Social graphs, social sets, and social media

Bill Howell, versions sent out: 1st draft based on material from home 06Oct2011, framework frozen ~21Dec2011, very incomplete termination 30Dec2011

Summary

[Social graphs, social sets] represent relatively new foundation concepts for building workplace [toolsets, applications, processes, systems]. One might consider [Client Management Systems, Contact Managers] as early precursors of "things to come", but at a very primitive level. This paper discusses a random selection of potential [themes, implications] of [social graphs, sets] for social media in the workplace, organized according to readers of a variety of not-necessarily-overlapping interests, namely [applications users, conceptually-oriented, tool builders, system designers, star gazers].

While [Social graphs, social sets] are the concepts that are *central to this paper, the overall objective of this paper is not to provide a review or roadmap for experts who are building social media toolsets and systems, but rather to greatly expand the awareness of the social media and collaborative communities concerning the "larger world of capabilities"* that [social graphs, social sets] *will help to enable.*

With respect to building social media capabilities into government IT systems, given their very immature state at present, rather than focus on specific ideas it is more important to consider ***3 themes****:*

1. *Identify & cull a wide diversity of concepts that are being proposed or implemented around the world; and given this understanding…*
2. *Plan and develop IT systems to allow for the easy integration of new toolsets, processes and systems, many of which will be completely unknown and unpredictable at the time of integrating current capabilities (such as Facebook, Twitter, etc) into government systems. In this light, it is more important to design our IT systems to be open to accommodate new unexpected capabilities, rather than to provide a shopping list of semantic or social graph capabilities to select from.*
3. *Allow for "multiple conflicting developments" – demonstrations to try out many ideas and see what works in the "social media marketplace". It for to easy to over-emphasize analysis and planning when both are of limited effectiveness.*

This can be considered as the main recommendation from this report, and its companion report "Semantics beyond search". *Although systems design issues are discussed in a third separate paper, hopefully it will be clear from this paper that the utilization of new semantic capabilities will be helped and/or hindered by the systems mindsets (conventional or open).*

It is my assumption that the most important social media capabilities will be neither predictable nor well understood in their initial stages. Within that context, the current document is a limited, random look at several potential tie-ins between [social graphs, social sets]-based *technology concepts and work-environment applications.*

Note that [social sets, social graphs] and other concepts in this paper are far from "established" technologies, in spite of Facebook's statement that social graphs are the heart of the new social media. This is especially true when one considers their dynamics.

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Related Reports by the same author

Note that NONE of the reports is complete, some having progressed to only 1/5th completion. In the time available for the SPINE project, I considered it far more important to get a "conceptual outline" down, than to go to completion with the concepts and explanations, and to do a full, quality write-up.

Reports for the SPINE project:
Howell 2011 – Systems design issues for social media.doc (18pp ~20% finished)
Howell 2011 - How to set up & use data mining with Social media.doc (15pp ~20% finished)
Howell 2011 – Semantics beyond search.doc (30pp ~25-30% finished)
Howell 2011 – Social graphs, social sets, and social media.doc (63pp ~25% finished)

Personal (hobby) reports:
Howell 2011 - Confabulation Theory, Plausible next sentence survey.doc (31pp 100% finished)
Howell 2006 - Genetic specification of recurrent neural networks (18pp 100 % completed – a published version exists)

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Status as of 06Oct2011:

- Initial outline is being developed
- Frankly, there are a huge number of relevant concepts and I can't cover them all in a short paper. However, as the intent was to "push the thinking" on Semantics, what I have included should have that effect for individuals having the right basis and interests.

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CAUTION:

Please note that this document is largely drawn from home hobby interests, projects and postings of Bill Howell. It is adapted here to the context of social media as per the SPINE project at NRCan. There is therefore a strong personal bias and background perspective to this document, which limit its generality, and I am several years out of date on this subject area. Much of the content is also NOT NRCan property, as major components are from the literature, or are personal concepts that have been posted on my website and pre-date SPINE by several decades (in particular the section on Confabulation theory and the survey that I did in 2006-2007 based on material from 2002 and 2007).

