The brain and the web:
intelligent interactions from the desktop to the world

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http://www.hcibook.com/alan/papers/brazil2006/

first things ...

good to be here

you speak Portuguese

I speak English ...

... too fast

if I speak too fast ...

... shout “Slow Down”

but in case ...
I have tried to put all
the words on the slides

… but

although I speak English
I am not English
I am **Welsh**
rydw i'n Cymraeg

… finally of the firstly's

I work in Lancaster
and live in Cumbria
The Lake District

HCI2007 in Lancaster
3rd-7th Sept. 2006

I am not talking about …

- situated displays, eCampus,
  small device – large display interactions
- fun and games, artistic performance,
  slow time
- physicality, creativity, bad ideas
  + dreams and regret!!

some numbers

back of the envelope … the Dix number

how much memory for full AV record of your life?

- assume ISDN quality (10Kbytes/sec)
- 30 million seconds / year => 300 Gbytes/year
- one hard disk x number of years
- but Moores Law … size reduces each year
- max is after 2 years
- never need more than one big disk

baby born today …

- the life of man is 3 score and ten = 70 years
- 21 tera bytes … but with Moores Law …
- memory the size of a grain of dust

… from dust we came …

more back of the envelope

The Brain

- number of neurons ~ 10 billion
- synapses per neuron ~ 10 thousand
- information capacity
  - number neurons x synapses/neuron x 40 bits
  - 40bits = address of neuron (34 bits) + weight (6 bits)
  - total = 500 terabytes or 1/2 petabyte

The Web

- web archive project 100 terabytes compressed
- or Google 10 billion pages x 50K per page = 500 terabytes

and more ...

The Brain

- total number synapses = 100 trillion (10^{14})
- firing rate = 100 Hz
- computational capacity = 10 peta-nuops / second
- nuop = neural operation - one weighted synaptic firing

The Web

- say 100 million PCs
- assume 1 GHz PC can emulate 100 million nuop / sec
- computational capacity = 10 peta-nuops / second

?

News Flash Japan 2011
10 petaflop super computer

so what?

- global computing approximating raw power of single human brain
- does not mean artificial humans!
  but does make you think
- we live in interesting times
  an age pregnant for “intelligent” things
- but maybe not as we know it
  ... AI = Alien Intelligence

and now ...

- a tale of three systems
  - one past – onCue
  - one present – Snip!t
  - and one still to come – TIM
- none very intelligent !
- but baby steps



onCue

systems past



onCue origins

- dot.com company aQtive
  with Russell Beale, Andy Wood, and others
- venture capital funding from 3i
  … BEFORE dot.com explosion
- onCue principal product
  - over 600,000 copies distributed
  - 1000s of registered copies
- needed second round funding …
  … just AFTER dot.com collapse :-(

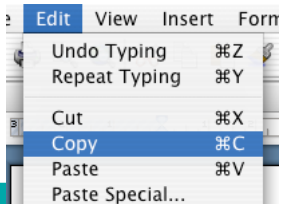
aQtive

onCue

- intelligent ‘context sensitive’ toolbar
- sits at side of the screen
- watches clipboard for cut/copy
- suggests useful things to do
  with copied date

