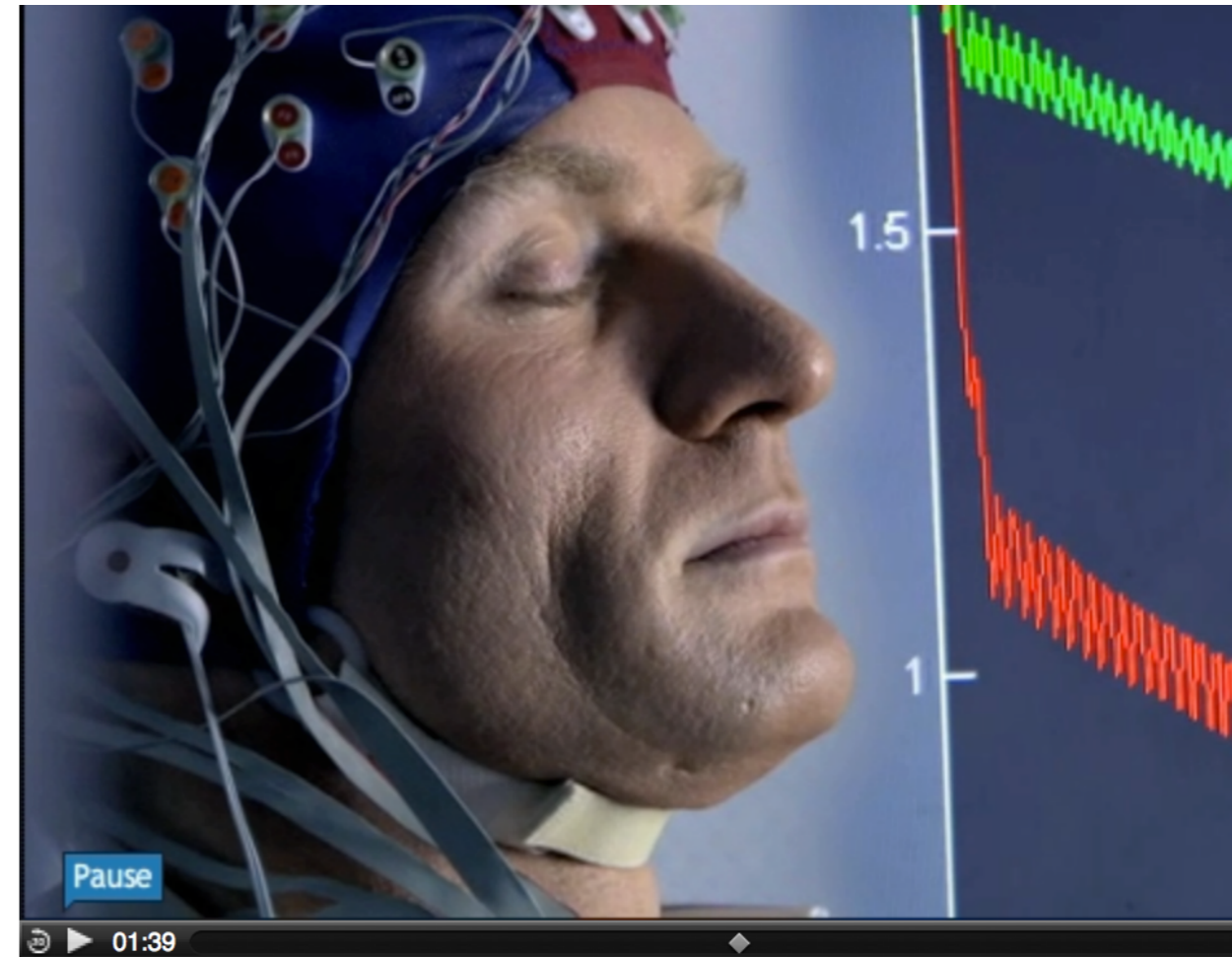
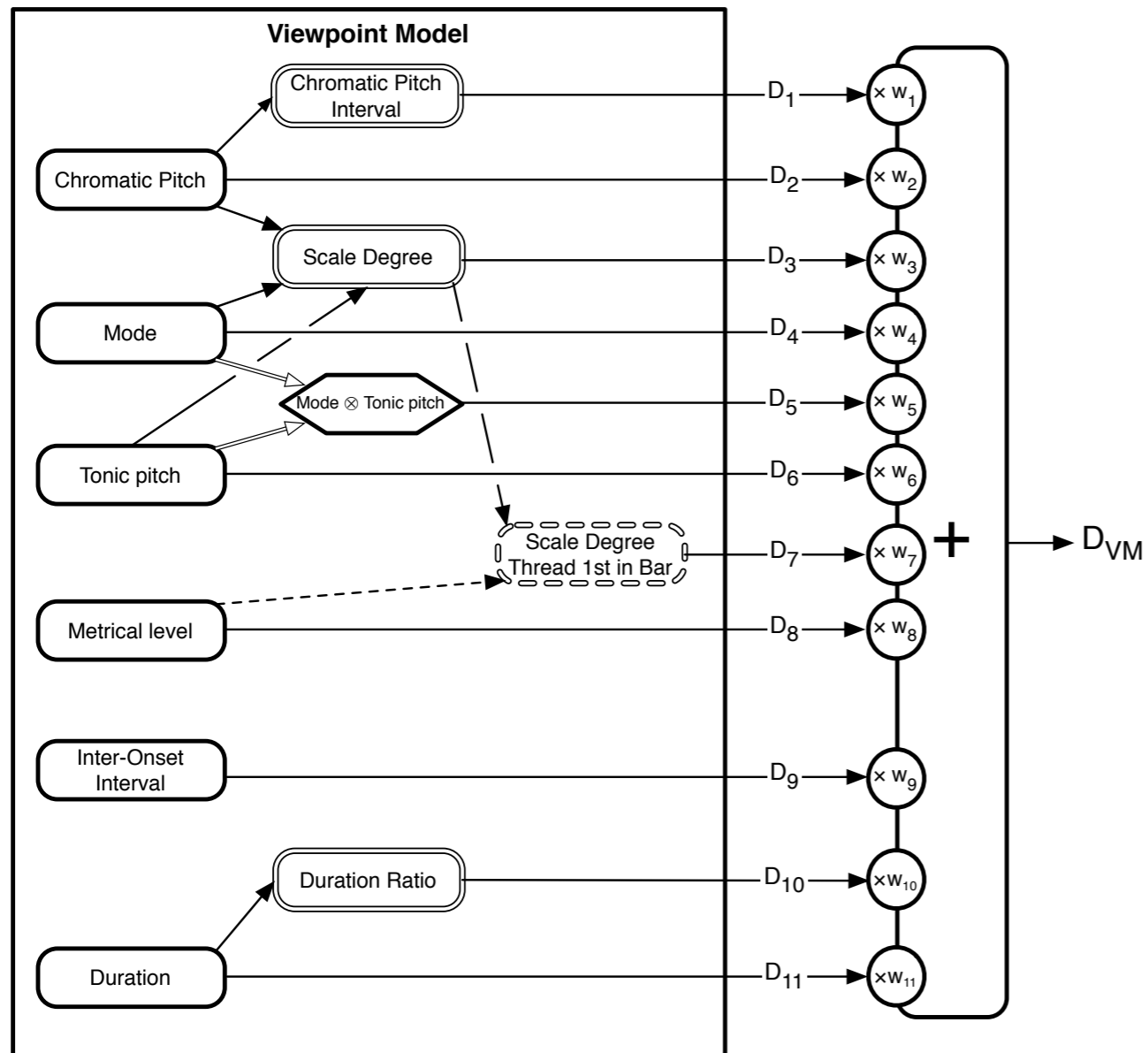
Understand
this
bit



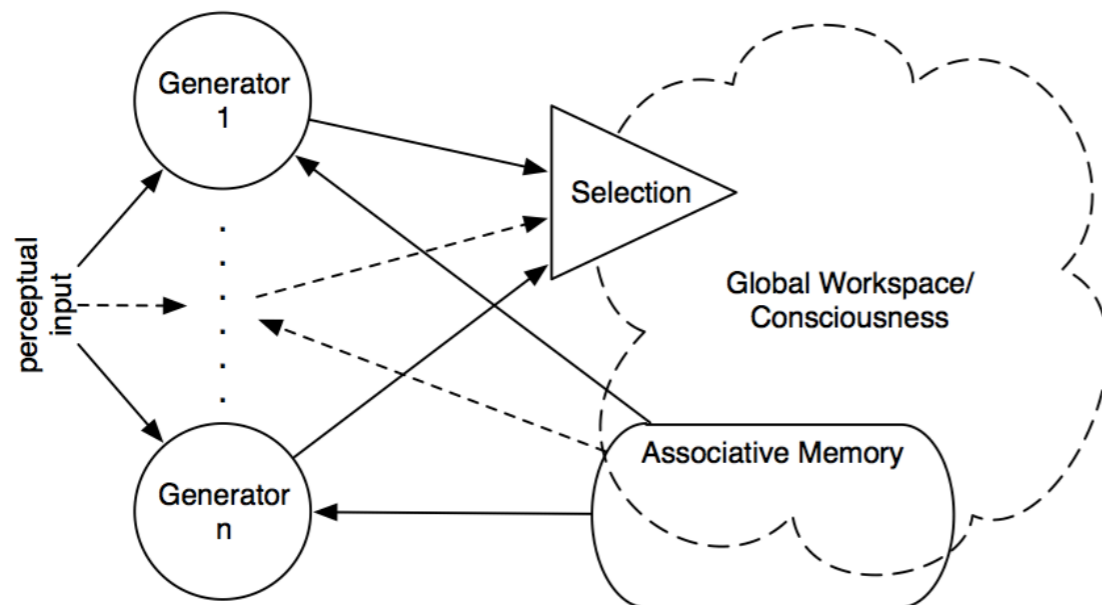
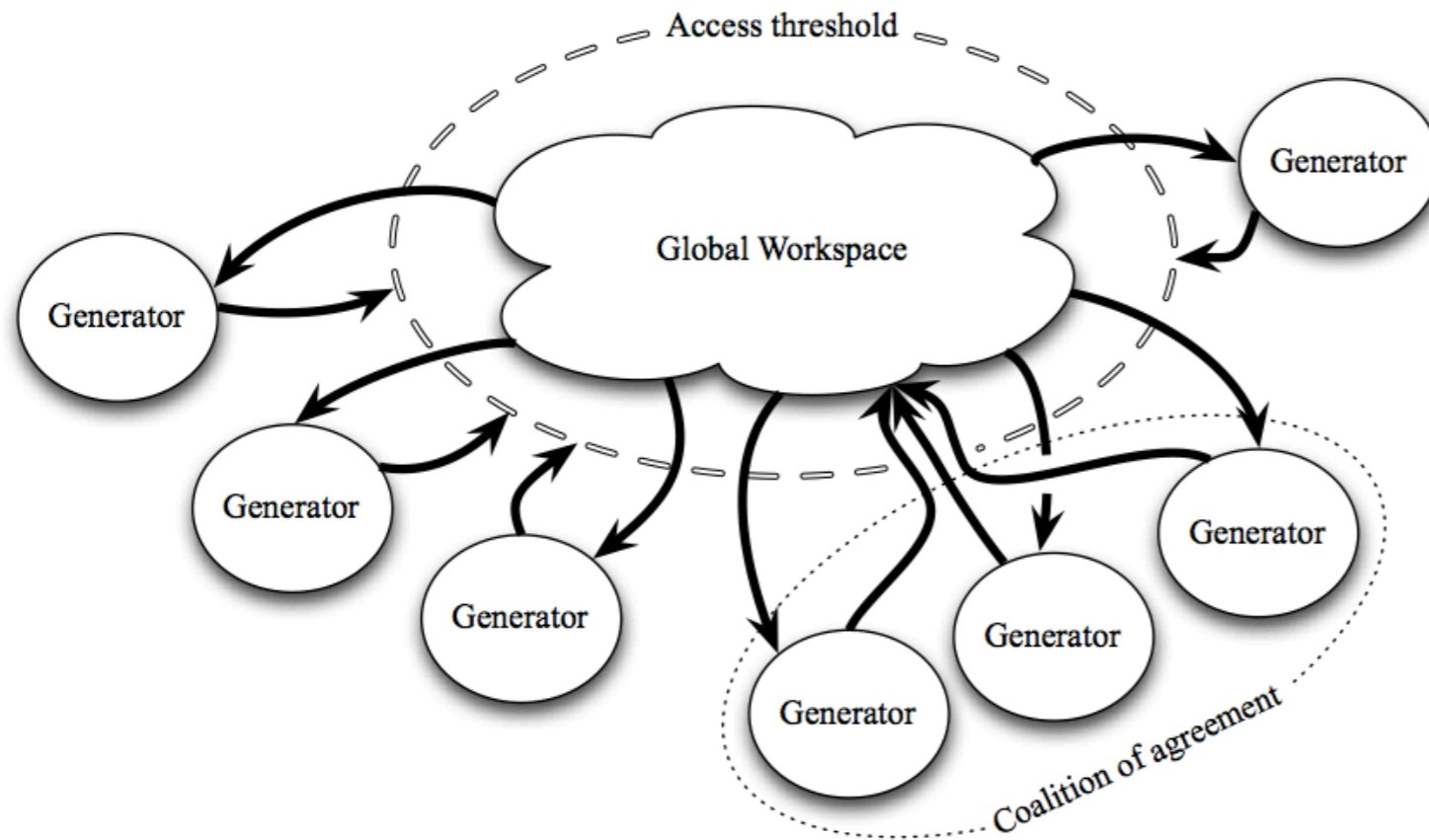
Des
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b