DOUBLE CAUTION: Social graphs are NOT my field, nor have I made a special effort to read into it extensively. My own knowledge is from the area of Artificial Neural Networks in the larger sense (including modeling and interpretations of neuroscience, psychology, linguistics, cognition, and consciousness). I have extensively participate in neural network conferences and their organization, journal and conference paper reviews (only one paper written), a wide range of discussion with conceptual leaders, and some of my own modeling work.

Targeted audiences: This report is targeted to very different types of readers, and most readers will want to restrict their perusal to the appropriate Parts:
[USERS, CONCEPTUALISTS, TOOL-BUILDERS, SYSTEM-BUILDERS, STAR-GAZERS]

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Part 0 - Be selective: Don't read the whole paper!

This paper, "SPINE – Social graphs, social sets, and social media", is not written as a "read-through" text. Instead, semi-independent components are targeted at individuals who are focused on:

- **How can we use social media in the workplace?** - USERS (i.e. most readers!) who are only interested in the potential impacts of [social graphs, social sets] in the workplace should go to "Part II - Social [graphs, sets, media] and Workplace Applications", perhaps after going quickly through this Introduction. It is also much easier to read Part II than subsequent Parts, and hopefully this will pique some readers' interest enough to go through the remaining Parts carefully.
- **Foundation concepts underlying social media** – CONCEPTUALISTS readers may wish to start with "Part III - Foundation Concepts" for the background and context to this paper's approach to [social graphs, social sets]. After all, the concepts in this paper tend to be unique as compared to the vast array of other tools and systems in use in the workplace. Perhaps "social graphs and social sets" are closest related to contact databases (Customer relationship Management S/W – a big growth application for social media),
- **Technologies and Toolsets** - TOOL-BUILDERS may want to go directly to "Part IV - Social [graphs, sets, media]: Technologies, and Toolsets" for descriptions of tools that MAY be relevant to the future evolution of social media, their derivatives, and their hybrids.
- **Simple, fundamental capabilities** - SYSTEM-BUILDERS might want to pay close attention to capabilities that are essential to the successful implementation of the "Technologies and toolsets". For the most part, this area may be a no-brainer, but frankly, even conventional systems have long suffered from a failure of conventional IT [networking, databases, system] professionals to understand the importance of even very basic capabilities, let alone how to implement them. Admittedly, there is a dearth of real discussion of system design issues for social media in this paper. A few more details are covered in the 1/5th complete (but stopped) companion paper "SPINE - How to set up & use data mining with Social media.doc", but again, it won't be general enough for satisfying system-builders for anything but narrow, focused themes.
- **Far beyond current systems** - STAR-GAZERS may be interested in this serious, but far-from-available, perspective.

This paper will NOT be of much interest to those focused on:

- **Broad visions of technology, market trends** - No attempt is made to go into a discussion of how to integrate a broad range of classical and modern capabilities, nor is a list of key technologies provided outside of the focus areas.
- **An IT-centric analysis of social media implementation** - The caveat here is that while conventional IT analysis is essential, it is not adequate, and must not destroy the potential of social media systems before the design and implementation even starts!
- **Immediate usability** - There is no assessment of current social media systems, and which are best positioned for the long run.

Part I - Introduction (for ALL)

As indicated by the title, Part I targets ALL readers [USERS, TOOL-BUILDERS, SYSTEM-BUILDERS, CONCEPTUALISTS, STAR-GAZERS].

REPEATED PHRASE: Many of the themes listed for semantics in "Semantics beyond search" also apply to social graphs and sets – in a sense, the semantic themes are simple metaphors (usually subsets) for the concepts in the connectionist/ computational intelligence context. In the points below, the material from "Semantics beyond search" are retained in blue italics font, and differences from a social graph/sets perspective are provided in normal black font. As you can easily see, much of the content applies to both areas, that is "Semantics" and "Social graphs and sets". This approach (and often this NOTE) is applied throughout this report.