onCue in action

user selects text



and copies it to clipboard

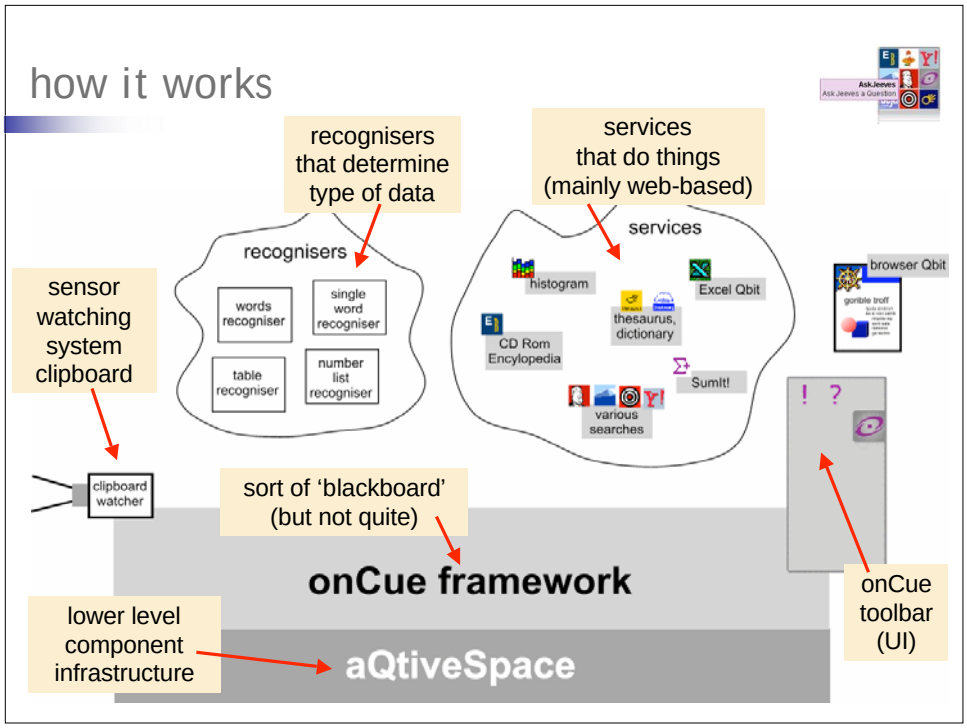
slowly icons fade in

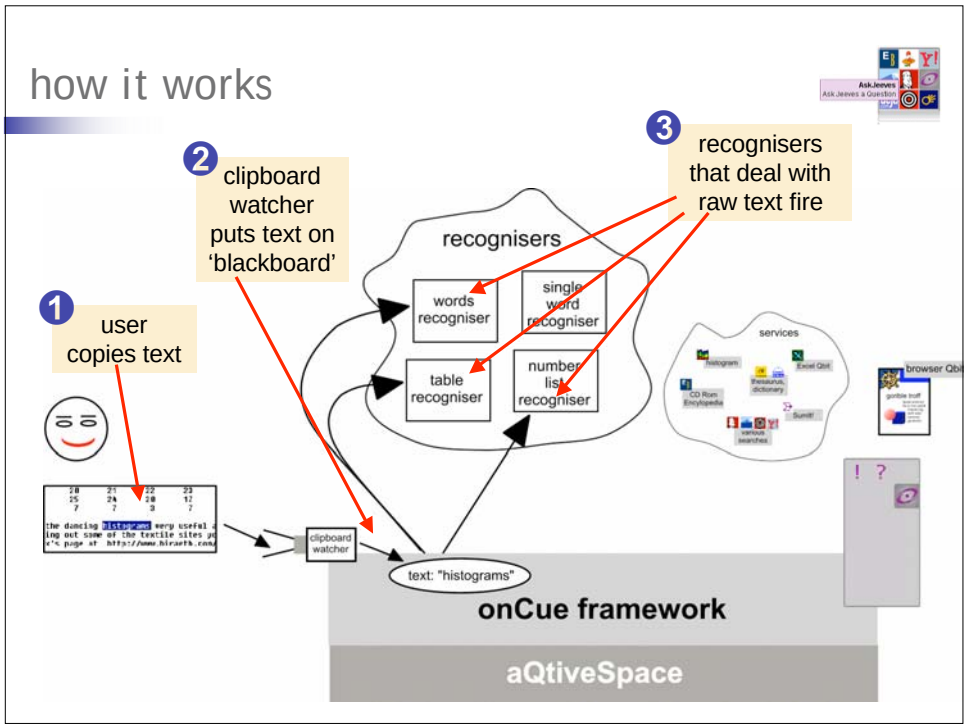
```
     20      21
     25      24
      7       7       3       7

the dancing histograms very useful a
ing out some of the textile sites yo
x's page at http://www.hiraeth.com/
```