Understanding Music

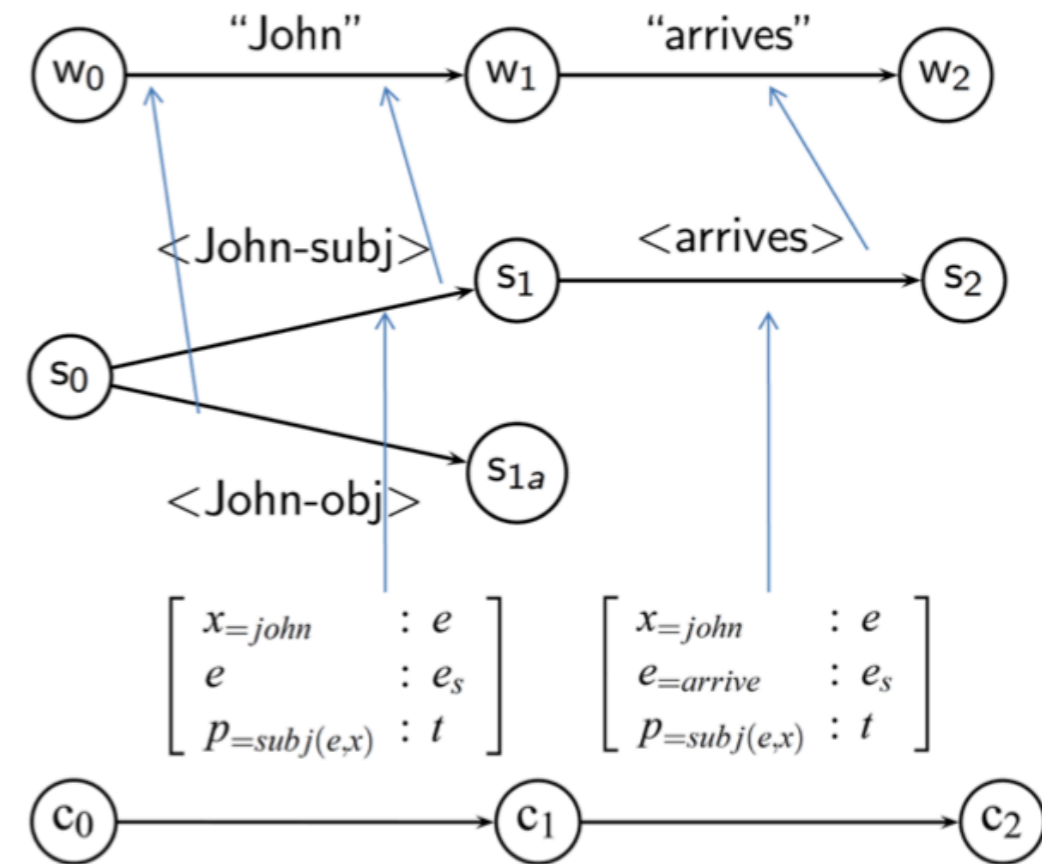


Computational Creativity



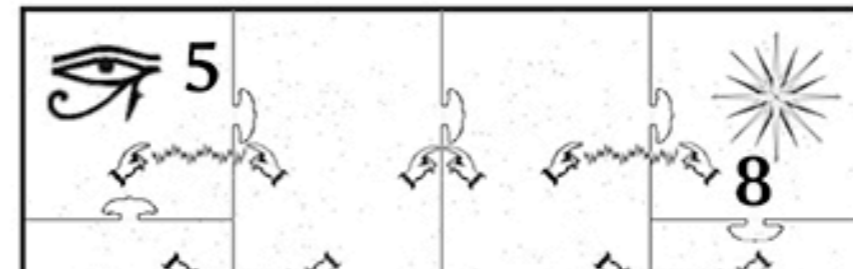
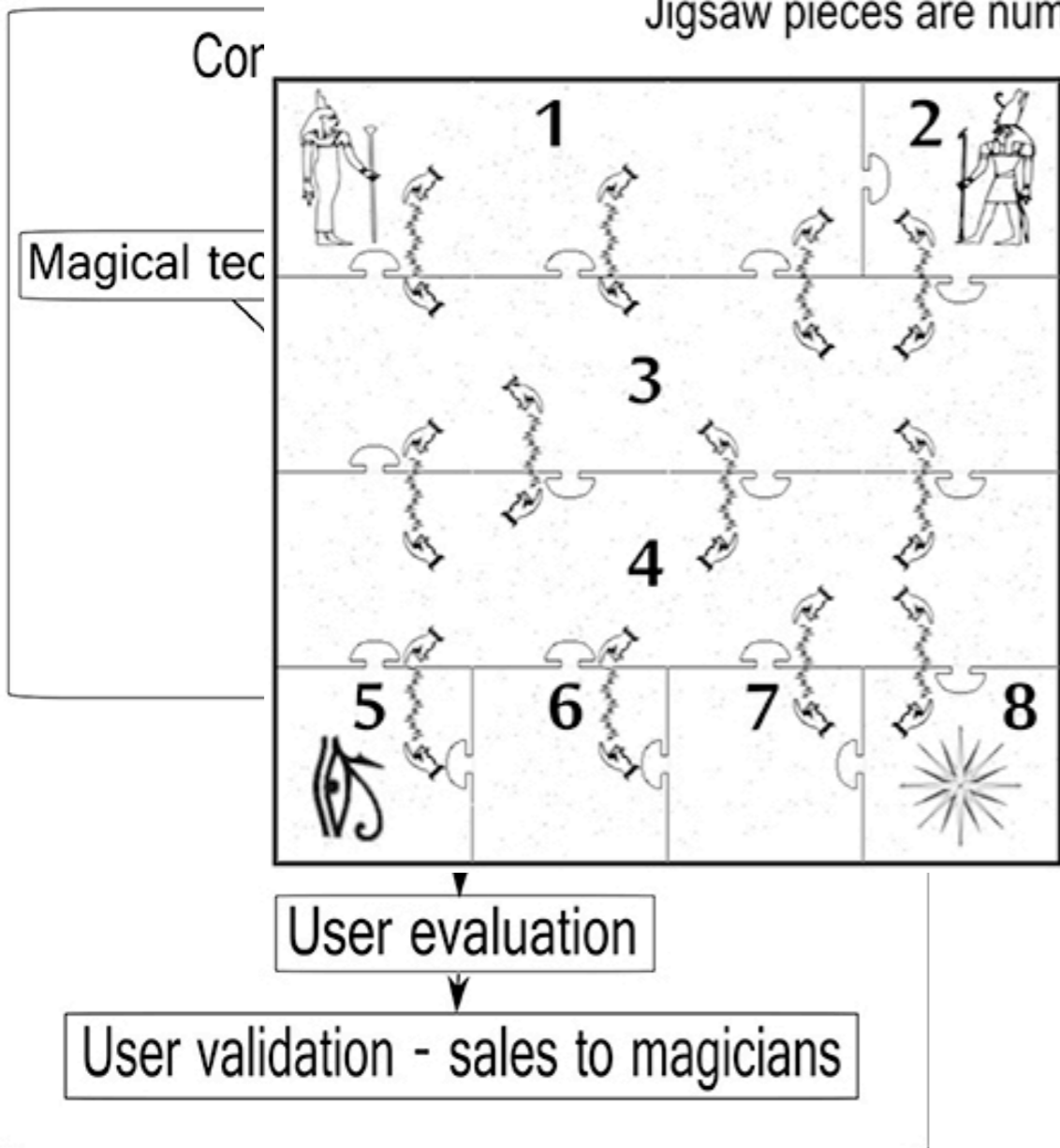
DS-TTR
SE/GENERATION
STATE GRAPH

INCEPT GRAPH
(OUTPUT)



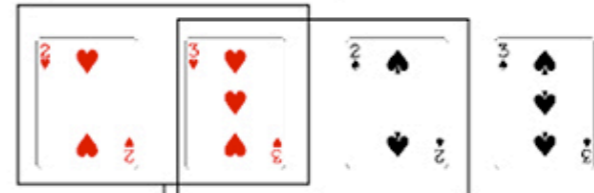
Computational Magic

Magic trick design and evaluation framework

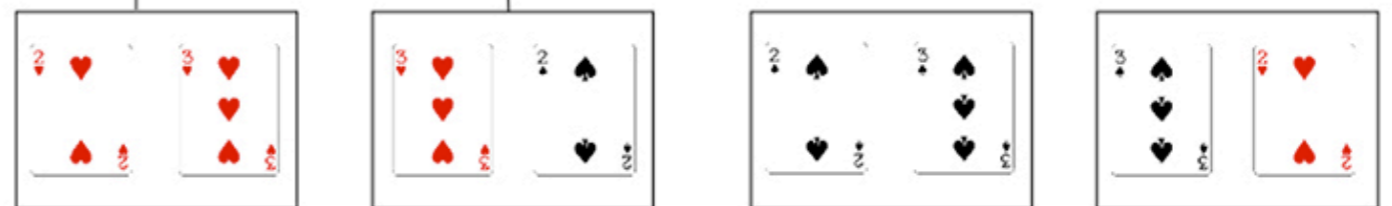


Card trick tree structure - simple example

Initial deck - cyclic sequence defined by colour of cards - sequence length 2



Cards dispensed in pairs



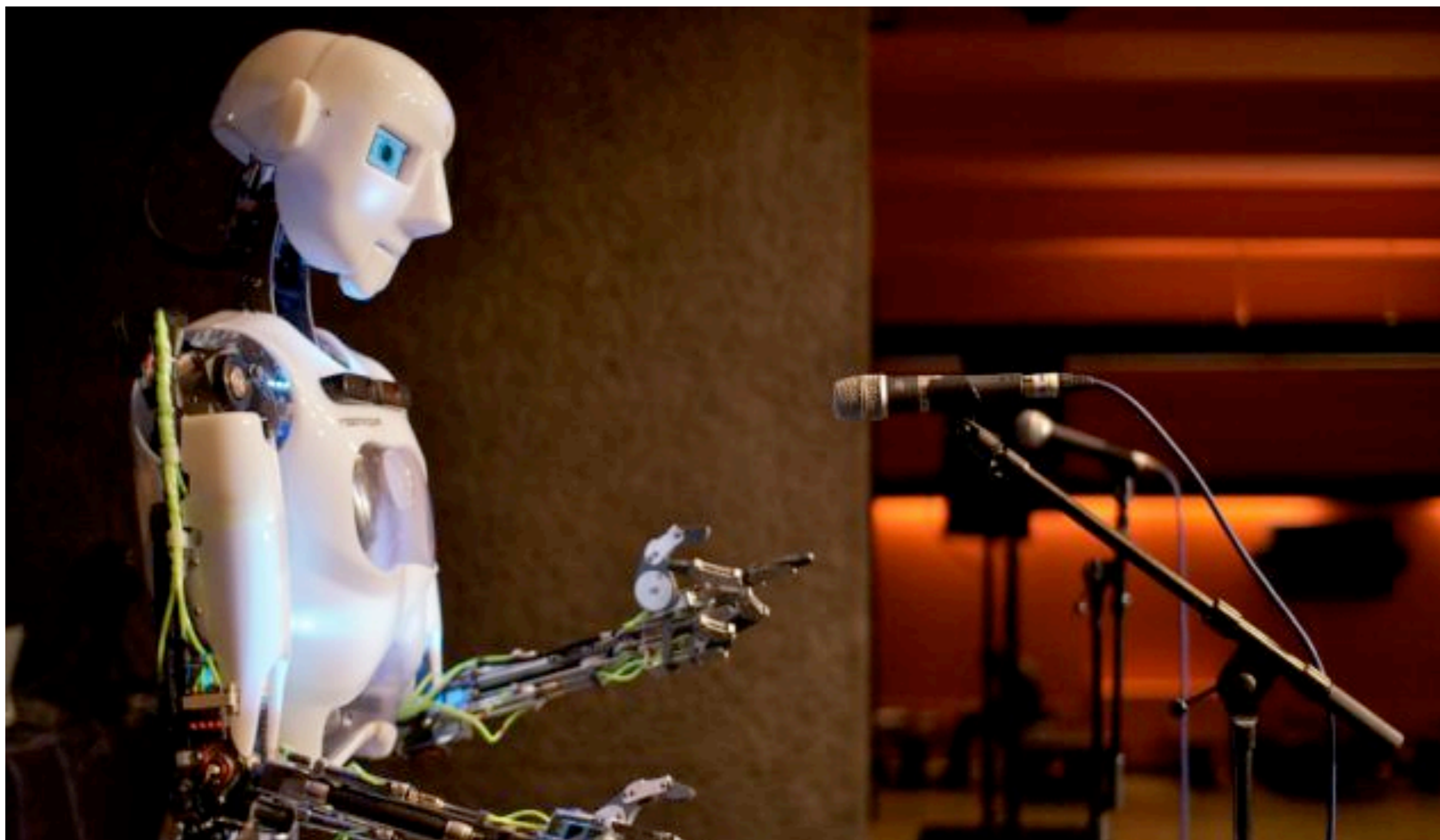
Each leaf node is a unique tuple of red and/or black