While this report will hopefully stimulate some interest in the concepts, in a more practical sense it is a warning to "keep systems open" for future developments and toolsets. While it may be difficult or impossible to build systems that will not be destroyed by successive waves of technology, it may be relatively easy to build in features that, for:

- **Technology developers** - Provide a modest level of [flexibility, adaptability, robustness, longevity] for systems, by building "technology foundations" which can accommodate
- **Technology providers** - Keeps [technology] suppliers in the market much longer than would normally be the case, and
- **Technology users** - Helps users to benefit substantially from the new technologies long before their competitors, partially through an understanding of some of the key foundations and features to look for, and thereby helping to identification of platforms that that have those features and which may provide more far more value than competitors through the "social media systems life cycle".

Therefore, while "Social [graphs, sets, media]" *are the concepts central to this paper, the overall objective of this paper is not to provide a review or roadmap for experts who are building social media toolsets and systems, but rather* ***to greatly expand the awareness of the social media and collaborative communities concerning the "larger world of capabilities" that these concepts will help to enable***. Furthermore, it is my gut feel that there exist fundamental capabilities and opportunities that are not yet recognized, including the importance of picking up from where classical tools (including semantics and logic) fall apart.

Introduction to social graphs and social sets

While more detailed definitions and descriptions of "Social graphs and social sets" are provided in later sections, it will help to provide a simple, concise definition here:

Social graphs –

Social sets

The reader may wonder why I have not used the phrase "social networks", which is perhaps more descriptive and precise than "social graphs and social sets". The reason for this is the phrase "social networks" is a very commonly used phrase, but that has a very different meaning, especially in the context of social media. I felt it important to use a different phrase to ensure that the readers would quickly understand that we are dealing with quite different concepts.

In contrast to "semantics" [Howell Oct2011 "SPINE - Semantics beyond search"], which has become a fashionable word in collaborative systems and social media systems, "social graphs and social sets" are rarely mentioned except in "under the hood" conceptual/technical articles that are quite rare, or in specialized discussion for a such as guidelines for applications developers. However, concepts related to "social graphs and sets" are, in the opinion of this author, of far greater power and significance than that of semantics or the much more visible state of understanding of current social media users (consumer, business, and government).

Facebook clearly indicates their view of the importance of social graphs in notes for their developer community:

"… …" hyperlink

But even Facebook seems to under-estimate the potential for social graphs/sets, and seems oblivious to the entire "dynamics" of social graphs, let alone the entire areas of connectionist computing and computational intelligence which tie in so well.

Artificial neural networks provide a very concrete and well-advanced area that is the basis of much of my thinking, and that illustrates the concepts well.

This paper finishes with some practical examples of "social graphs and social sets". In contrast to "Part II - Social [graphs, sets, media] and Workplace Applications", the examples are functioning prototypes, or in some cases, operational systems, which will hopefully give the impression that at least some of the concepts discussed may be viable.

Social graphs and social sets in a broader context

Throughout this paper I will be considering "connectionist systems" and "computational intelligence" as a far broader conceptual context than merely considering social graphs/sets. This is similar to a view that that classical semantics can be viewed as a subset of a connectionist view of language, but certainly NOT the other way around! This reflects my own personal bias from years of following neural network research, and to a lesser extent evolutionary computation and other computational intelligence themes. However, "social [graphs, sets, media]" are only a small subset of the vast "connectionist/ computational intelligence" themes. My use of the

phrases in this paper is often interchangeable. Although that is convenient for me as author, I hope that this does not overly confuse the reader.

endsection

Part II - Workplace Applications (for USERS)

As indicated by the title, Part II targets [USERS] of workplace applications, but it may also be of passing interest to [TOOL-BUILDERS, SYSTEM-BUILDERS]. I doubt that this Part will be of interest to readers who are [CONCEPTUALISTS, STAR-GAZERS], and I therefore recommend that they pass on this Part unless they have time to kill.

REPEATED PHRASE: Many of the themes listed for semantics in "Semantics beyond search" also apply to social graphs and sets – in a sense, the semantic themes are simple metaphors (usually subsets) for the concepts in the connectionist/ computational intelligence context. In the points below, the material from "Semantics beyond search" are retained in *blue italics font*, and differences from a social graph/sets perspective are provided in normal black font. As you can easily see, much of the content applies to both areas, that is "Semantics" and "Social graphs and sets".