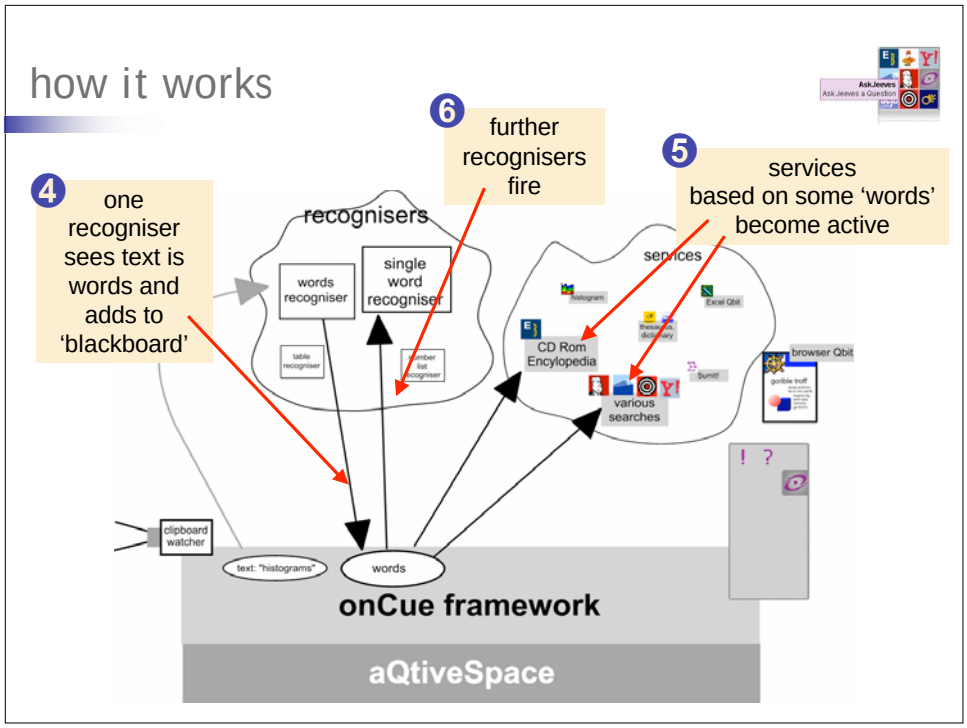
kinds of data

short text	–	search engines
single word	–	thesaurus, spell check
names	–	directory services
post codes	–	maps, local info
numbers	–	SumIt! (add them up)
custom	–	order #, cust ref ...
tables	–	...