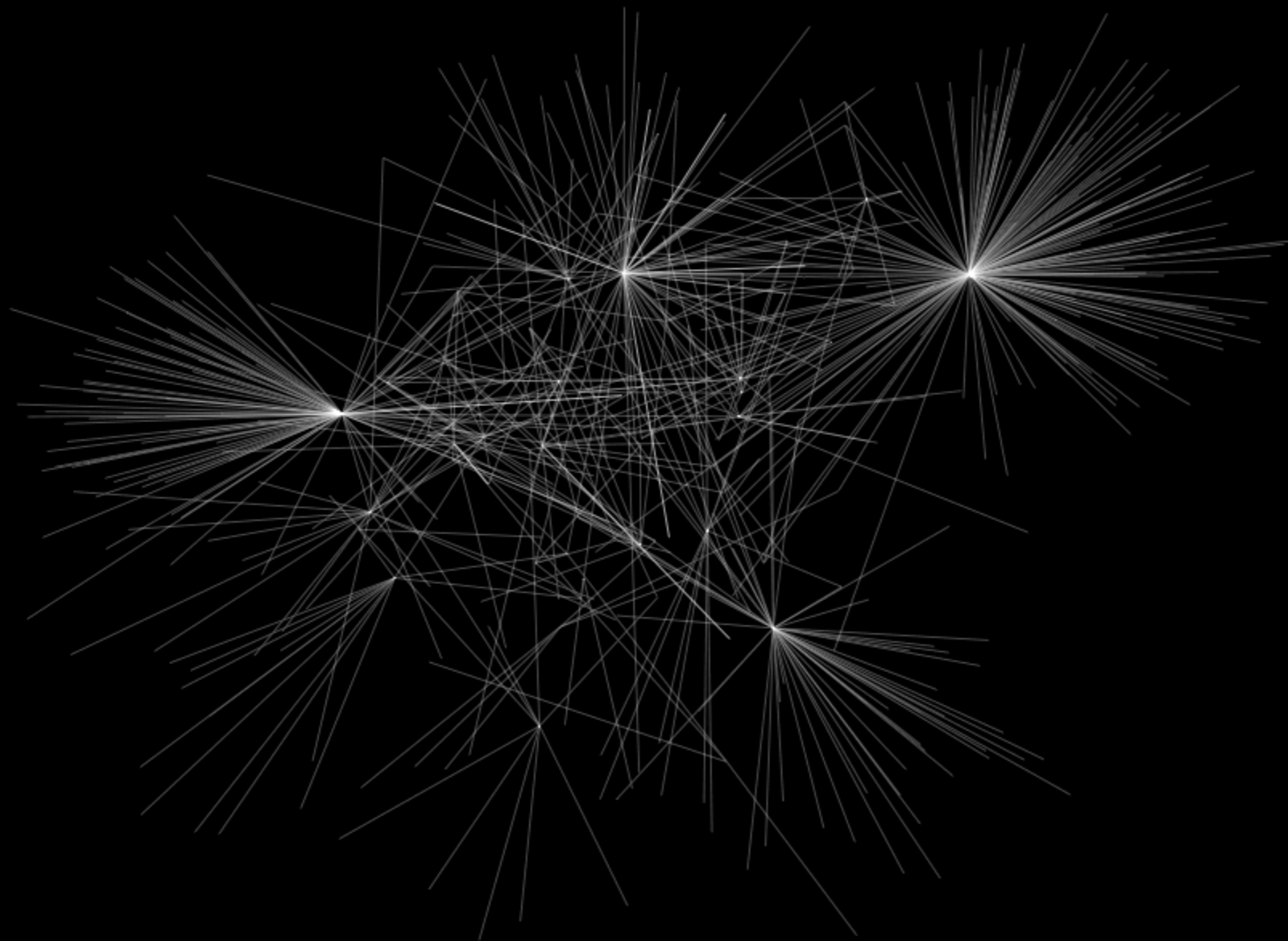
CHI+MED

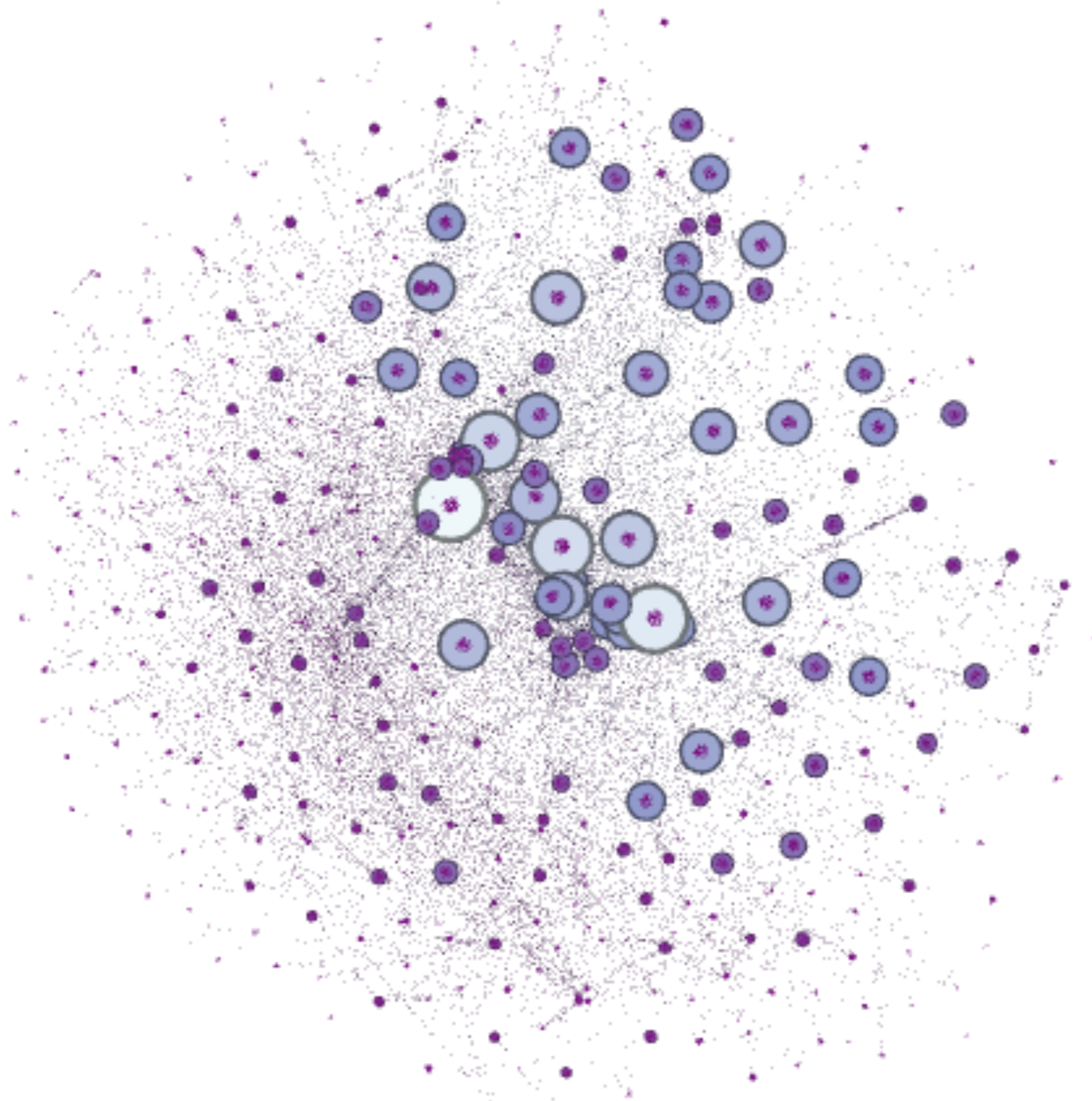






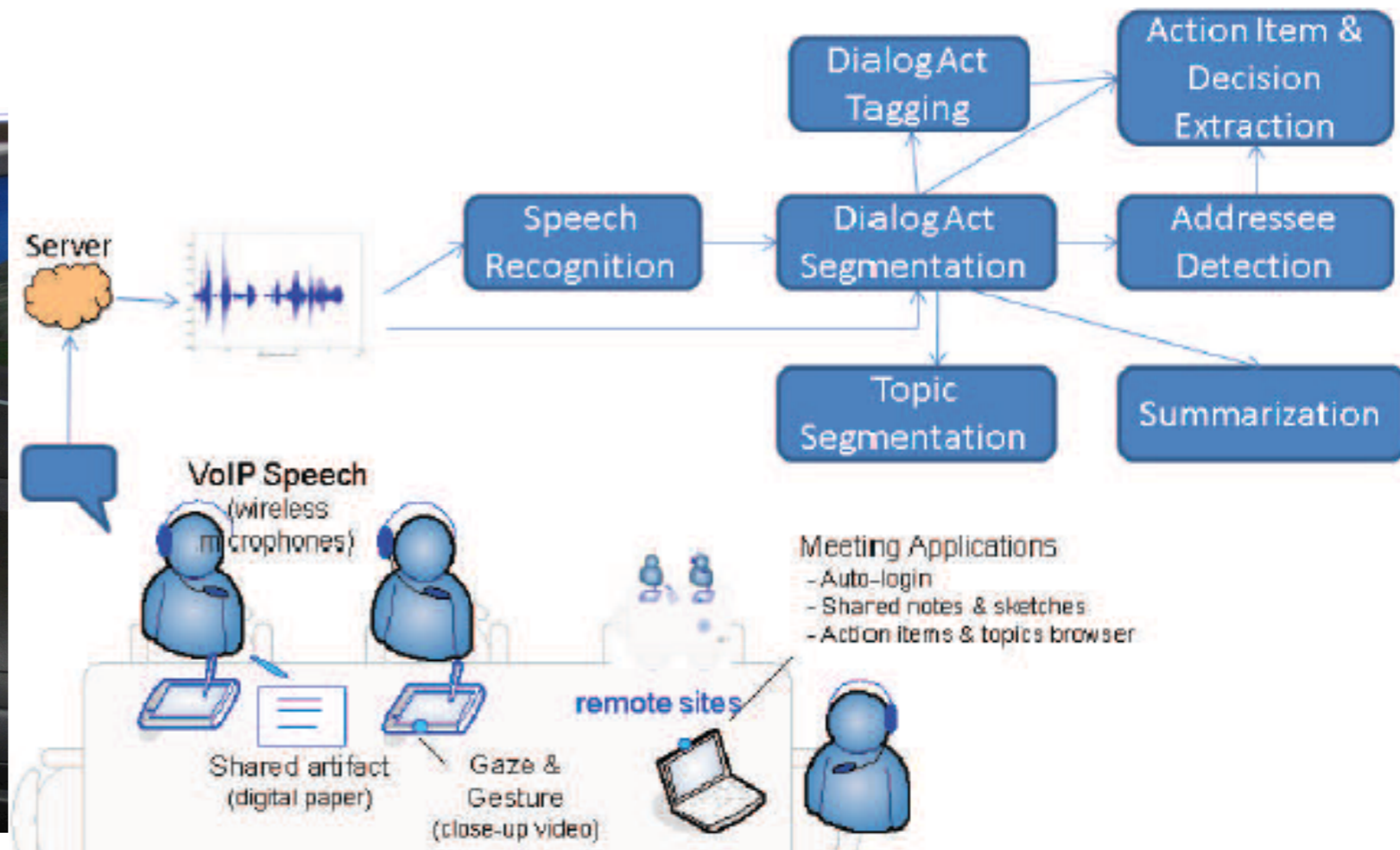
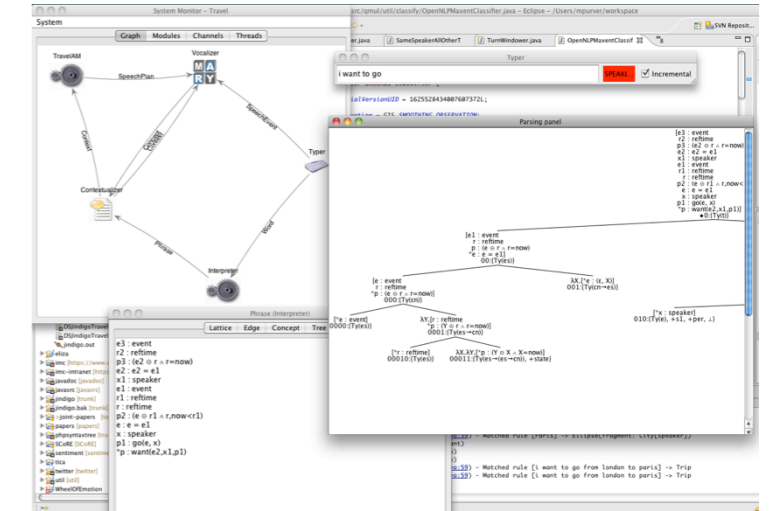
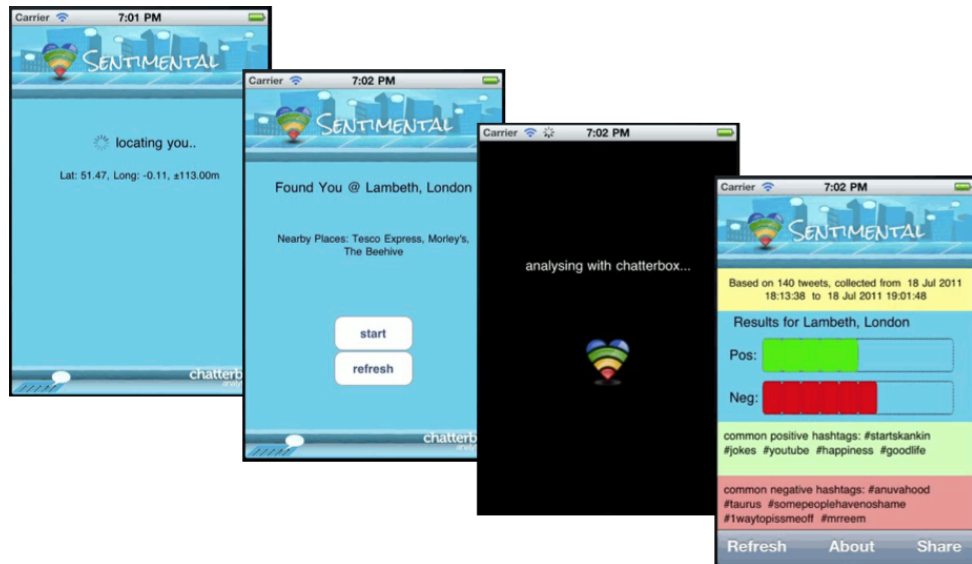








