# Principles of Distributed Representation

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**Is this a talk about metadata?**

**Not really.**

- **The changing nature of knowledge**

- **Implications for educators**

- **Taking networks seriously**

- **Distributed representation**

# What we thought knowledge was like…

- **Mental states - entities in the brain corresponding to 'Paris is the capital of France**

- **Brain writing – these entities have *syntactic* properties (Chomsky) and *semantic* properties (Fodor)**

**The information-theoretic view…**

- **Communication consists in getting a bit of knowledge P from point A to point B**

- **In learning, the concept of *transactional distance (Moore)* is based on this idea**

- **Pedagogy therefore consists in *improved communication* and *interaction***

**Transactional distance…**

- **"the physical separation that leads to a psychological and communications gap, a space of potential misunderstanding between the inputs of instructor and those of the learner"**

  – Moore http://www.ajde.com/Contents/vol5_3.htm
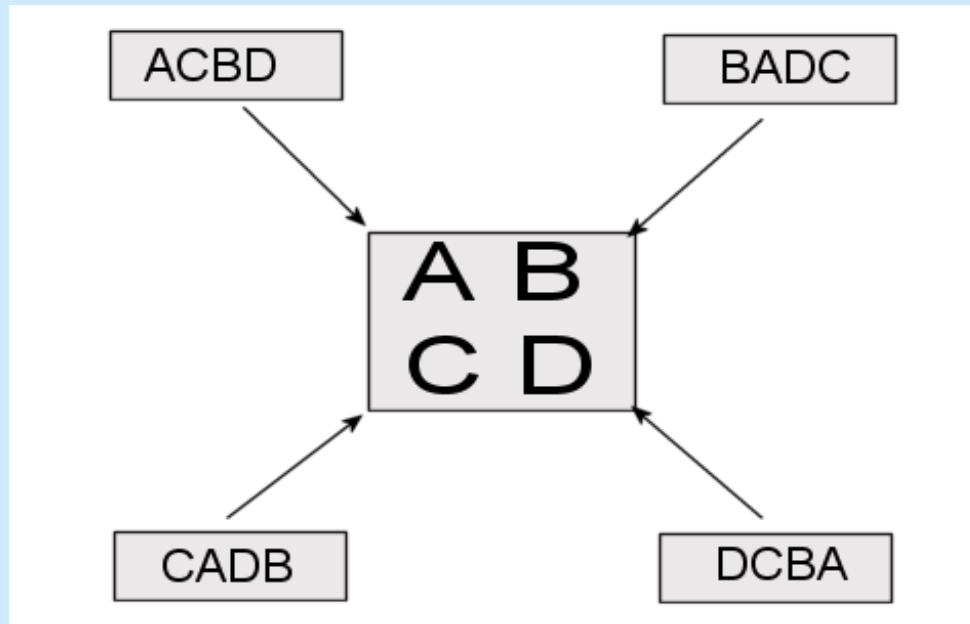
# In effect…

- 'Knowledge' is like sentences (RDF anyone?)

- Vocabulary is unambiguous; meaning is fixed and universally understood

- Description (and for that matter, truth) does not vary from person to person (a 'horse' is a horse (of course, of course))

