

# IMAGINING EMERGENT METADATA, REALIZING THE EMERGENT WEB

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# WHAT IS EMERGENCE?

- ▶ Independent Agents Interacting
- ▶ Agents following relatively simple rules
- ▶ New levels of complexity EMERGE in the system
- ▶ Organizes spontaneously, without intelligent control

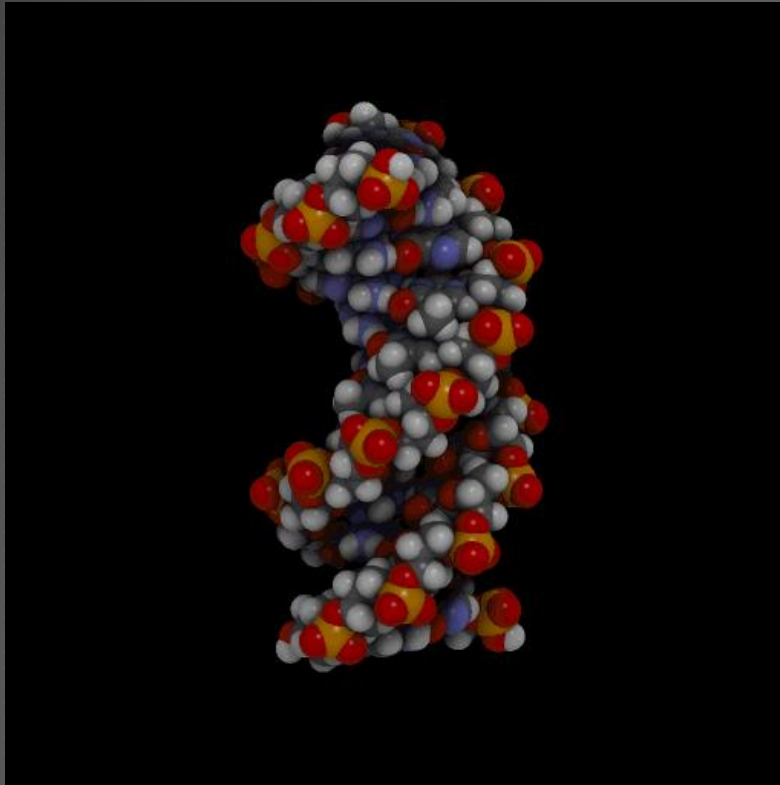
# EXAMPLES OF EMERGENCE



Complex behaviours  
by creatures of  
relatively low  
intelligence working  
in concert (such as  
social insects)

Flickr image created by Ian  
Armstrong

# EXAMPLES OF EMERGENCE (CONTINUED)



Genetic Expression  
(genotype becoming  
phenotype)

# HOW DO WE KNOW IT'S EMERGENCE?

- ▶ No organizing intelligence can be identified
- ▶ Outcomes can only be predicted through  
SIMULATION
- ▶ Simulations cannot be compressed
- ▶ Outcomes exert constraints over the individual  
agents

# WHY IS THIS IMPORTANT?

- ▶ Emergent phenomena cause systems to
  - ▶ SELF-ORGANIZE
  - ▶ Organize from the bottom up
  - ▶ Generate outcomes that cannot be predicted through ordinary means
  - ▶ Operate outside of traditional reductionism

# WHAT COULD THIS MEAN FOR INFORMATION SYSTEMS?


- ▶ Information systems that:
  - ▶ SELF-ORGANIZE
  - ▶ Operate outside the limitations of human design
  - ▶ “Self repair” shortcomings in original configuration
  - ▶ Respond to change DYNAMICALLY
  - ▶ Respond to change without human intervention



# WHY METADATA?

- ▶ Metadata, in one form or another:
  - ▶ Lies at the heart of all modern information systems
  - ▶ Allows for interoperability
  - ▶ Allows for searchability
  - ▶ Forms the basis of MACHINE SEMANTIC systems


# WHAT ABOUT METADATA NEEDS TO CHANGE

- ▶ Metadata units need to interact with each other
  - ▶ Metadata units need room to be more machine-centric
  - ▶ Metadata units need to be ontology-agile
- 