Language





theatre
art
dance

film
learning
music

venue hire
membership
support us

visitor information
event calendar
eat & drink
shop
[login/register](#)

search



welcome to the barbican



Yeah Yeah Yeah
Until 24 Oct
Cinemas



Chailly's Brahms / Gewandhausorchester
22 - 31 Oct
Various Venues

what's on today?

find out more
register today
for barbican
e-news



Milton Nascimento + Siba
Sun 20 Oct
Hall



Boy Blue Entertainment
22 Oct - 2 Nov
Theatre



Pop Art Design
22 Oct - 9 Feb
Art Gallery



Join Membership from £40
Priority booking, discounts,
special events + much more

Therapy Communication



Yeh, it doesn't happen in real life, does it?

What do you mean by real life?

You can't—there are no messages coming from the television to people are there?

Computational Linguistics

- Computational semantics:
 - Relating language to meaning
 - “sandy likes kim” vs like(s', k')
- Computational pragmatics:
 - Relating language to its function
 - “does sandy like kim?”
- Human-computer language
 - Computers that can talk to humans
- Human-human language
 - Computers that can understand human talk

Language is complicated

- It has structure:
 - dog bites man
 - man bites dog
- It involves meaning:
 - dog chases cats
 - puppy pursues kittens
- Meaning depends on structure:
 - no dog chases cats
 - no dog chases cats slowly
 - no idea if dog chases cats

It's not just about the words

- Structural dependencies
- E.g. negation

justin's new hair is nice

justin's new hair is not nice

justin's new hair is not very nice

justin's new hair is not as nice

justin's new hair is not really all
that nice

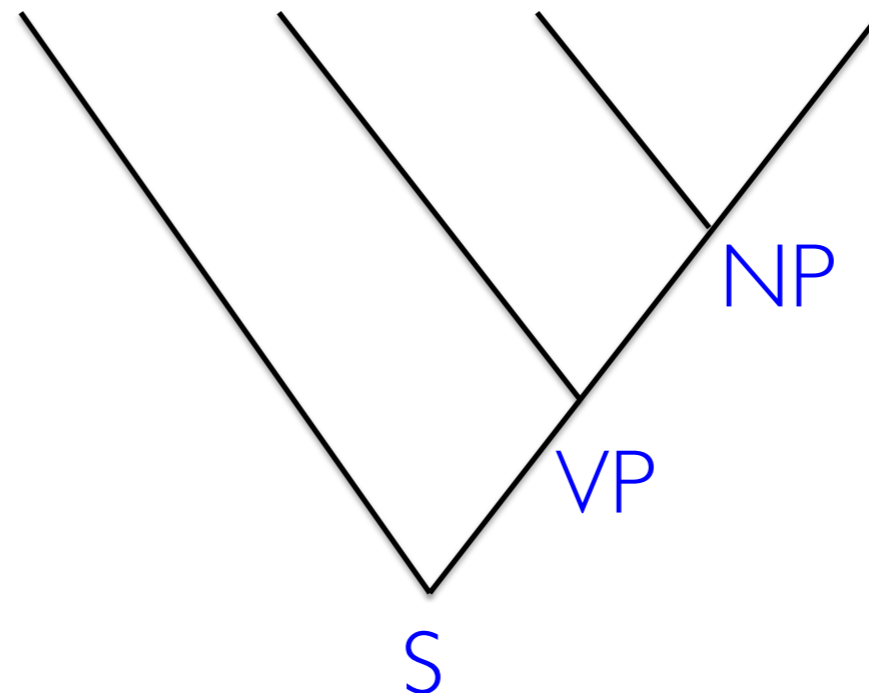
justin's new hair is not short but
very nice

Linguistic Analysis

words: mary hires a detective

parts of speech: PN VBZ DET CN

syntax:



semantics:

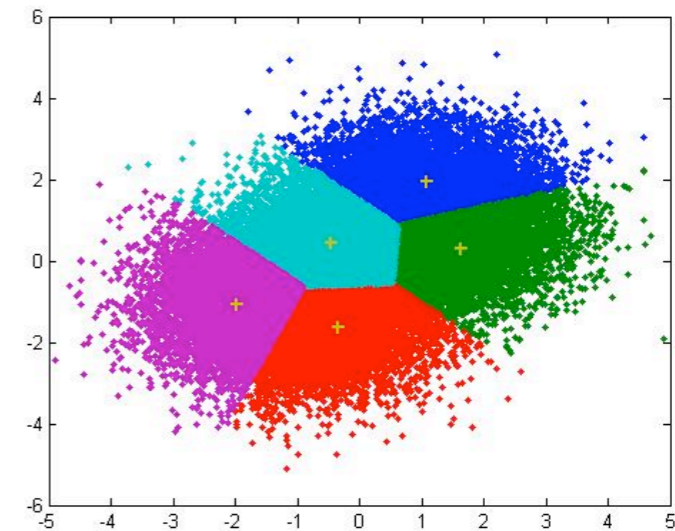
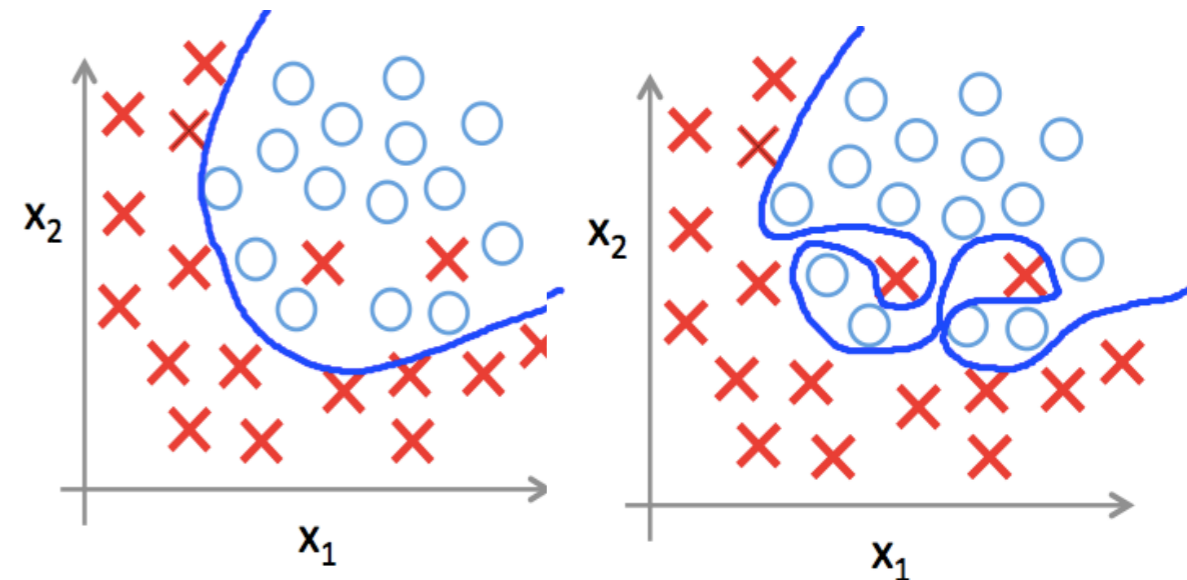
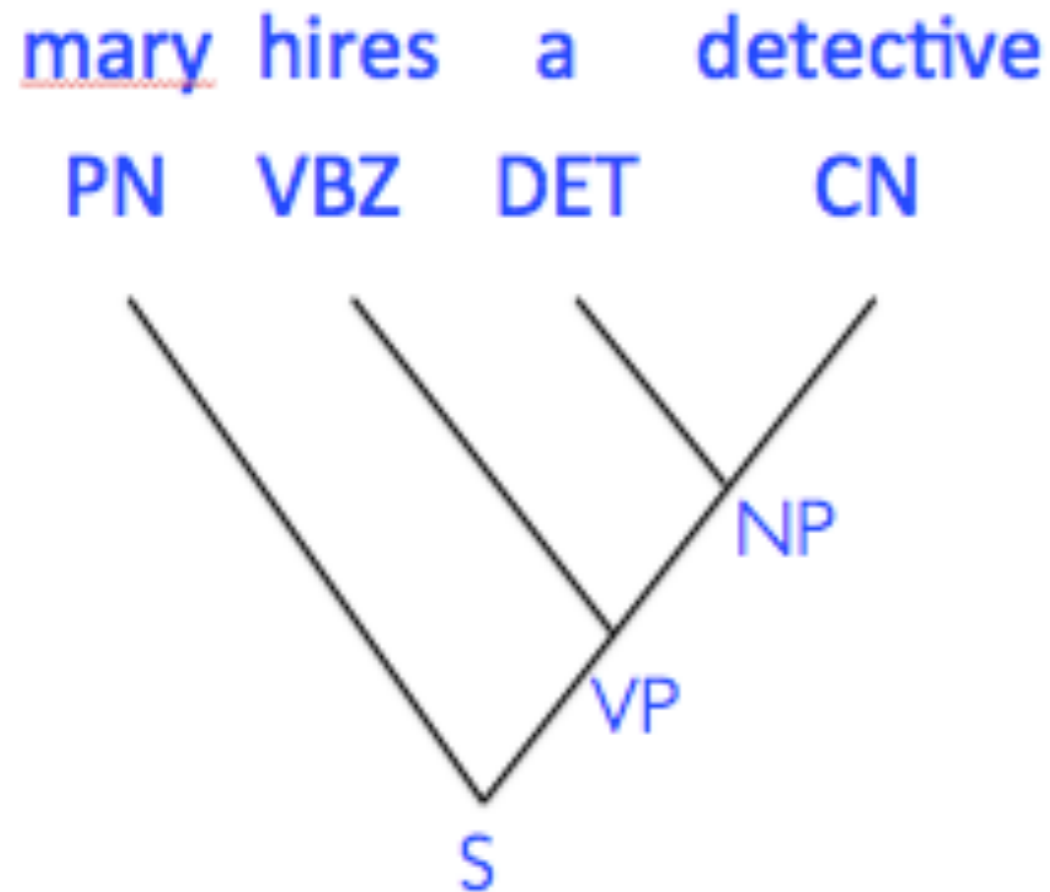
$\exists e, x . \text{hire}(e) \ \& \ \text{subj}(e, \text{mary}) \ \& \ \text{obj}(e, x) \ \& \ \text{detective}(x)$

Linguistic Analysis

- Meaning is often what we're interested in
- How do we understand:
 - Subjective vs objective statements
 - Statements of fact
 - Positive vs negative stance
 - Anger vs sadness vs disappointment vs ...
 - Topic of conversation
 - Expression of opinions
 - Expression of intentions
- Words are not enough!