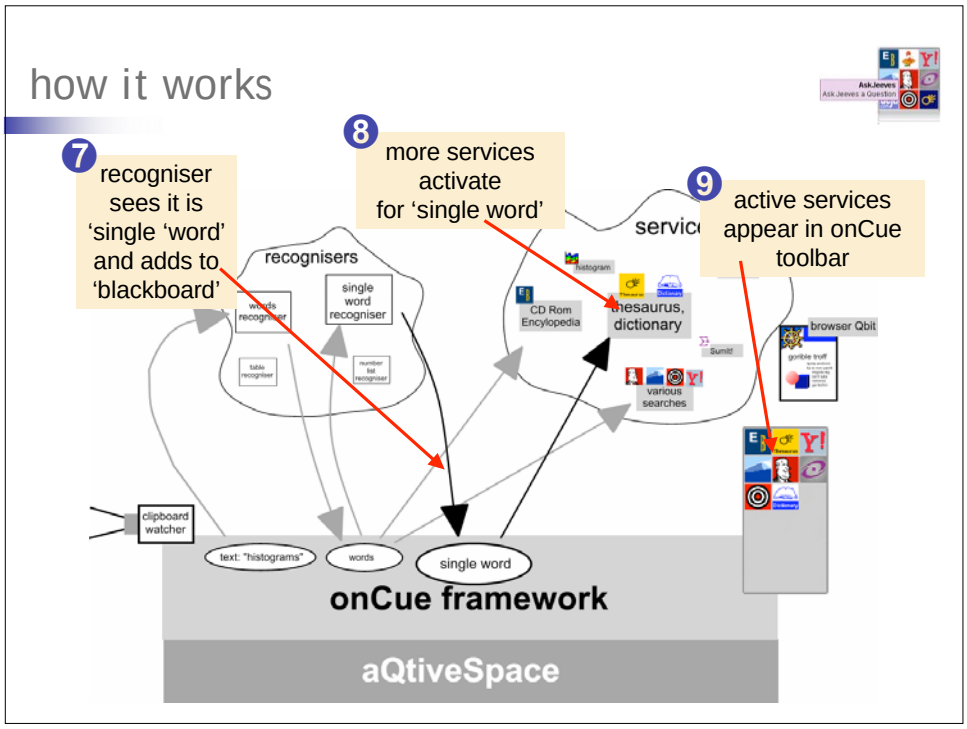

how it works
recognisers that determine type of data
services that do things (mainly web-based)
recognisers
words recogniser
single word recogniser
table recogniser
number list recogniser
services
histogram
Excel Qbit
thesaurus, dictionary
CD Rom Encylopedia
SumIt!
various searches
browser Qbit
sensor watching system clipboard
clipboard watcher
sort of 'blackboard' (but not quite)
onCue framework
lower level component infrastructure
aQtiveSpace
onCue toolbar (UI)


how it works
2
clipboard watcher puts text on 'blackboard'
3
recognisers that deal with raw text fire
recognisers
words recogniser
single word recogniser
table recogniser
number list recogniser
1
user copies text
clipboard watcher
text: "histograms"
onCue framework
aQtiveSpace

how it works



how it works



issues …

appropriate intelligence

- often simple heuristics
- combined with the right interaction

rules of standard AI interfaces

1. it should be right as often as possible
2. when it is right it should be good

good for demos
look how clever it is!

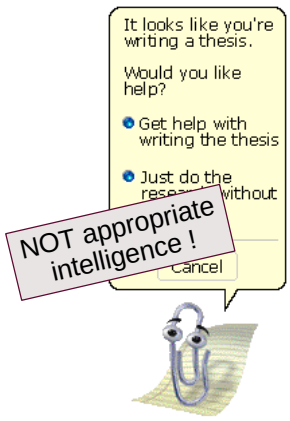
rules of appropriate intelligence

1. it should be right as often as possible
2. when it is right it should be good
3. when it isn't right ...
   it shouldn't mess you up

} what makes a system really work!

Hit or a Miss?

✘ paper clip
- can be good when it works
- but interrupts you if it is wrong



✓ Excel '∑' button
- guesses range to add up
- very simple rules (contiguous numbers above/to left)
- if it is wrong ... simply select what you would have anyway

onCue appropriate?

1. it should be right as often as possible
   - uses simple heuristics:
     e.g. words with capitals = name/title
2. when it is right it should be good
   - suggests useful web/desktop resources
3. when it isn't right it shouldn't mess you up
   - slow fade-in means doesn't interrupt

architecture

- high level
  - recognisers & services
- low level
  - Qbit components
  - based on status–event analysis

theoretical framework bridging human activity to low-level implementation

working with Jair Leite on 'next generation' SE components and notation

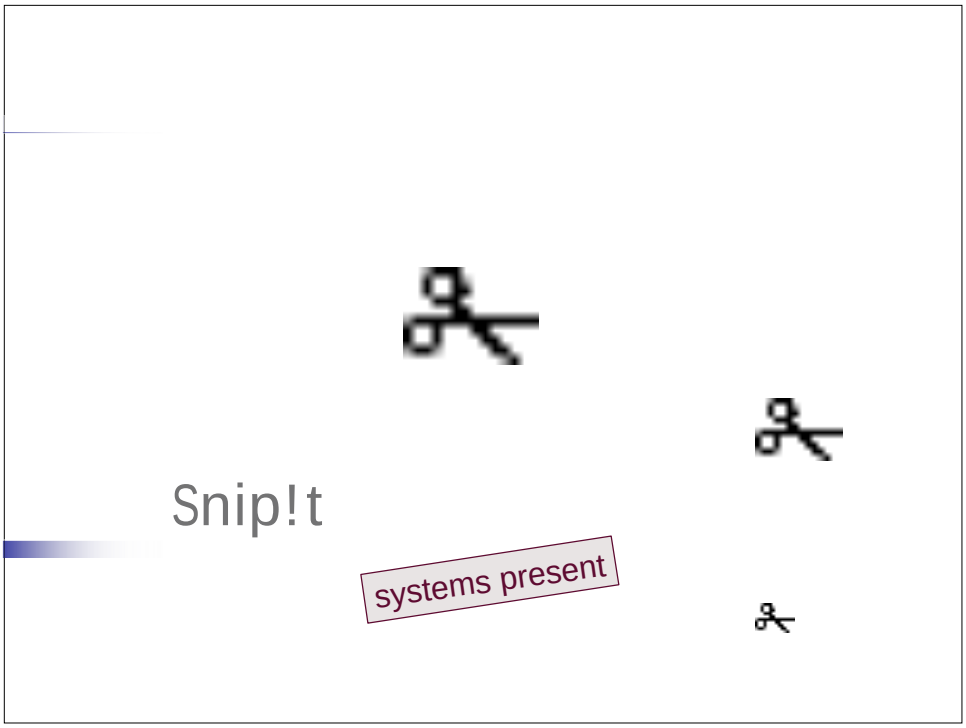
events	– happen at single moment e.g. button click, lightening
status	– can always be sampled e.g. screen, temperature