**But none of this is true, can't be true…**

- **If it were true, *context* would have no effect on truth or meaning**

- **But *context-sensitivity* is everywhere**

- **Wittgenstein (meaning), Quine (observation), van Fraassen (explanation), Hanson (causation), Lakoff (categorization), Stalnaker and Lewis (modality)**
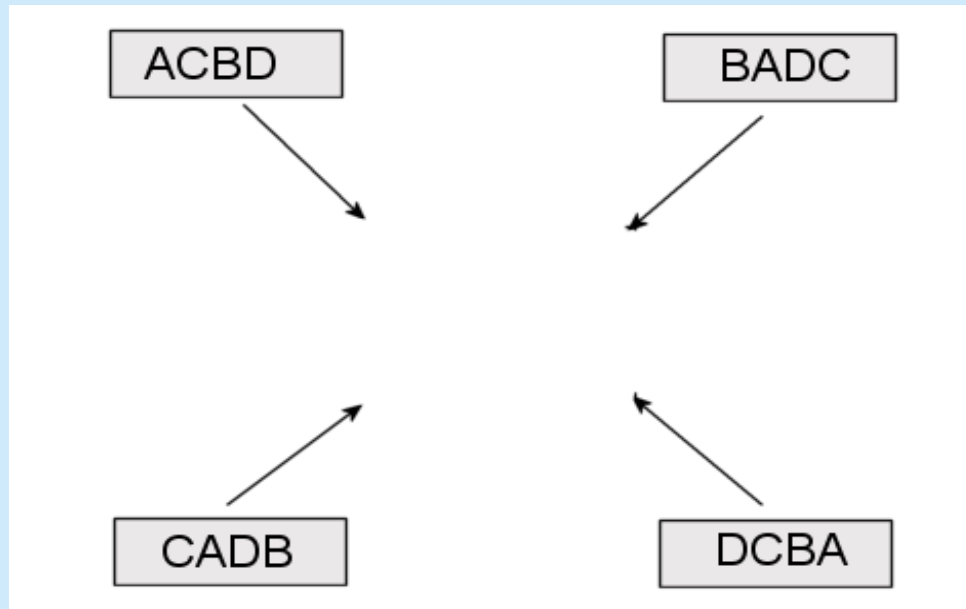
# What we know depends on our point of view…



# (Note that this does not entail relativism)

# *All we have* is our point of view…



**Language is, at best, an approximation of knowledge, and at worst, a parody of it**

# Implications…

- **First, knowledge is *sub-symbolic***

- **That is, *mere possession of the words* is not the same as knowledge**

- **The words make sense only when applied in context**

# Implications…

- **Second, knowledge is *distributed***

- **That is, *there is no specific entity* that constitutes, say, the belief that 'Paris is the capital of France'**

- **There is no given *person* that possesses this knowledge (who would that person even be?)**

# Implications…

- **Third, knowledge is *interconnected***

- **That is, the knowledge that 'Paris is the capital of France' is actually *a part of* the knowledge that 'countries have capitals' and even 'ducks are animals'**

- **Cf.**
  **http://www.guardian.co.uk/life/feature/story/0,13026,1517186,00.html**

# Implications…

- **Fourth, knowledge is *personal***

- **Your belief that 'Paris is the capital of France' is quite literally different from my belief**

- **Think, for example, about the word 'Paris' – would your neighbour have exactly the same thoughts? *Why not?***

# Implications…

- **Fifth, knowledge is *emergent***

- **The knowledge that 'Paris is the capital of France' (in its pure, abstract form) is not contained in any given mind, but emerges as a result of connections between them**

- **'Emergence' is not a *causal* phenomenon but rather a *perceptual* one – we have to *recognize* it**

# The wisdom of crowds…

- **Each of us has a piece of the puzzle**

- **We don't *acquire* this piece, we *create* it**

- **Creation is a process of acquisition, remixing, repurposing, feeding forward**

- ***Knowledge* is the interplay between our bit of the network and other bits of the network**

## Hence (for example)…

- **Thomas Kuhn – learning a science is learning how to solve the problems at the end of the chapter**

- **Etienne Wenger – learning as participation in a community of practice**

# Properties of successful networks…

- **Charles Vest – three key attributes:**

  – **Diversity (many objectives)**
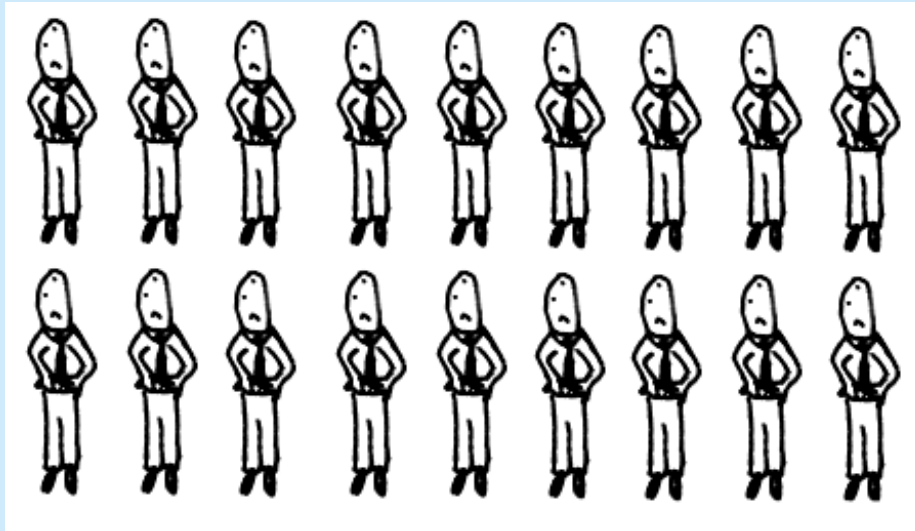
  – **Interwoven (many activities)**