Two main approaches

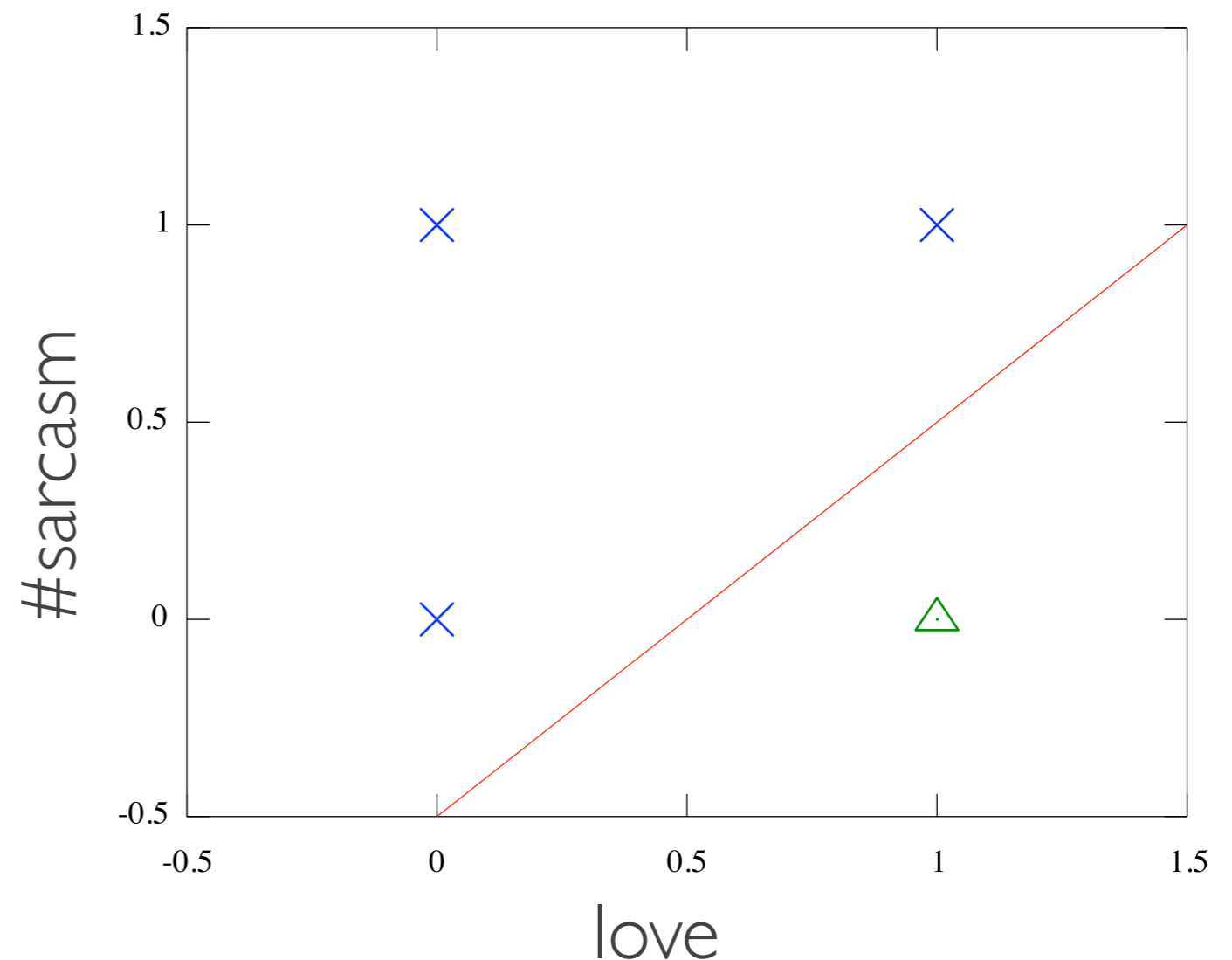
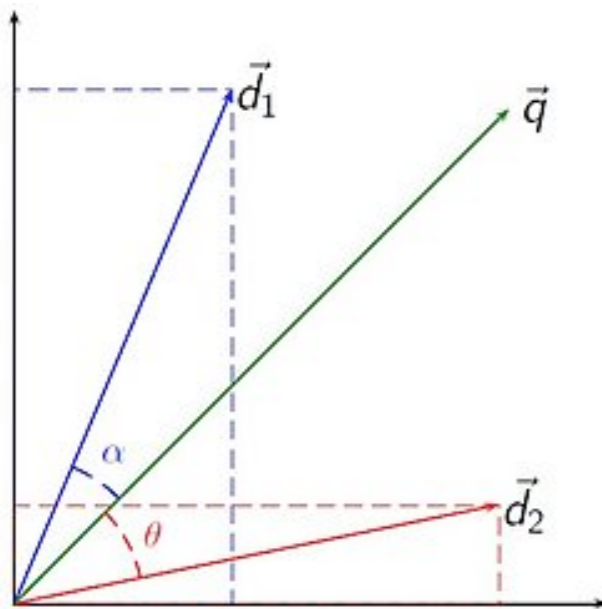
- Structure vs statistics:



coursera.com, wikipedia

Statistical Models

- Binary classification e.g. SVMs for sentiment
 - **i love @justinbieber #sarcasm**



Computational analysis

- Syntactic & semantic parsing

- (Probabilistic) grammar rules:

- $S \rightarrow NP VP$
- $VP \rightarrow VBZ NP$
- $NP \rightarrow DET CN$
- ...

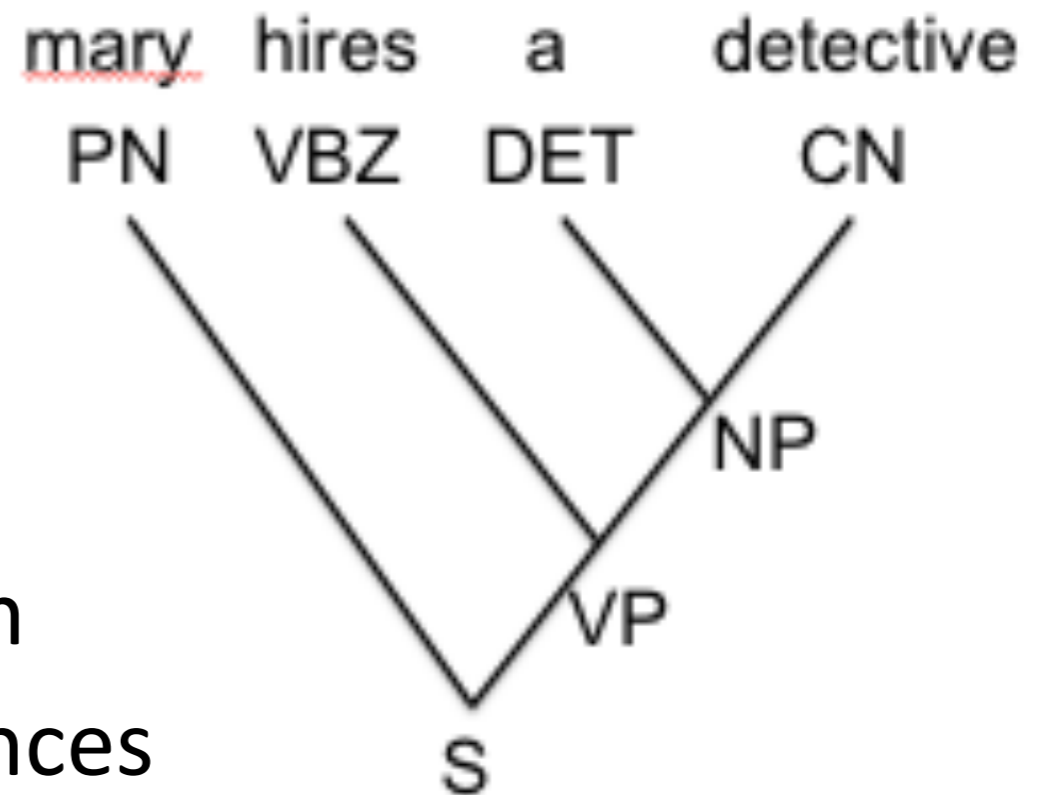
- (Probabilistic) parsing algorithm

- Syntax-semantics correspondences

- Good accuracy c. 80-90%

- See e.g. (Clark & Curran, 2007)