related systems 'data detectors'

- late 1990s
  - Intel selection recognition agent
  - Apple Data Detectors (Bonnie Nardi)
  - CyberDesk (Andy Wood led to onCue)
- recently
  - Microsoft SmartTags
  - Google extensions
  - Citrine – clipboard converter
  - CREO system (Faaberg, 2006)
- way back
  - Microcosm (Hypertext external linkage)

syntactic / regexp

'semantic' / lookup



Snip!t origins

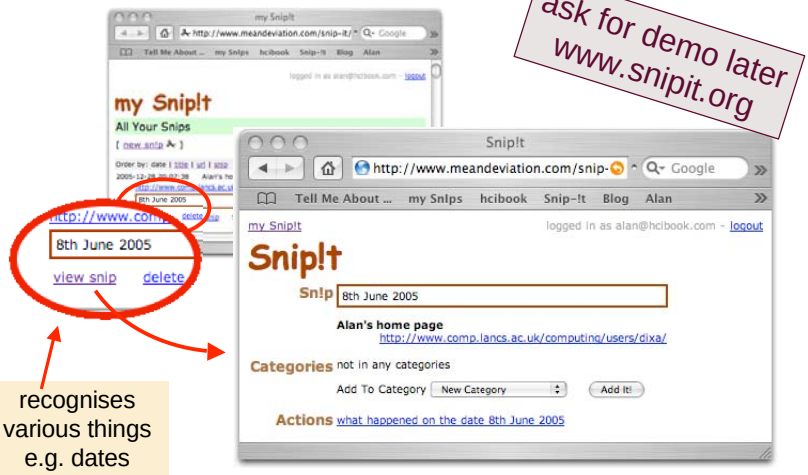
- MSc project 2002 (Jason Marshall)
- studying bookmarking
  - focus was organisation
- exploratory study
  - found users wanted to bookmark sections
- so one evening Alan has a quick hack
  … and about once or twice a year since
- now being used for other projects
- live system … try it out

Snip!t

users selects in web page and presses “Snip!t” bookmarklet

Snip!t pops up page with suggested things to do with the snip (and saves it for later, like bookmark)

Snip!t



ask for demo later
www.snipit.org

recognises various things e.g. dates

issues ...

bringing it together

Kinds of recogniser:

syntactic	–	regular expression / patterns / structure e.g. post code, email address
lexicon	–	large look up tables e.g. countries, internet TLD
hybrid	–	popular first names => full name
+context	–	telephone number ... what country??

architecture

representation vs. semantics very important

- server-side ‘intelligence’
- recognisers + services again
- different kinds of recogniser chaining:
  - from semantics to wider representation
    e.g. postcode suggests look for address
  - from semantic to semantic
    e.g. domain name in URL
  - from semantic to inner representation
    e.g. from Amazon author URL to author name

provenance

when you have a recognised term:

- where did it come from
  - text char pos 53-67
  - transformed from Amazon book URL
- how confident are you
  - 99% certain Abraham Lincoln is a person
- how important
  - mother-in-law’s birthday

kinds of context

context of SOURCE

WHAT – data/text in focus

WHERE – immediate environment
- web snip – country of origin, topic
- email – sender, related mails

WHEN – trace of recent activity

WHO – profile/prefs, long-term activity

context of USE

N.B. not always this simple distinction

DELOS

systems yet to come

DELOS

PIM++

beyond personal information management

DELOS

what is PIM?