  – **Open (many minds)**
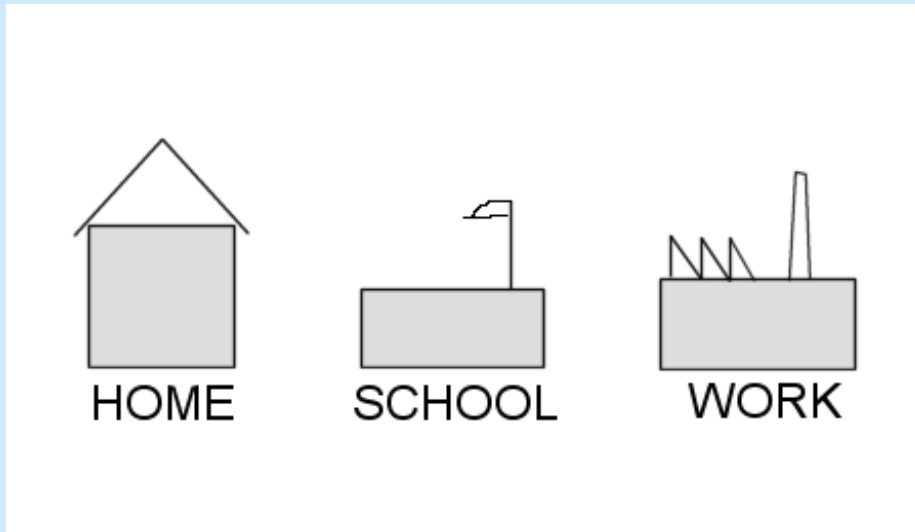
    - *Charles M. Vest, SAC, August 8, 2005*

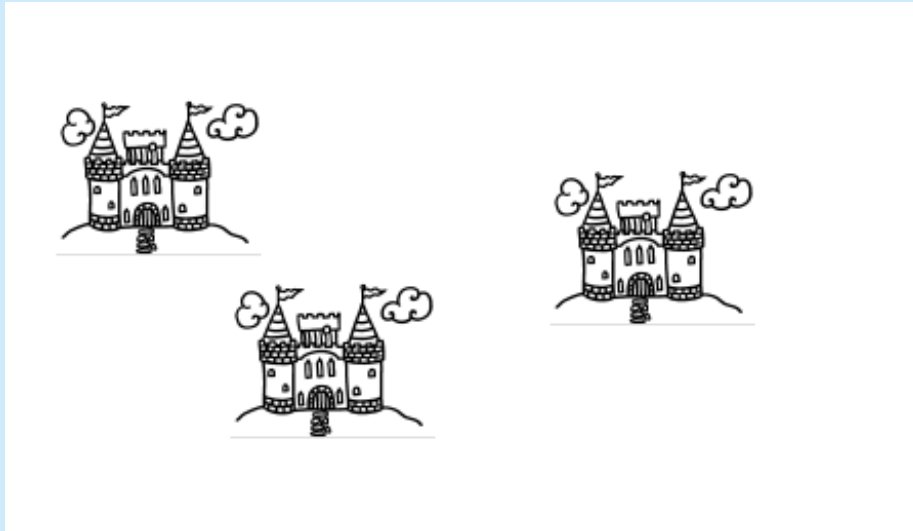    http://jade.mcli.dist.maricopa.edu/cdb/2005/08/08/opencourseware-sac2005