- But: written (mostly) by hand, or learnt from specific datasets

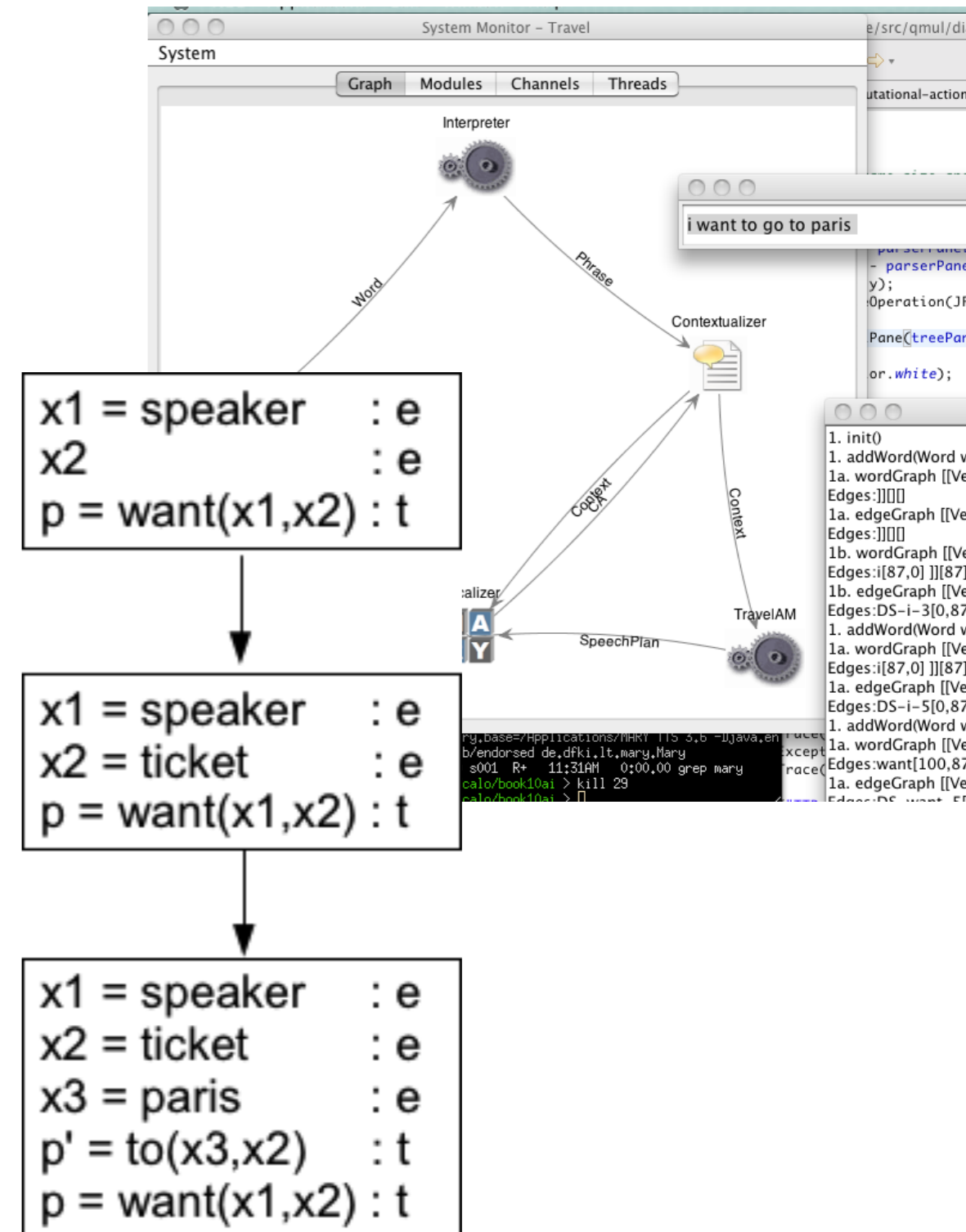


Human-Computer Dialogue

A: Ticket to London in March
B: OK

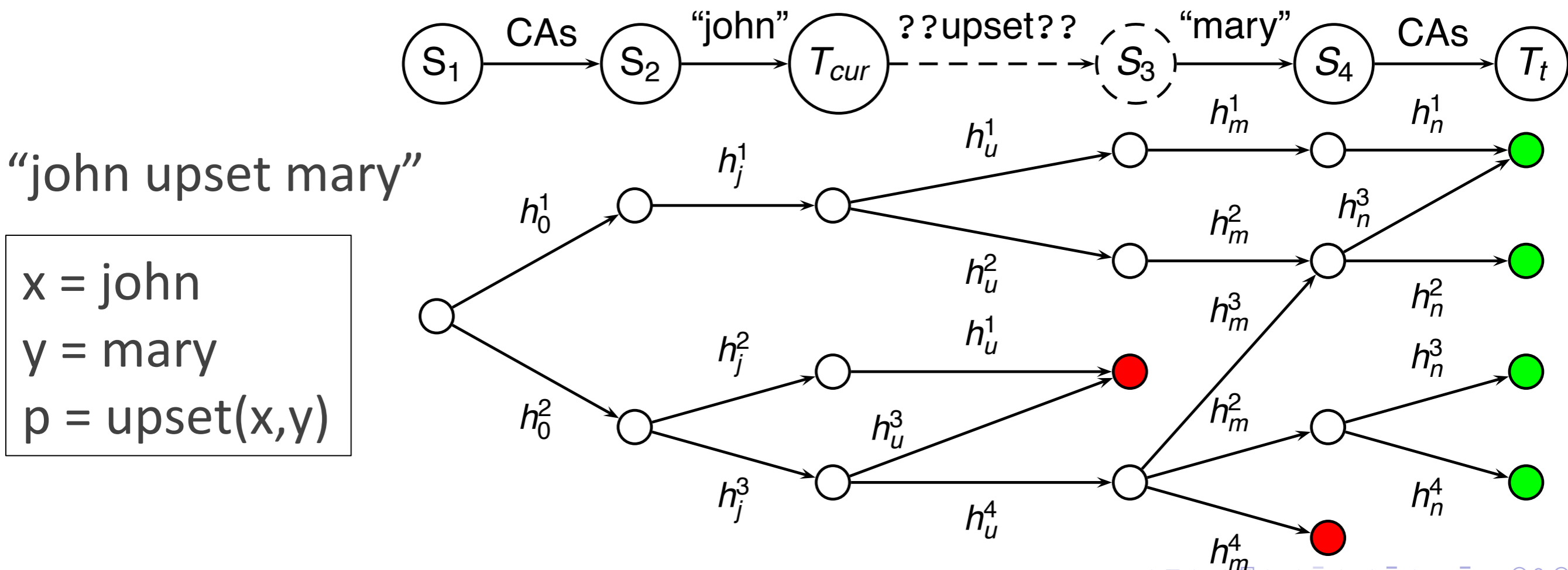
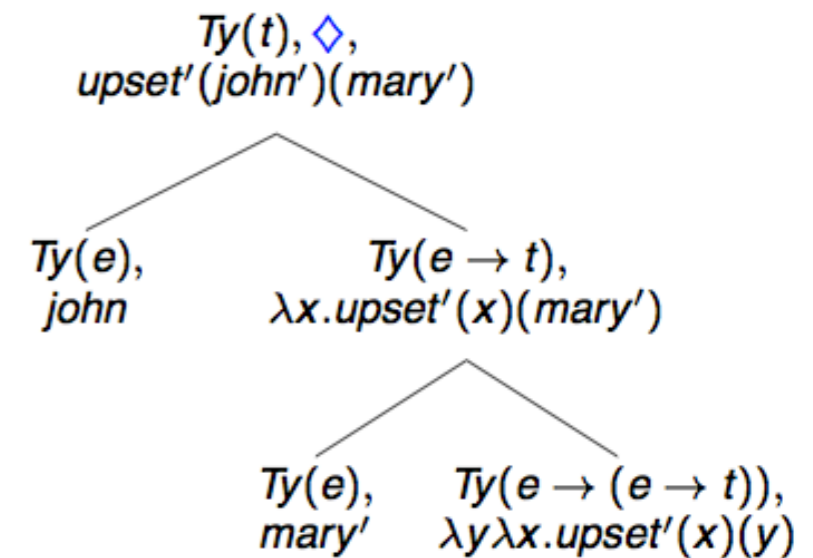
A: I want to go to er
B: yes
A: to London
B: London?
A: sorry no Paris, in March

- Incrementality
 - Semantic parsing and generation
 - DYLAN dialogue system
- Coordination and repair
 - Self-repair, other-repair, clarification



Incremental Grammar Induction

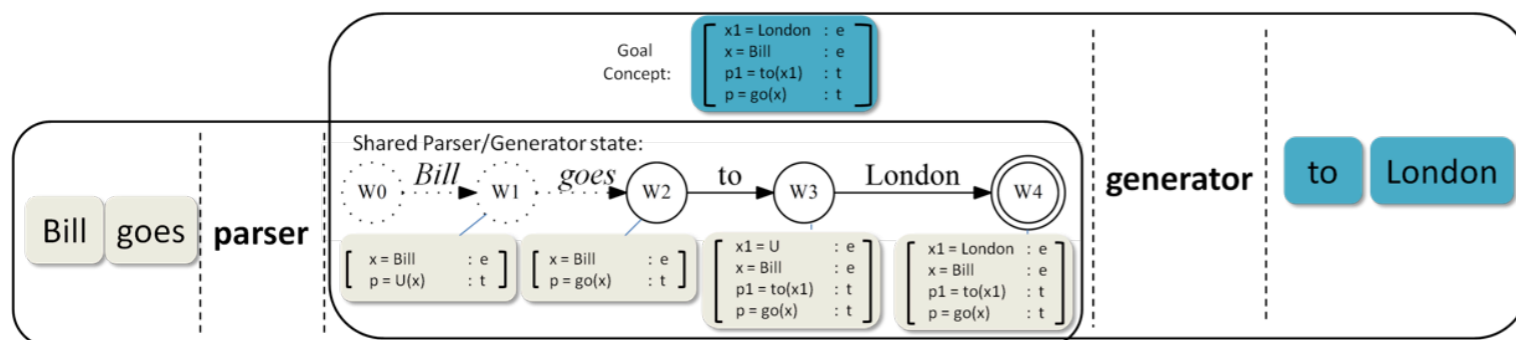
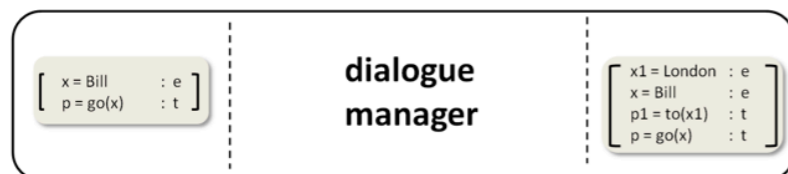
- Induction from semantics
 - for an incremental grammar
 - with incremental learning
 - 92% coverage, 85% F-score on CHILDES



Incremental dialogue: DyLAN

- Dynamic Syntax
- Type Theory with Records
 - (IWCS 2011, TTNLS 2014)

I want to go to Paris
...

$$\left[\begin{array}{l} e = now \quad : e_s \\ e1 = future \quad : e_s \\ x1 = Paris \quad : e \\ p2 = to(e1, x1) \quad : t \\ x = speaker \quad : e \\ p1 = go(e1, x) \quad : t \\ p = want(e, x, p1) \quad : t \end{array} \right]$$


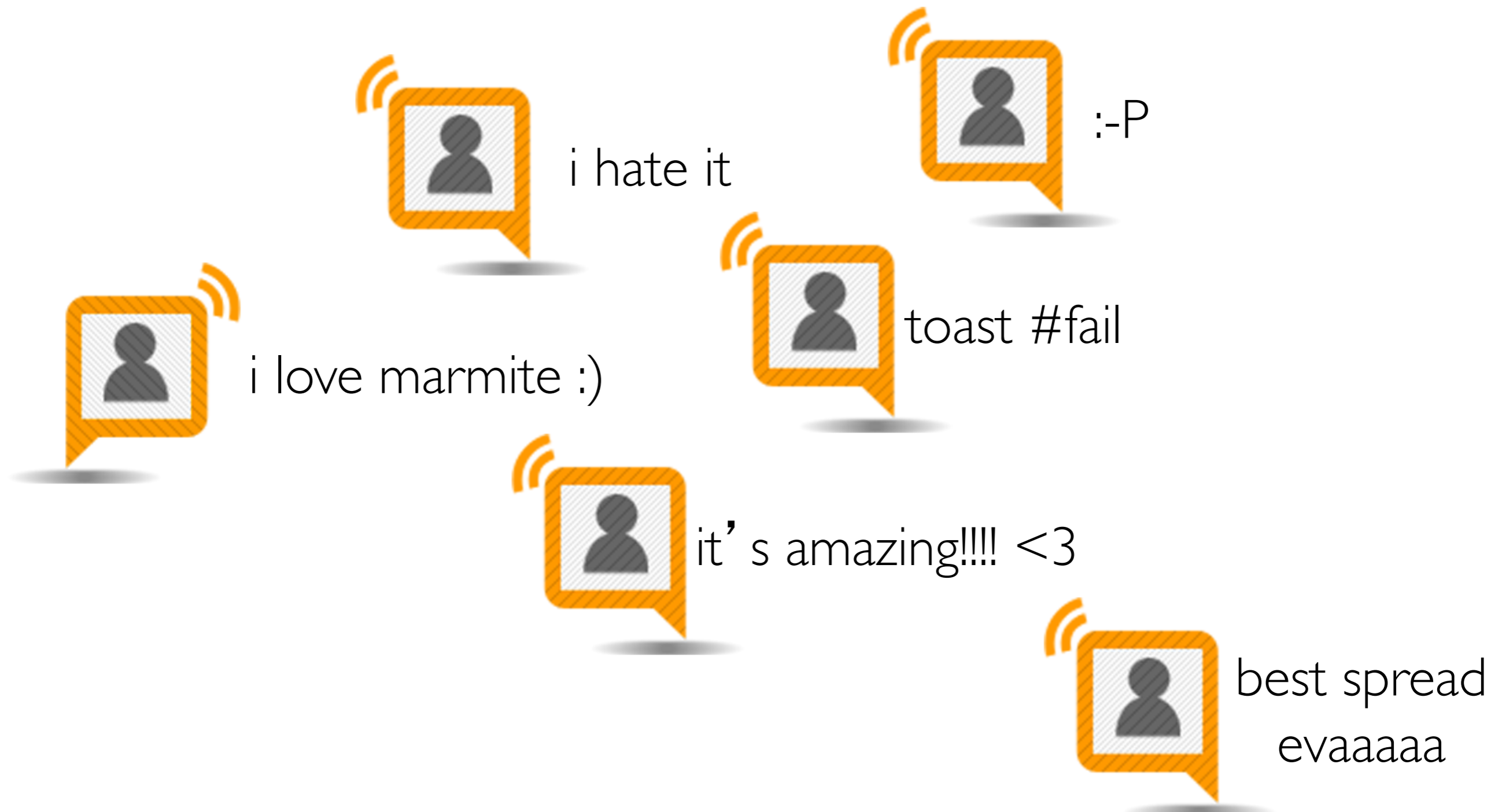
Online language

Nyt alexx tweetdreamsh RT @JDBAustralia: Goodnight everyone, i will tweet you all tomorrow <3 #loveislouder