# HOW CAN WE MAKE THESE CHANGES?

- ▶ Use tools like bots, browsers, and evaluators to cross-pollinate Metadata units
- ▶ Recreate Metadata units as code with encapsulated Metadata tags
- ▶ Create room in Metadata schemas for tags reflecting non-human organizing principles
- ▶ Allow Metadata units to dynamically reference external ontologies
  - ▶ Actively (as software)
  - ▶ By proxy (cross-pollination)

# WHY HASN'T THIS BEEN DONE ALREADY?

- ▶ Digital technology defies the physical
    - ▶ Items can exist anywhere on a network
    - ▶ Items just need to be linked digitally
    - ▶ Extensive, offsite resources can be easily referenced
    - ▶ Moving from resource to resource happens at near light-speed
  - ▶ Artificial processing and evaluation are now more sophisticated
  - ▶ Digital resources need less direct human oversight
  - ▶ Processes can be automated easily
- 

# CROSS-POLLINATION

- ▶ Simpler
  - ▶ Uses less computing power
  - ▶ Could be implemented using multiple mechanisms
  - ▶ More realistic in the short term
  - ▶ Would probably rely heavily on user navigation
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# CROSS-POLLINATION

- ▶ Browsing tools would act as catalysts
- ▶ As users moved from one item to another:
  - ▶ Browsers could make changes to level 2 and 3 tags
  - ▶ Evaluate tags for retention
  - ▶ Metadata agents would interact by proxy

# METADATA AS SOFTWARE

- ▶ Allows for direct interactions
- ▶ User navigation less important
- ▶ More potential for novel connections/channels to Emerge

# METADATA AS SOFTWARE

- ▶ Metadata would exist as information within small programs
- ▶ These programs could interact
- ▶ These programs could run on a shared network or the internet




# DEFINING OUR TERMS

- ▶ Metadata files are AGENTS
- ▶ AGENTS contain data in FIELDS
- ▶ Each discrete piece of data in a FIELD is a TAG

# METADATA TAGS SET IN LEVELS

- ▶ **Level 1**: regular, base level
- ▶ **Level 2**: identical to level 1 but generated through navigation
- ▶ **Level 3**: tags employing machine-semantic metadata

# LEVEL I

- ▶ Will often be assigned by a human cataloger
  - ▶ Designed to be machine readable and human semantic
  - ▶ Not meant to be edited by mechanical agency
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## LEVEL 2

- ▶ Uses the same tag content as Level 1 tags
- ▶ Meant to be assigned/edited by mechanical rather than human agency

## LEVEL 3

- ▶ Tag content meant to be machine semantic only
- ▶ Might be human readable/semantic but doesn't have to be
- ▶ Meant to be assigned/edited by mechanistic agency

# AGENTS CAN BE FILE GESTALTS

- ▶ With digital technology files can be split up
- ▶ Level 1 tags could be local
- ▶ Level 2 and 3 tags could be linked from a remote server

# AGENTS FOR THE WEB

- ▶ Should probably be stored in offsite indexes/networks
- ▶ Similar to keyword indexes used by search engines now
- ▶ This would keep even Level 1 tags from being modified unscrupulously

# FOCUSING ON SUBJECT TAGS


- ▶ At this time I have chosen to focus on subject heading tags
- ▶ Some navigational tags are also part of Level 3
- ▶ Probably the easiest place to identify useful effects