# Diversity…



**The idea of making everything the same –** *anything* **the same – is fundamentally misguided**

# Interwoven…



HOME    SCHOOL    WORK

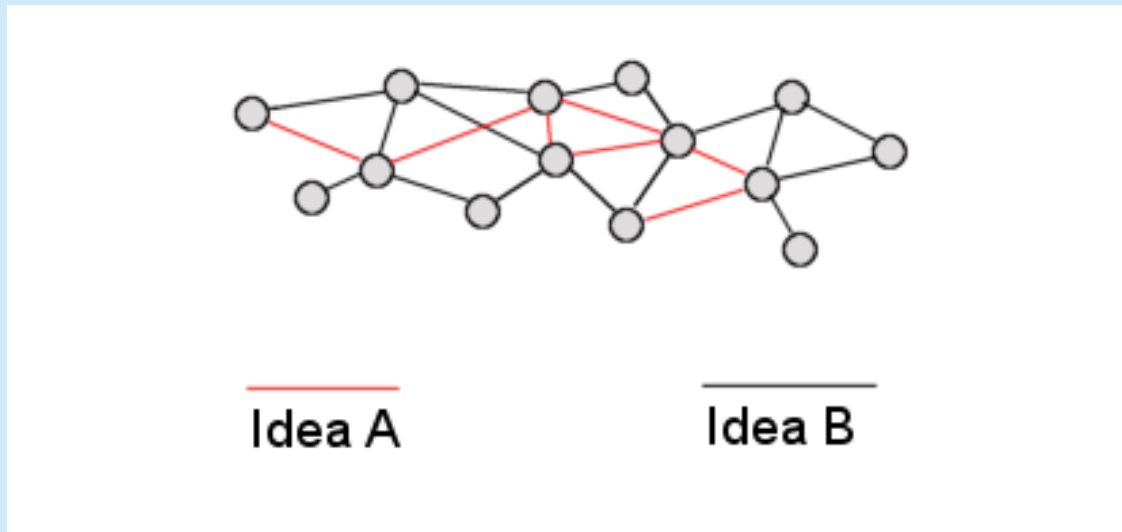**The idea that our different activities are distinct is fundamentally misguided**

# Open…



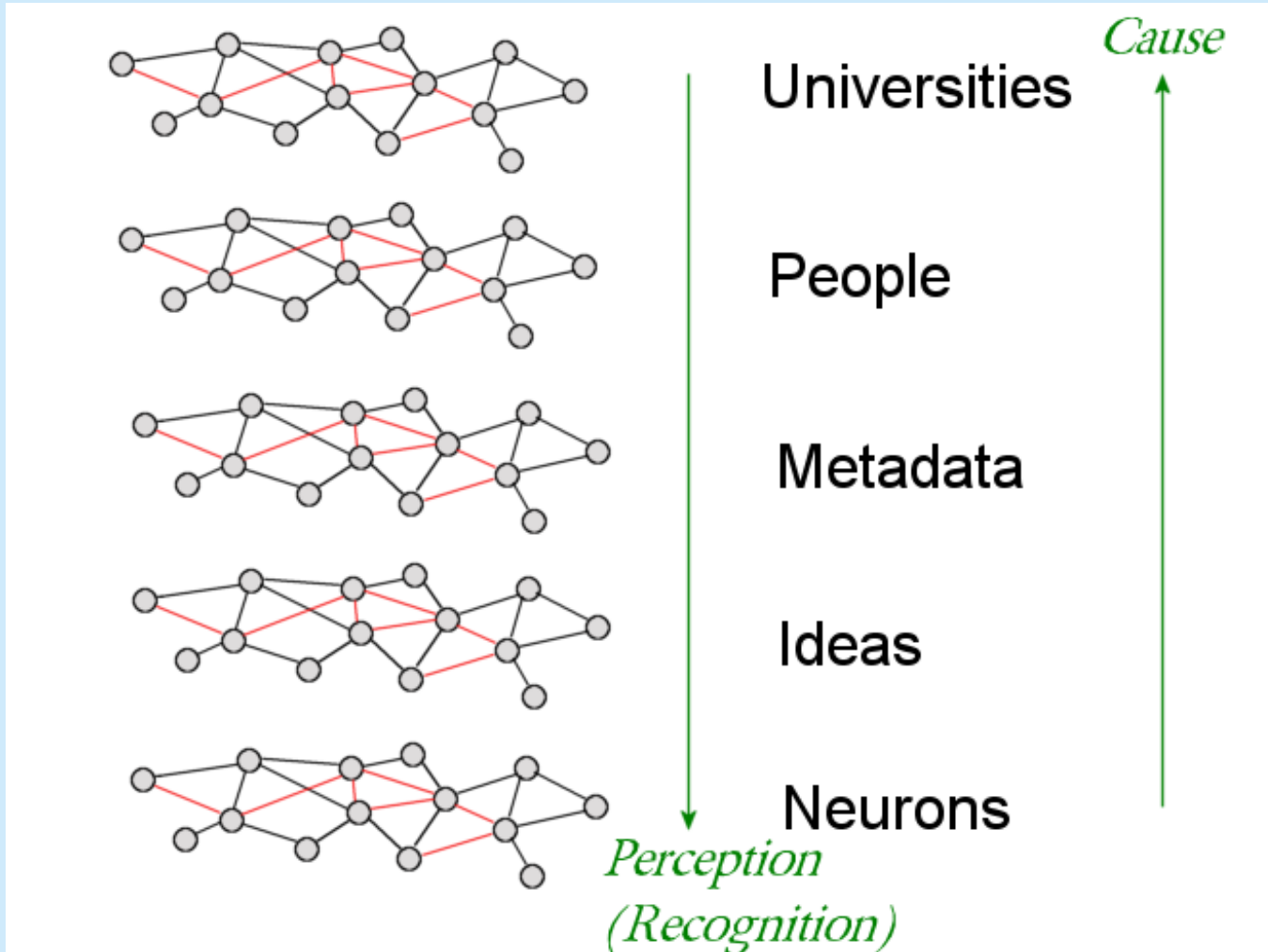**The idea that we can store knowledge in *closed repositories* is fundamentally misguided**