Personal Information Management

- contact management
- diary and events
- organising, accessing: mail, files, etc
- bookmarking
- reminding, to-do lists, to-be-done-to

alan is a socio-cyborg

www.vfridge.com
/crackers

- virtual cracker list
- list from previous year …
  … new names to add?
- look in email
  - named folders, important events
  - people where I said “ah, I remember …”
- ONLY real social contacts AND in email …
  … 120 names – and just one year
- bigger than human social limits (~200 total)
- socially interdependent with computer :-?

TIM origins

- DELOS
  - European Network of Excellence in Digital Libraries
- TIM – task-oriented information management
  - sub-project of DELOS
- TIM partners
  - Lancaster University, UK
    - myself, Azrina Kamaruddin, Devina Ramduny-Ellis
  - Universita' di Roma "La Sapienza", Italy
    - Tiziana Catarci, Antonella Poggi, Benjamin Habegger
  - University of Athens, Greece
    - Yannis Ioannidis, Akrivi Katifori, Giorgos Lepouras

TIM – Task-centered Information Management

- personal ontology
  - people, projects, papers, etc.
  - build it, visualise it? make it easy?
- semantic save
  - tag files/email wrt. ontology
    … infer classification? c.f. folksonomies??
- task-based interaction
  - learn and suggest actions
- architecture
  - happening …

issues ...

ontology issues

- class predicate duality
  - Friends class - seems sensible
  - but also relation Person<friend>Person
  - p ∈ Friend ⇔ p friend {me}
  - reasoning across meta/ground levels :-(

ontology issues

- class predicate duality
- quantification over relations
  - want to say “places closely related to Jair”
    ∃ p ∈ Place, e ∈ Entity , r1, r2 ∈ Relation
    st. r1(‘Jair’,e) ∧ r2(e,p)
  - semantically fine …
    but computationally …

ontology issues

- class predicate duality
- quantification over relatio
- user interface !!!
  - mainly using drill down
  - combined with some ‘best guesses’
  - right level of detail
    - ✗ Natal is name of city of university of department that Jair belongs to
    - ✓ Natal is where Jair works

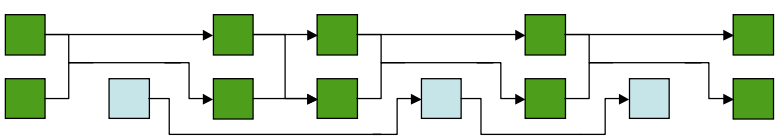
ontology browsing
– from entity to actions
form filling
– from actions to entities

ontology issues

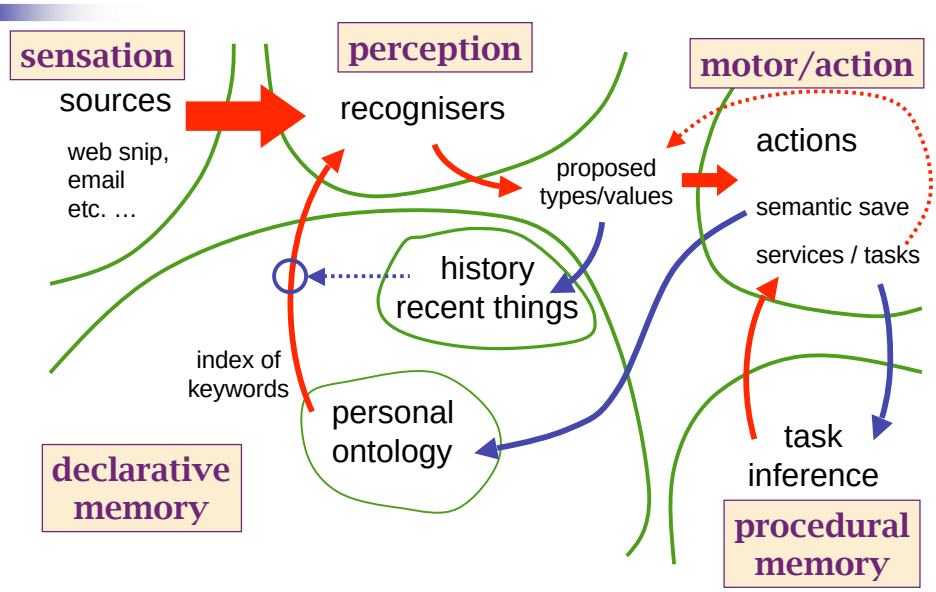
- class predicate duality
- quantification over relations
- interface !!!
- provenance
  - relation instances (SemWeb: statements)
    - level of confidence, how known, when valid, …
  - provenance of entities
    - less common?
    - why it exists at all