# WALKING THROUGH CROSS-POLLINATION

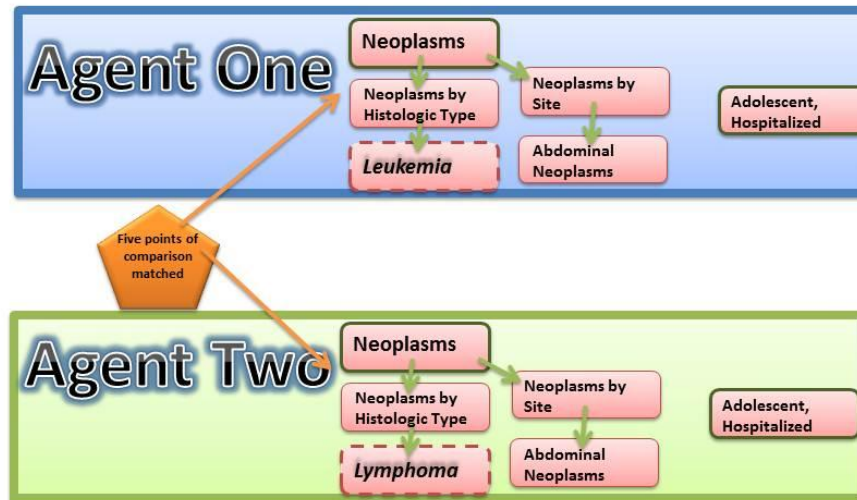
- ▶ Takes place in three cycles
- ▶ Should probably be catalyzed by a browsing agent
- ▶ On the web process would need to be anonymized and transparent

# LEVEL 2 EXCHANGES-DYNAMISM

- ▶ Designed to augment the Level 1 tags
  - ▶ May rectify shortcomings in original cataloging
  - ▶ May help respond dynamically to change
  - ▶ All Level 2 and 3 tags must keep a counter value
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# LEVEL 2 HANDSHAKE CYCLE

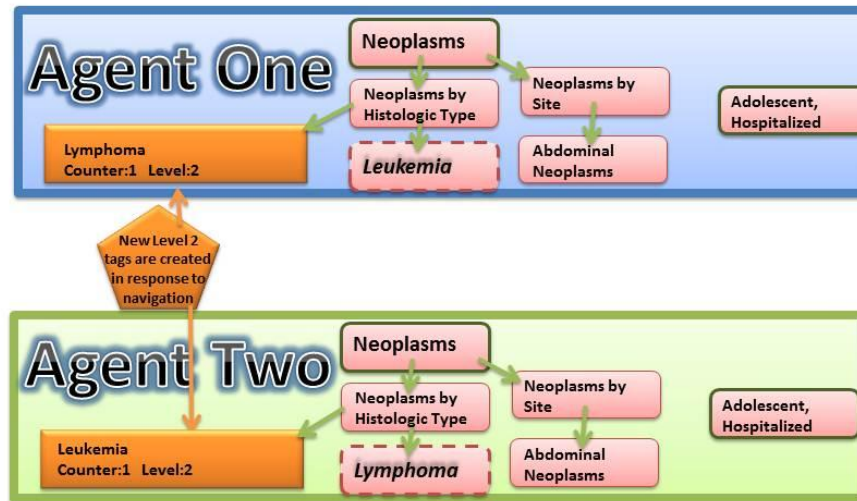
## 1. Handshake Cycle



For exchange to take place, there must be a certain threshold of matching tags and time on agent

# LEVEL 2 INTERACTION CYCLE

## 2. Interaction Cycle



With compatibility established tags are exchanged. Set as Level 2 with a Counter value 1

# LEVEL 2 EVALUATION CYCLE

## 3. Evaluation Cycle



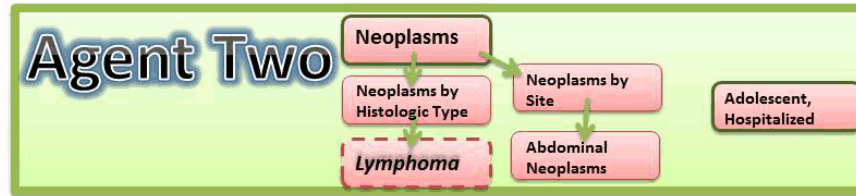
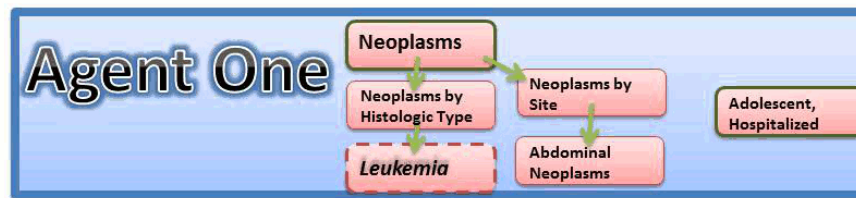
The last part of the cycle evaluates Level 2 tags by counter value for retention