# But what about metadata?…

- **These properties are not merely properties of universities…**

- **After all, the 'basic unit' of knowledge isn't the university…**

- **It is… well, it's many things:**

# Connections in networks…



Idea A          Idea B

**A diversity of entities, each acting autonomously, connected in an open network**

**Resource Profiles…**

- **Major features:**

  - **Different types of metadata (microformats)**
    diversity
  - **The information is *distributed***
    interwoven
  - **Any given perspective is *aggregated***
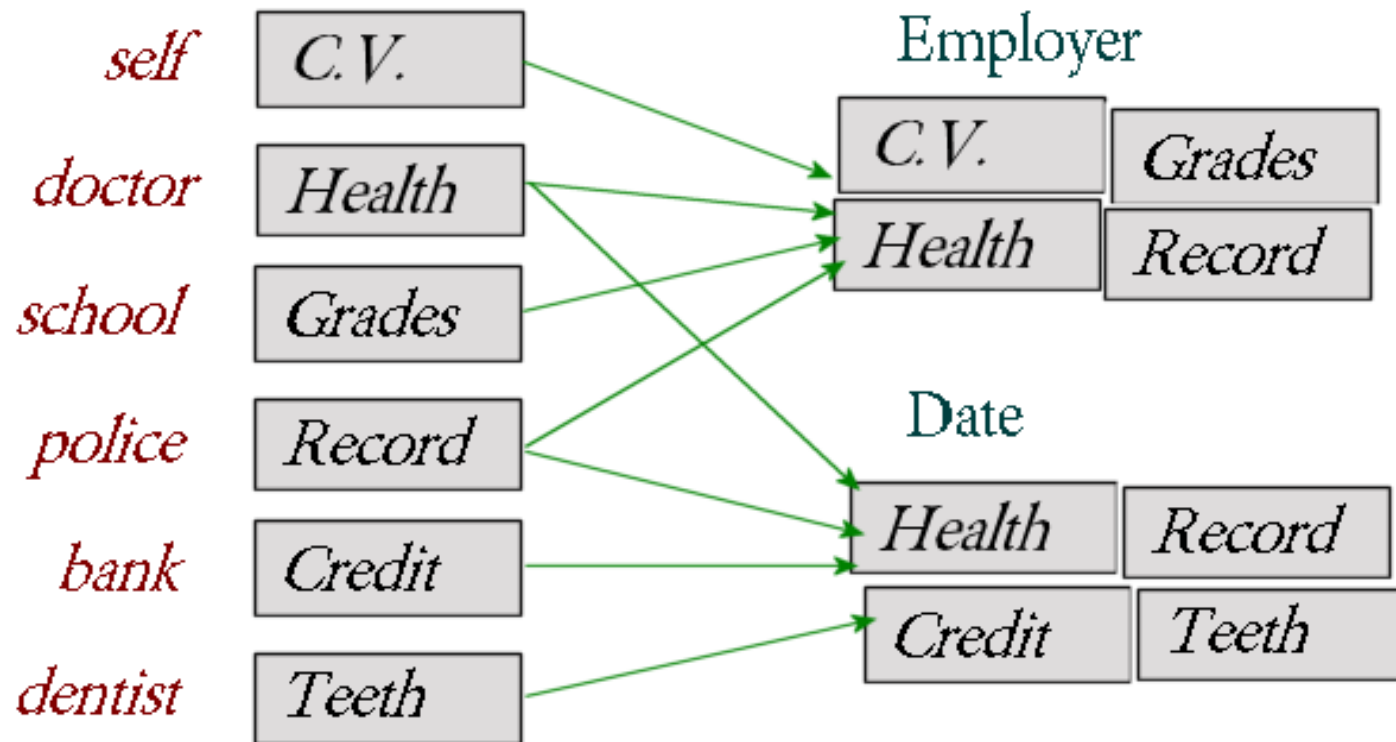    open