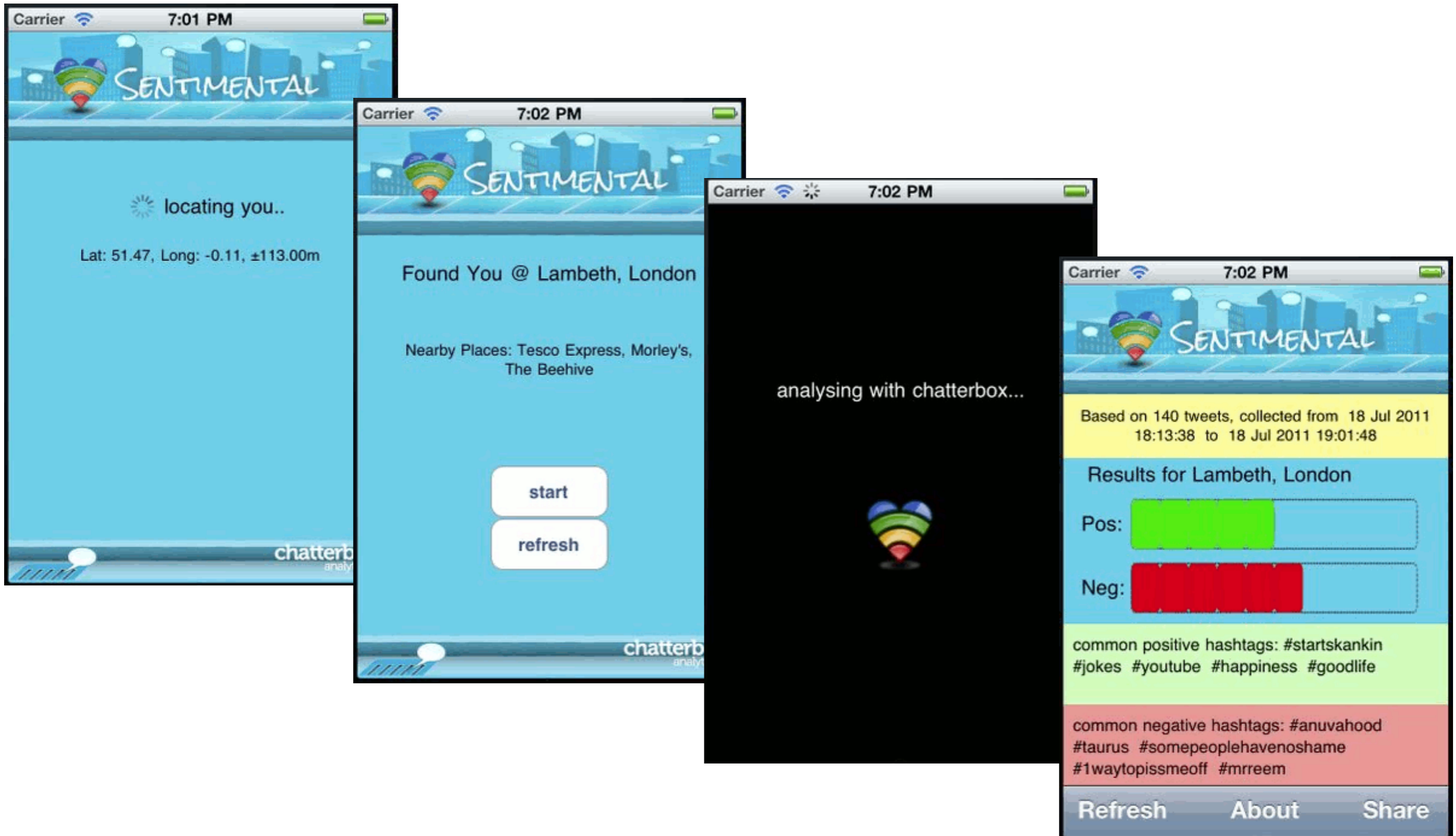
Im Not Goin o2 Be Sad o2day Imah \$MILE , Jus o4 Big Bruhh !

LOL IM BOR3D @ENYCHARM YU GOIN O2 DA M33TING?

Online conversations



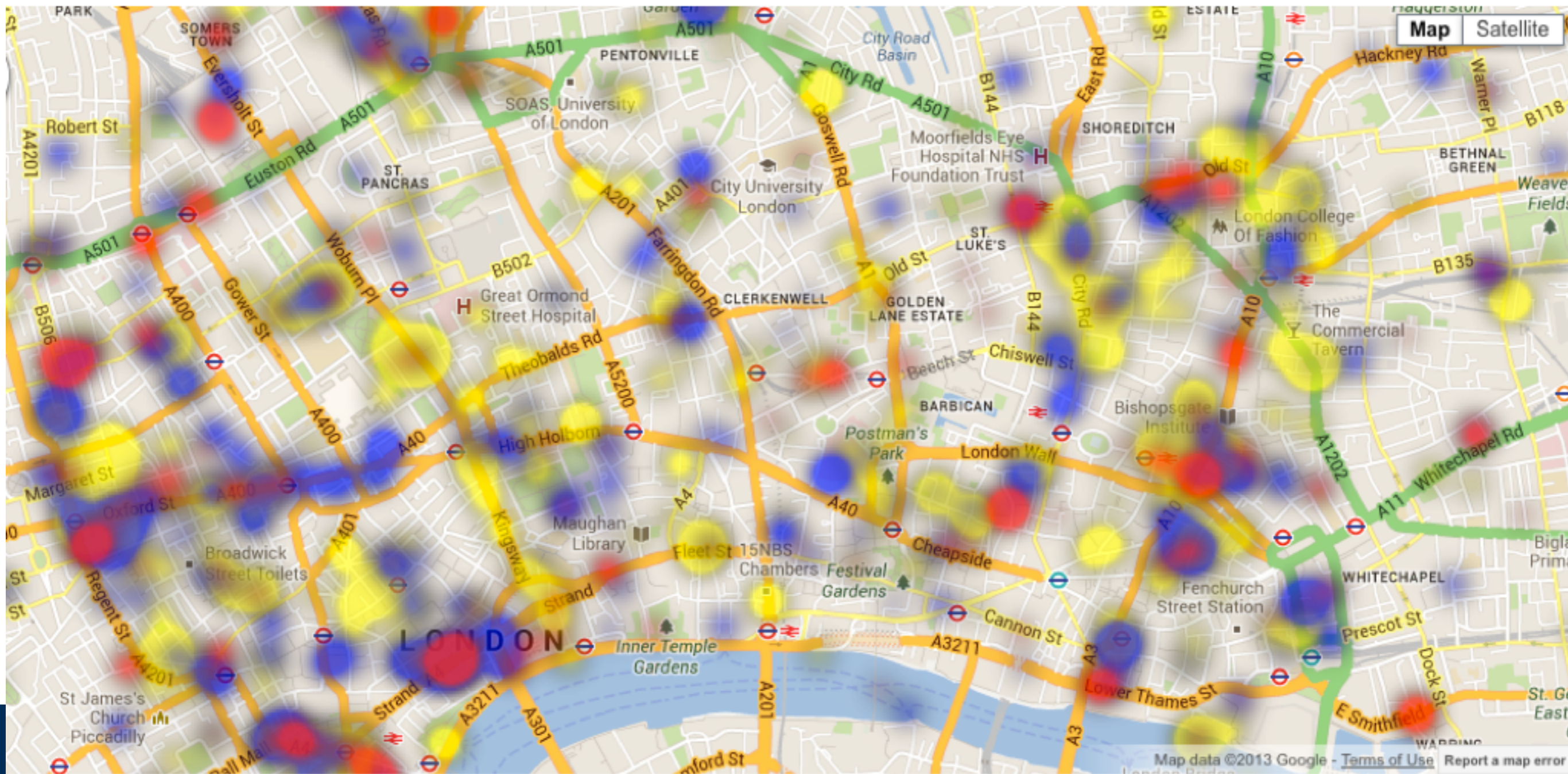
Sentimental



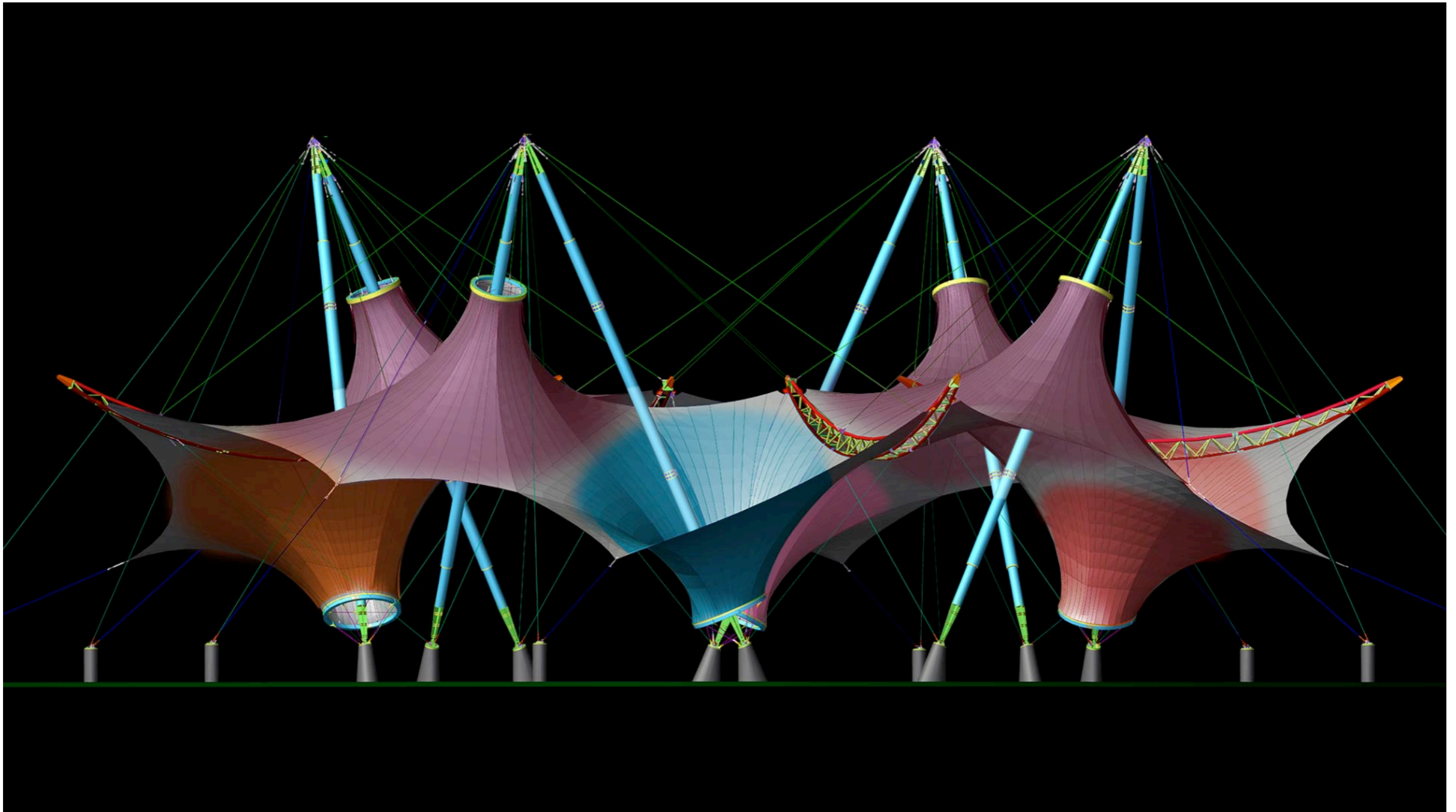
Live London Emotion Map

<http://www.eecs.qmul.ac.uk/~mpurver/emomap/>

(happy = yellow, sad = blue, angry = red)



'Beacon' @ Skysong Center



'Emotional weather' for Phoenix, AZ - www.edpurver.com

Barbican CMSI

- Understand audiences better
- Relate to offerings across artistic genres
- Locate curious audience members and learn from them
- Diversify audiences
- As automatically as possible
- Twitter: naturally occurring conversation as opposed to surveys etc



theatre
art
dance

film
learning
music

venue hire
membership
support us

visitor i
event c
eat & d
shop
login/re

search

welcome to the barbican



Yeah Yeah Yeah
Until 24 Oct
Cinemas



Chailly's Brahms / Gewandhausorchester
22 - 31 Oct
Various Venues



Milton Nascimento + Siba
Sun 20 Oct
Hall



Boy Blue Entertainment
22 Oct - 2 Nov
Theatre



Pop Art Design
22 Oct - 9 Feb
Art Gallery








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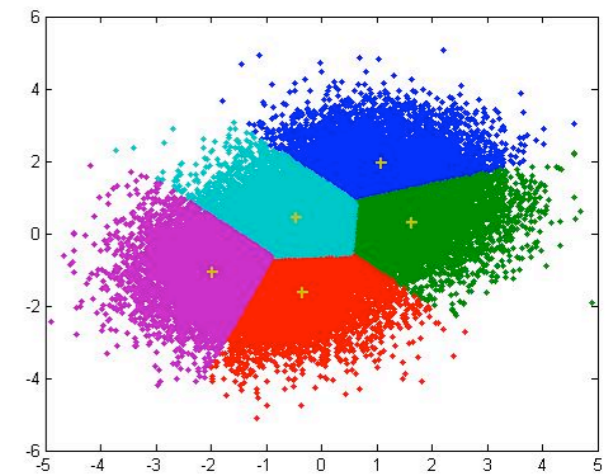
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Relevance Filtering

-  Ludovico Einaudi, Barbican, review: The composer's flexible show blended full-band gallops with eerily spaciou... <http://t.co/qxslvPnf>
-  Stand-up @MrEdByrne is in his Roaring Forties and coming to the York Barbican this October! <http://t.co/qu1HpGHyn7>
-  I miss Bank Holidays on the Barbican #drunk #memories #Plymouth
-  @Kimbletron Rub it in.. I wish I was down there on the Barbican with a big ice lolly.
-  I swear @Shuhzia is so dumb, she thought I was drinking alcohol -- it's Barbican, non alcoholic, ARABIC beverage
-  Pomegranate barbican is an addiction♡
-  Something going on at Barbican station about 12 emergency vehicles there mostly fire engines :-/