# EVALUATION CYCLE


- ▶ Uses two types of filter:
  - ▶ Survival Of The Fittest (SOTF)
  - ▶ Strength Of Weak Ties (SOWT)

# THE WHOLE LEVEL 2 SEQUENCE

## 1. Handshake Cycle



# LEVEL 3 EXCHANGES-ATTEMPTING REAL EMERGENT BEHAVIOR

- ▶ Using tag types distinct from the Level 1 and 2 tags
  - ▶ Designed to generate/cultivate unique information channels
  - ▶ Could be exploited by search and aggregation tools in a variety of ways
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# SOME POSSIBLE LEVEL THREE TAG TYPES

**Ontology:** Synonyms for tags from level 1 and 2 drawn from external ontology libraries

**Folksonomy:** Synonyms for tags from level 1 and 2 drawn from external folksonomy libraries

**CrossLink:** Links to other Agents that have been the subject of a successful exchange.

**References:** References from the Agent's Item and from any Agents that have been the subject of a successful exchange.

**Search:** The search terms present in the browsing mechanism at the time of a successful exchange.

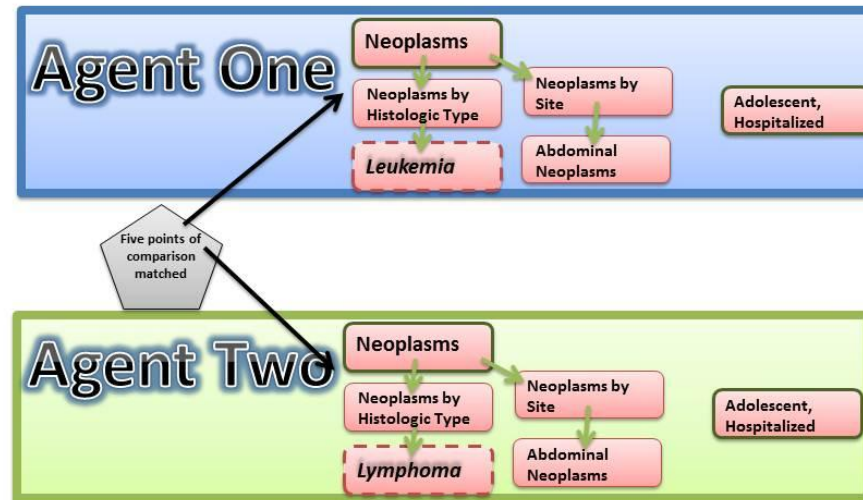
**Identity:** Presents as string. Three separate tags generated. Top three Ontology tags+top three Folksonomy tags as determined by Counter values and random number if too many Counter values are equal.

**Path:** Presents as string. Three separate tags generated. Top three Reference tags+top three Crosslink tags as determined by Counter values and random number if too many Counter values are equal.

**Route:** Presents as string. Three separate tags generated. Top three Search tags+top three Identity tags as determined by Counter values and random number if too many Counter values are equal.