# LOM Microformats…

- **The nature of LOM should vary according to the resource**

- **For example, 'technical metadata'**

  - use audio elements (eg., bitrate) for audio

  - use video elements (eg framerate) for video

# Types of Metadata Entities…

- **LOM needs to take its place among a wide range of metadata types**

- **Examples:**

  – Personal metadata, eg., FOAF

  – Rights Metadata, eg. ODRL

  – Events, organizations, publications, more…

# Distributed Resource Descriptions…

- **Information not only on a person's c.v., but in school transcripts, police records, credit bureau, phone book, etc…**

- **A prospective employer is interested in a very different *profile* than a prospective date…**

**Your metadata environment…**

- **Again, think about a person's metadata**

- **It includes pointers to external metadata about:**

  – Your property (which may cease one day to be associated with you)

  – Your pets (which you may give away)

  – Your car (which you may sell)

# Metadata Referencing…

- The metadata 'about' a given resource is not stored in a single file

- References to external entities (authors, licenses) are created by 'pointers'

- In RSS – the 'rel' data entity (and you can find them in web pages too)

# Principles of distributed metadata…

- **Metadata for a given entity should never be stored in more than one place (still allow mirrors, caching, etc)**

- **Metadata for a given entity should not contain metadata for a second entity**
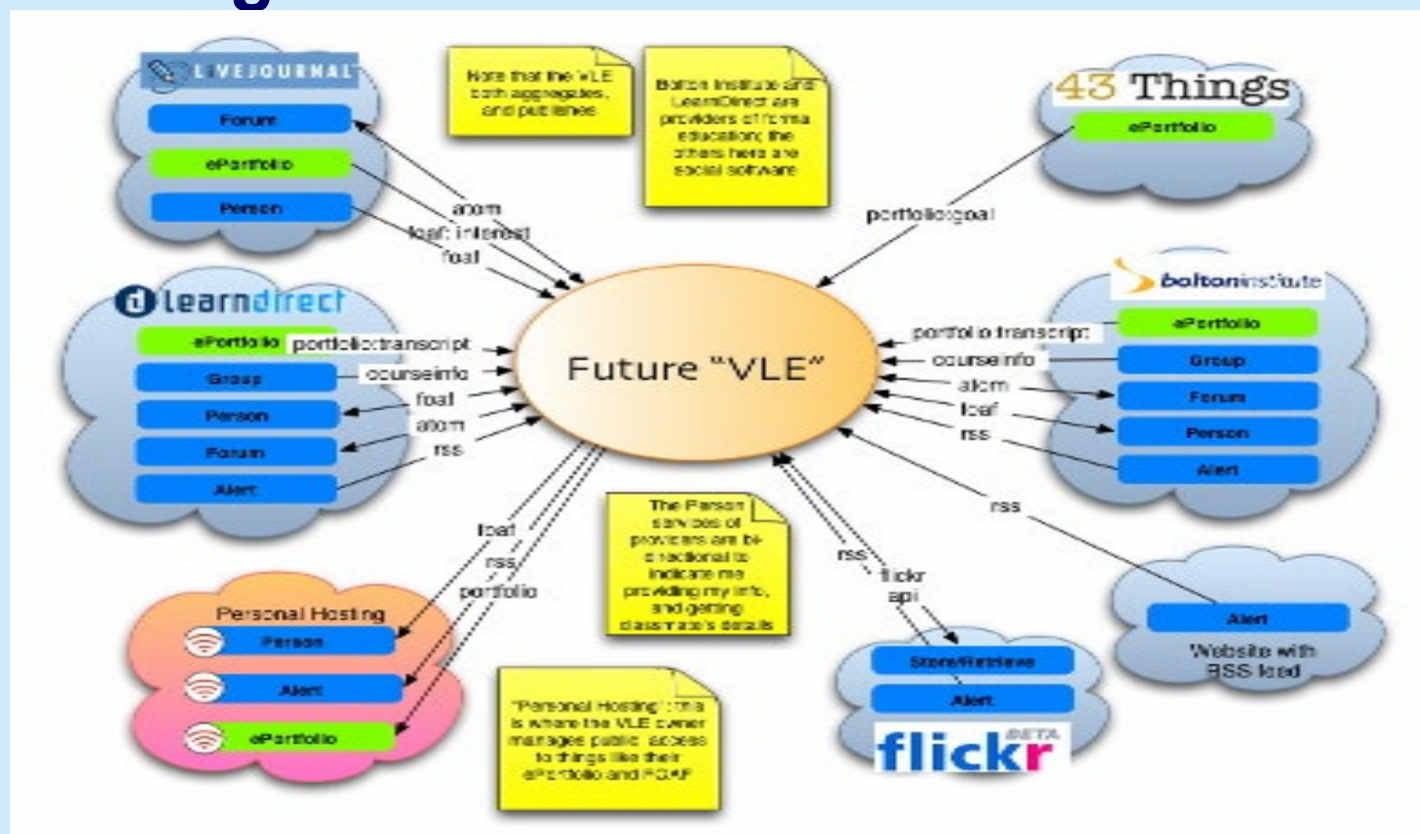
# Not Just Metadata…

- **The concept also applies to learning resources themselves…** *anybody* **can produce resources, anyone can use them**

- **It also applies to** *applications…* **a** *learning environment* **is not one application, but many applications**

- **"Small pieces, loosely joined"**

# The web is changing…

- **Web 2.0 – not just a slogan**

- **A shift from the idea of the web as *medium* to the idea of the web as *platform***