As stated elsewhere in this paper, [social graphs, social sets] are not really on the radar screen, even for many social media developers. Even the basic concepts "don't exist" for most people, so it makes it harder to communicate the potential applications and benefits of related toolsets and systems.

As a start, I present the list of applications from the paper "Semantics beyond search", adding in comments specific to [social graphs, sets]. After all, one way to look at "conventional semantics" is that it could be considered as merely a subset of a much larger concept of semantics from the world of Computational Intelligence, to which [social graphs, sets] are related in this paper.

The next subsection "Terra incognito", considers potential applications from the "purely" [social graphs, sets] perspective, within the context of Computational Intelligence (CI), and more specifically Artificial Neural Networks (ANNs).

Finally, this Part is would up by considering larger-scale context of [social graphs, sets], and considerations regarding its use.

Basic themes from the paper "Semantics beyond search"

1. ***Ghostwriter*** *© - Assisted thematic development, information gathering/ analysis, and composition of reports "… a giant step beyond word processing …". I have not followed up on the progress of this particular concept/ product from 4 years ago, which is based on Confabulation Theory (see Appendix A). However, irrespective of the toolset, this is a general capability we should be anticipating, perhaps in gradual steps, over the next decade or so. The ability to bring new employees or outside consultants into an "organizationally specific stylistic framework" for writing could be a huge benefit (often stylistic writing and formatting is an important part of the final product, and is difficult to guess at for outsiders). It also might make a huge difference when experts are not available, but when someone "familiar" with a subject is available to take a first shot at a subject/ issue/ request.*

(GhostWriter is a copyright of Fairfax Corp. 15Dec2011 Howell – I have recently found out that Fairchild went into Chapter 11 in the USA in 2008).

2. ***Organizational memory beyond records*** - *The gradual displacement of paper by electronic records (databases, documents, emails, spreadsheets etc etc) has not really gone much beyond the WAY that we used paper records (other than for some databases, which have required enormous resources to maintain and often to translate "records"). But the electronic availability of "native format" electronic files, combined with fast, advanced (including semantic) searches, provides us with the ability to treat available information much more like we use our own memories – a trend already well illustrated by web search engines for a couple of decades. The highly linked, and well-indexed web content, with quick, effective general sources like Wikipedia, allows us to come up to speed so fast that it's almost as if we had already learned / remembered the material. Strangely, "Knowledge Search" on NRCan has only been available for about a year, and its reach is extremely limited. Addressing information security in an effective, easy, scalable manner (from individual employees through to public-to-the-world) is essential for this to reach its potential.*

3. ***Checks on Organizational Filtering for Senior Managers & Employees*** - *This theme may fit more with the upcoming paper on "social graphs and social sets". Many problems arise in organizations because of dysfunctional message passing up and down the organization. This could become easily apparent with the right toolsets (perhaps more the social graph dynamics than semantics).*

4. ***Dynamic (real time) tools for [pertinence, salience, priority] of information flows*** *(emails, Facebook-like postings, Twitters, blogs, documents, wikis, webpages, etc). We're drowning in ever-greater information flows, so it's essential that automated tools be applied to help us keep focus and stay productive, rather than make the situation far worse. To some extent, more specialized social media environments will help, but we need MUCH more than that. In the same way that we have SPAM filters, we have to have tools to "hide" (information hiding as a valuable feature!) items that we can't afford to wade through – as executive assistants do for managers. Or, another way of looking at this is an "Un-Spam" filter that extracts a CONTROLLED flow (eg 30 items max per day) of material from diverse information flows each day.*

5. ***Organisational Diagnosis*** - *of [individual, group, organizational, network] x [dysfunction, normal-function, how-function, hyper-function] x [employee, line management, direction, regulation, client] - This capability is likely to be a complement to traditional and social [graphs, sets] analysis, but in combination with the latter may be particularly useful for rare event detection & tracking. This diagnosis would be static in the simplest analysis, where it would be a complement to traditional tools. But the only way to ??????????? It's interesting to note the portion of psychologists involved in analyzing social media applications for the government. Their background could provide a rich and powerful boost to the computer science way of looking at IT systems.*