task inference

- long history (lots of work early 1990s)
- limited success
  - interleaved tasks
  - generalisation
- ontology helps :-)
  - input/output links like ‘string of pearls’
  - ontology type allows single step learning



architecture

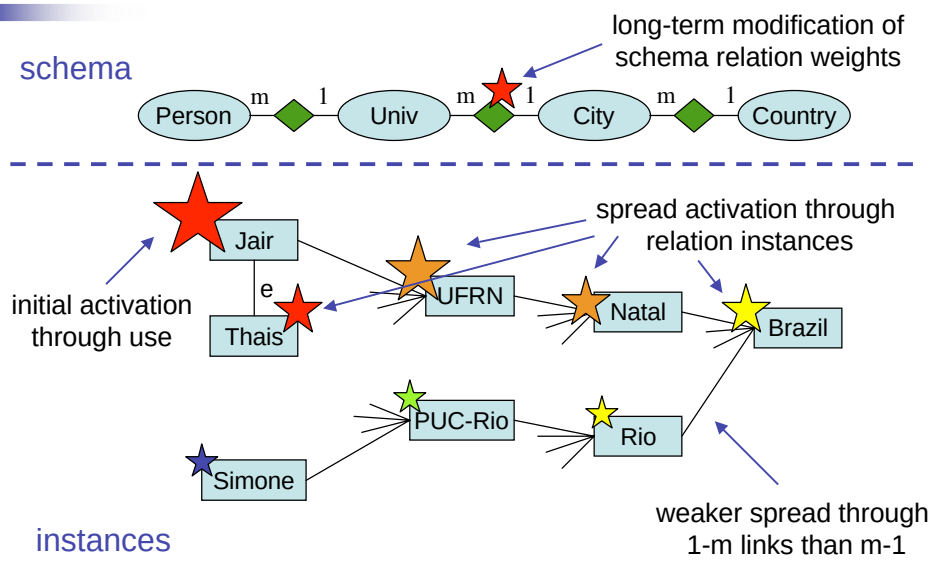


declarative memory

system		human		mechanism
personal ontology	–	long term	–	physical synapse growth
current task	–	short term 7±2	–	electrical neuron firing
recent history	–	*mezzanine* (no 'proper' name)	–	chemical LTP (long term potentiation)

? system mechanism

spreading activation over ontology



issues - ontology activation

- multiple weights
  - different memory timescales
  - interesting implementation issues …
- gives ranking of relevance
- copes with tentative/approximate
  - Alan:County almost_same_as ISO:Country
- open to the web
  - schema description of web resources
  - fetched when activation high enough
- allows hybrid & defeasible reasoning
  - rule inference based on high activation nodes only
- rather like brain!

they miss Wales

whole web is the knowledge base

summary

www.hcibook.com/alan

- numbers
  - an age pregnant for ‘intelligent’ things
- onCue
  - recognisers and services, appropriate intelligence, client-side code, status and events
- Snip!t (**www.snipit.org**)
  - different kinds of recognisers, lookup+syntax, server-side code, context, provenance
- TIM
  - personal ontology, task inference, memory by spreading activation on ontology, ‘brain-like’ reasoning open to the whole web