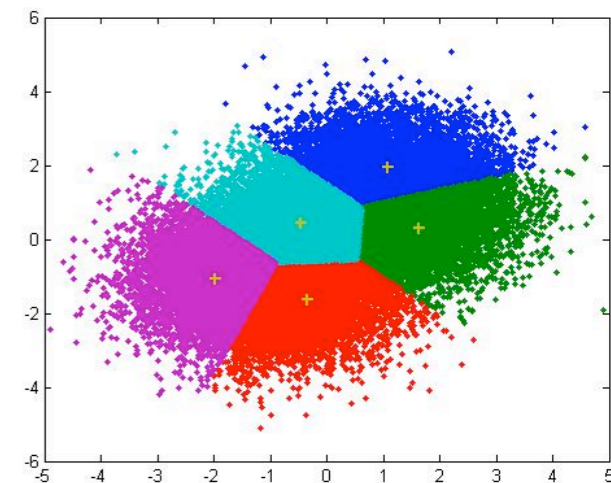
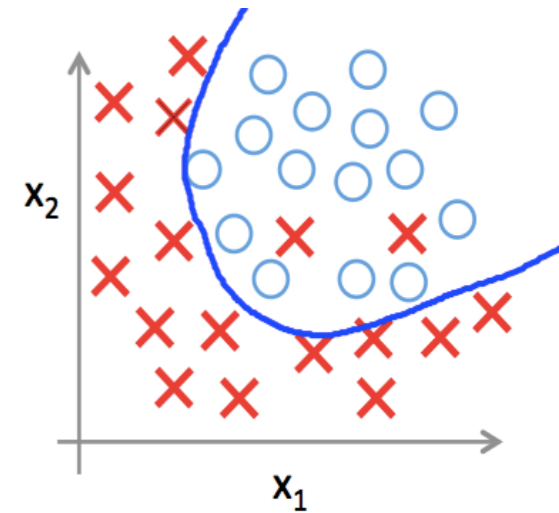
Topic Discovery



- tonight london night einaudi live ludovicoeinaud mogwai concert zidane
- london create art music festival centre city openeast weekend dance great
- street visit centre selling pay pop page tickets click albums london
- **road cloud ix saturday july drink tonight celebration party deh life beer**
- love tower interesting mark building em hate goldfinger shard division
- film london ideastap films aged short festival framed urban wandering
- hackthebarbican hack pm hacktb today week uk part dollop centre august
- **plymouth plymbarbican day time today great hoe good lunch nice night**
- london zorn show house dalstonhouse dalston john ticket september
- room gin drink rain drinks cinema haha school class trade bottle apple
- ...

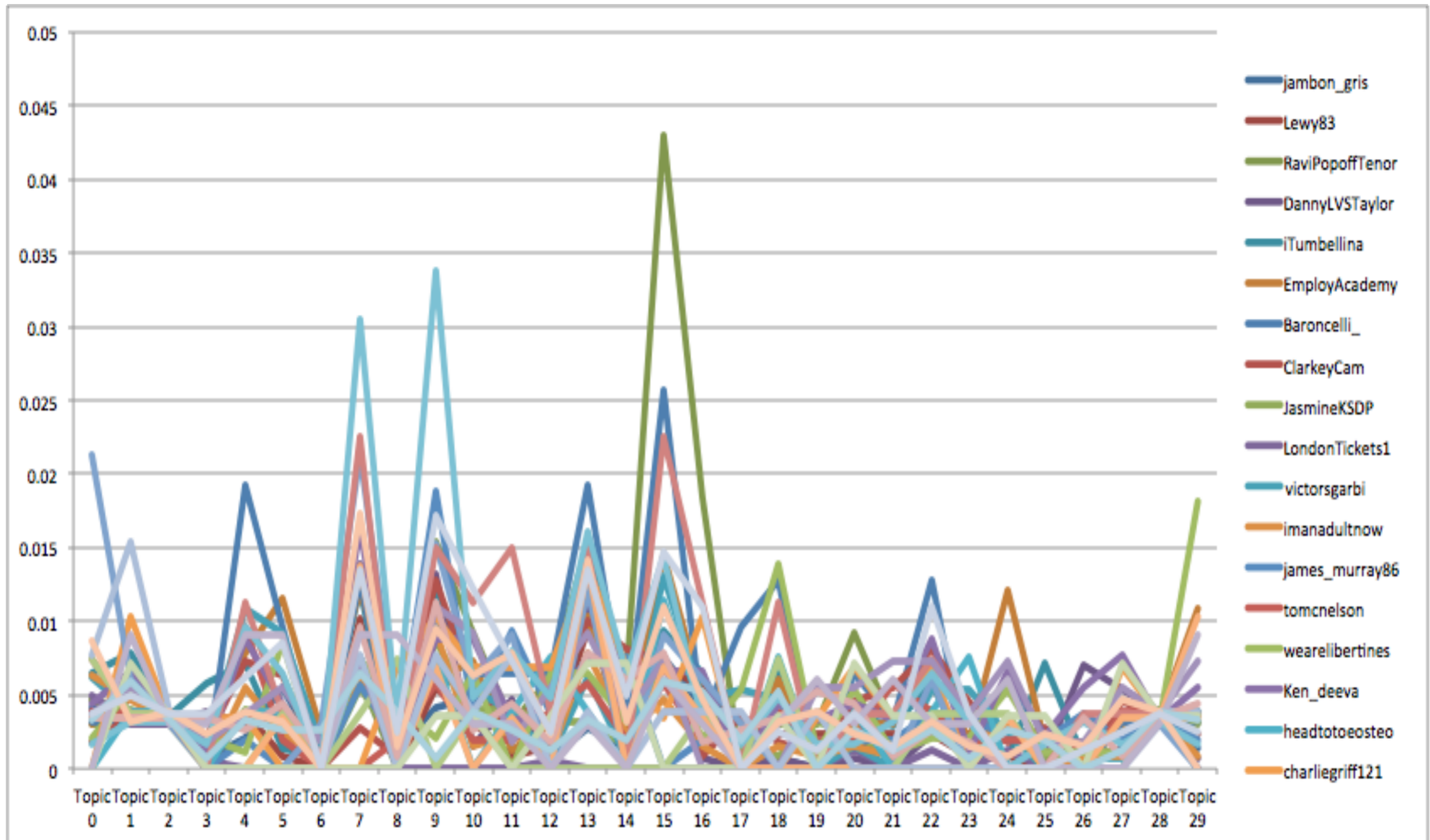
Finding Interests

- Relevance filtering; 95% accurate
- Topic discovery:
 - artistic genres
 - sentiment

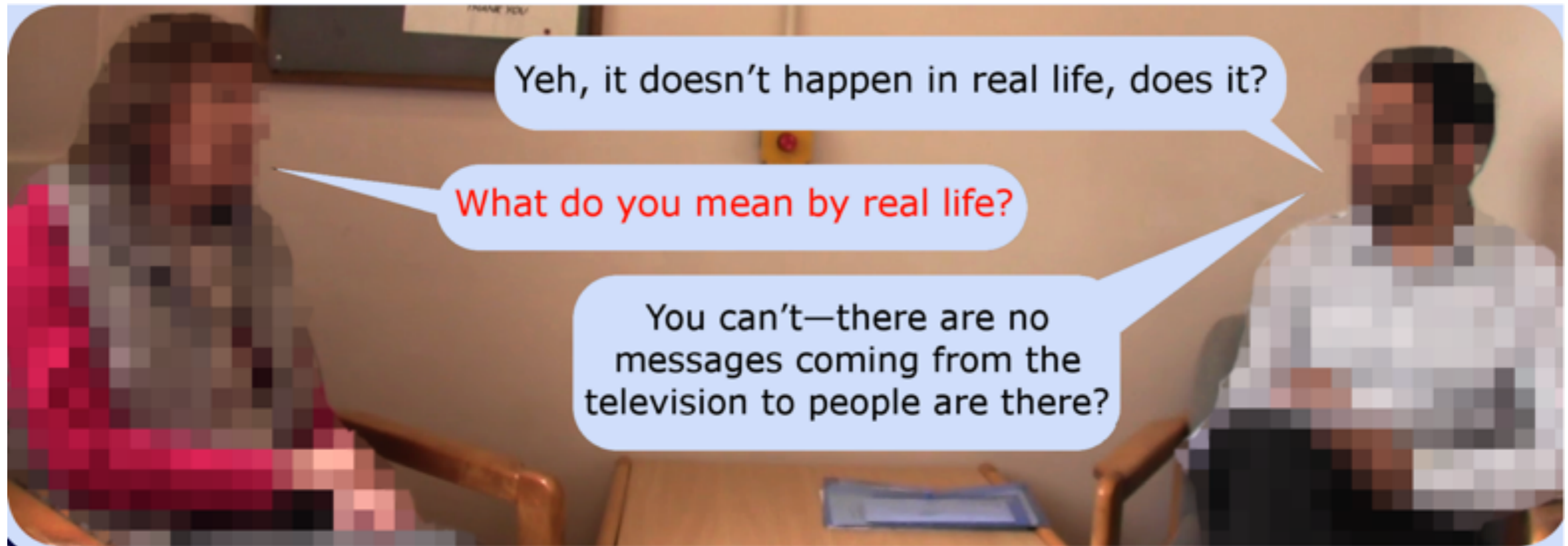


'Enjoyment'	'Ludovico'	'HTB'	'Gigs'	'Festival'
time	einaudi	hackthebarbican	mogwai	london
good	ludovicoeinaud	uk	tickets	create
love	night	dollop	zidane	festival
lunch	tonight	hack	tonight	openeast
day	ludovico	today	live	park
back	amazing	jackmaster	mogwaiband	weekend
walk	concert	part	devendra	olympic
night	music	loefah	london	east
nice	time	htb	banhart	music
haha	evening	free	bought	open

Cultural Mobility?



Mental Health



- Analysing language and conversation in therapy
- Schizophrenia: face-to-face outpatient consultations
- Depression & anxiety: online text-based CBT

Repair in Therapy Dialogue

- Self-repair:

Dr: You probably have seen so many psychiatrists **o o over the years**

Dr: **Did you feel that did you despair so much that** you wondered if you could carry on

- Other-repair:

Dr: Rather than **the diazepam** which I don't think is going to do you any good

P: **the valium**

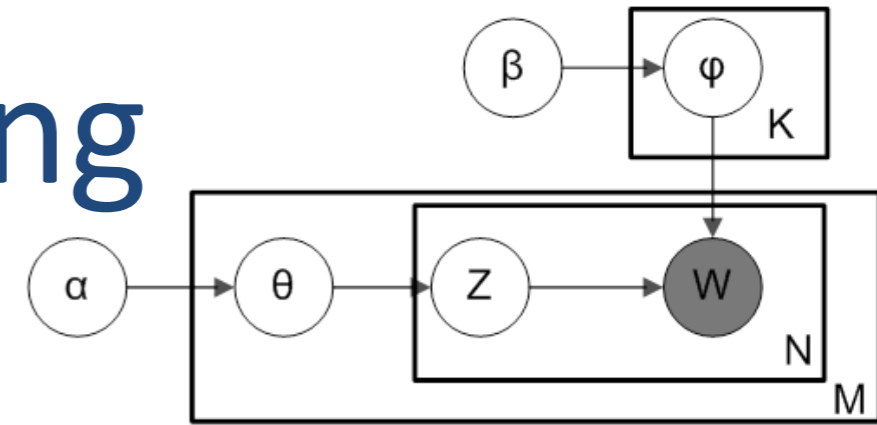
Dr: Yeh, it doesn't happen in real life does it?

P: **What do you mean by real life?**

Dr: **You can't - there are no messages coming from the television to people are there?**

Automatic topic modelling

- Infer 20 lexical “topics”:



Topic 0	feel low alright mood long drug feeling tired time confiden
Topic 4	voices pills mood cannabis telly voice shaking chris contro
Topic 5	letter health advice letters council copy send dla cpn prob
Topic 7	church voice voices hear medication sister bad hearing tak
Topic 9	school children kids back september oclock gonna phone
Topic 10	weight months medication stone risk lose eat write gp has
Topic 11	place support work centre gotta job stress feel psychologis
Topic 12	door house police thought ring knew worse wall hadnt sat
Topic 13	doctor alright years nice ill anxious write long sit eye hear
Topic 14	drug taking milligrams hundred doctor night time medicat
Topic 15	sort medication work drugs kind team issues drink alcohol
Topic 16	mum place brother tablets died dad depot house meet mo
Topic 17	people life drug make care lot friends dry camera live cope
Topic 18	alright house drink drinking money alcohol god drugs living

Predicting outcomes

- Schizophrenia: doctor/patient ratings:
 - PANSS positive symptom scale: 60% accurate
 - HAS Helping Alliance Scale: 75% accurate
- Schizophrenia: adherence to treatment in 6 months:

Data	P (%)	R (%)	F (%)
Human expert with text	60.3	79.6	68.6
Automatic	70.3	70.3	70.3
Human expert with video	69.6	88.6	78.0

- Depression:
 - final in-caseness: 70-75%
 - dropout: 73%

Thanks!