# LEVEL 3 HANDSHAKE CYCLE

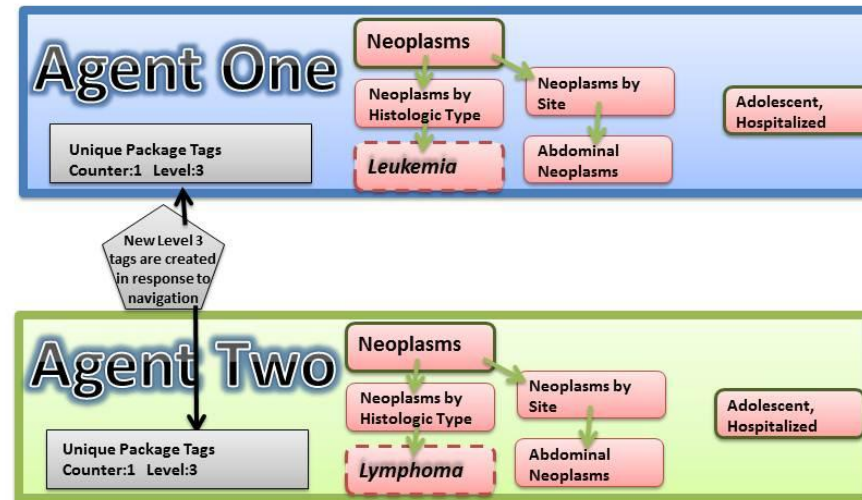
## 1. Handshake Cycle



For exchange to take place, there must be a certain threshold of matching tags and time on agent

# LEVEL 3 INTERACTION CYCLE

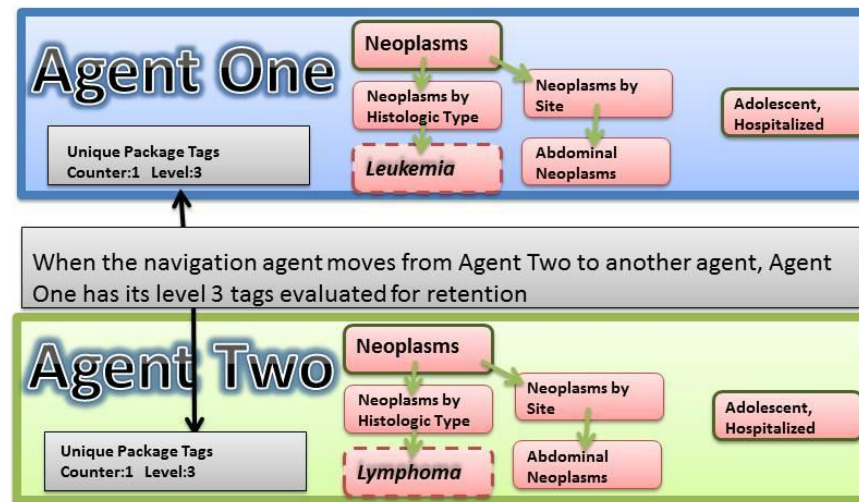
## 2. Interaction Cycle



With compatibility established tags are exchanged. Set as Level 3 with a Counter value 1

# LEVEL 3 EVALUATION CYCLE

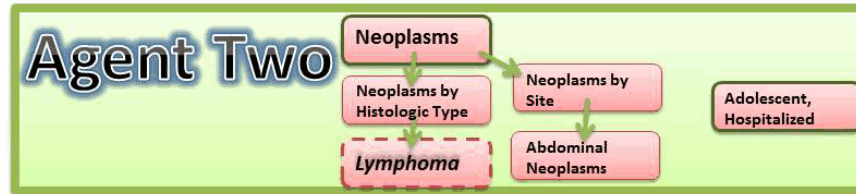
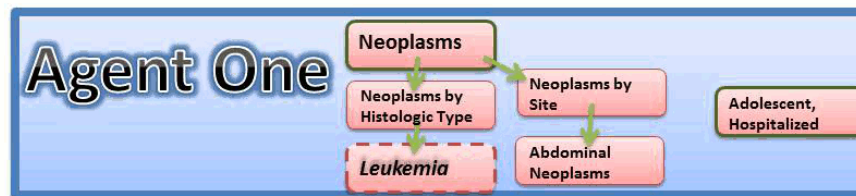
## 3. Evaluation Cycle



The last part of the cycle evaluates Level 3 tags by counter value for retention

# LEVEL 3 PUTTING IT ALL TOGETHER

## 1. Handshake Cycle



# NEXT STEPS

- ▶ Determine if the idea has utility through simulation
- ▶ Use an emergence simulator like NetLogo (if possible)
- ▶ If these tools are inadequate, create a proprietary simulation methodology

# WHAT ARE WE LOOKING FOR

- ▶ Useful adaptations to navigation or other environmental changes
- ▶ The appearance of novel channels or networks in the form of linking and navigational pathways

QUESTIONS?