- **This *just is* a shift from the idea of the web as communication (information theory) to the idea of the web as *network* (or environment… pick your metaphor)**

# E-Learning 2.0…

**Learning as a network phenomenon…**

- **Web of user-generated content (eg. Wikipedia)…**

- **Social networks and communities (entails a genuinely portable (and *owned*) identity**

- **Networks of interactions (aggregate, remix, repurpose, feed forward) – syndication**

- **The *personal* learning centre**

# Microformats on the web…

- **Specialized formats for particular applications**

- **Can be *embedded* in, say, web pages or XML metadata, harvested and indexed**

- **Are niche-driven, application-specific**

- **Eg. XFN, hcalendar, hcard, rel tags, rel license, lists and outlines, more…**

http://microformats.org/

# Web 2.0 Checklist…

- **Structured microcontent**

- **Data outside, not local (feeds galore)**

- **Web APIs (poor man's web services)**

- **Single identity** http://www.downes.ca/idme.htm

- **User generated, user-managed**

http://www.sivas.com/aleene/microcontent/index.php?id=P2205

# What we need…

- *"We need a system that is optimized toward slotting in new pieces as they become available, not as an after-thought or an add-on, but as a fundamental characteristic of the system."*

  - *Michael Feldstein, August 7, 2005*

    http://mfeldstein.com/index.php/the_long_tail_of_learning_applications/

# Takeaway…

- **Charles Vest talked about a 'meta-university'**

- ***This* (if I may be so audacious) is the information architecture of the meta-university**

- **The key is not large, integrated systems, but rather, small, flexible bits that can be connected**

- **This applies to metadata too**

# LOM will be rewritten…

- … or maybe, bypassed entirely

- Instead of a single standard, will be a set of microformats

- Will link to other types of metadata describing authors, resources, rights, etc.

http://www.downes.ca

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