6. ***Emotional analysis*** *(is the Mona Lisa smiling?) – is so important to verbal and visual communications, and inter-personal relations in general. A good example is the popularity of face-to-face meetings and video-conferencing as opposed to conference calls. Another example is the challenge of interpreting emotions across cultural and linguistic groups, or even across organizational cultures. The alter example of emotional content is the problem that many experienced with the onset of email and now with texting, that a lack of visual and verbal emotional signals can lead to a misinterpretation of intent or motivation, and a flaring up of communications. NRC has been looking at emotional analysis tools, which may become a useful tool for security applications. If these tools work out over time, this could also be a big boost for employee morale surveys throughout an organization.*

7. ***Employee surveys*** *- My suspicion is that feedback and surveys often miss the "real problems", as individuals are reluctant to stick out, or to being recognized as the source of complaints and criticisms. Several of the applications discussed in this sub-section (in particular the emotional analysis point above) might be useful inputs into a system that might (at a low level requiring very careful interpretation!) compliment traditional surveys, or provide feedback in the absence of surveys.*

8. ***Employee performance appraisals*** *- As pointed out in an article distributed to SPINE team members by Ken Hart [Marlow 14Jul11], social media provide a completely new, and in some ways potentially superior, form of hard data for appraisals. Whether privacy or other concerns block its use for this application is another story, but in the same way that security agencies find social media to be information rich for their purposes, performance appraisals could potentially be enriched by automated processing / analysis associated with social media tools. In a sense this has long been accomplished via Bayesian statistics for Microsoft's internet gaming! The ranking of players and teams is critical to providing a challenging and fun online experience. Maybe we need to match people at work like this too?*

Social [graphs, sets] differences -

9. ***Where's Waldo****? - This concept includes rare event detection (eg trying to track down Osama bin Laden), or the automated extraction of "unusual and innocuous anomalies" that may be of importance to an [individual, group, organization], and which will generally be buried in a torrent of "noise" and distracting information.*

10. ***Finding what you weren't looking for*** *- When walking sown library isles looking for a book, it occasionally happens that we see a title on a completely different subject that turns out to be even more important than what we are looking for. It is impossible to wade through the torrent of potentially important information on the internet which may be of importance to us, but given our past emails, documents, reports etc, a system probably could recommend "strange topics" to look at. Amazon's suggestion of books to read is at one end of the spectrum. Your friend or teacher's suggestion of new people or themes is probably at the other end of the spectrum of intuition.*

11. ***Birds of a feather: Automated coalescence and dissolution of groups around automatically generated new themes*** - *It seems "natural" (?) that systems will evolve to the point that new themes can be automatically "created", and initial diverse sets of people be invited to discuss or act on different aspects of that new concept. Concepts might be technical, social, market, political or other themes, or cross-disciplinary views of an event or subject. This occurs now through the actions of organizers or advocates,, and it may be that such systems would best work through individuals and organizations who tend to do this sort of thing anyways, and who can screen and combine suggestions in creative ways.*

12. ***New pathways - Automated development or suggestion of new processes*** - *It is one thing to apply semantics to themes and issues, and quite another to apply it to processes. But we all tend to work in silos, and having a "huge world" view of the function or dysfunction of processes, and a comparison against other organizations would be a great help – especially to employees buried in a dysfunctional system and looking for supporting arguments to effect change! Consultants and auditors do this type of "forensic work", which is a check on how management has defined the organization. But I am not aware of the toolsets, and whether powerful semantic tools are being combine with hyperlink and business flow (MIS) capabilities*

13. ***Automated abductive logic suggestions for [individuals, groups, organizations, issues or themes]*** – *This is like Chrystia Chudczak's "web-page recommendations" suggested as a SPINE feature across views, but pushes an underlying, under-exploited concept.*

14. ***Bursting past the "frames problem" - Semantics and logic versus connectionist approaches, and hybridizing the two*** - *I'll not elaborate on this for now, as it "leaks into" much larger themes… and will be described in the paper related to social graphs and social sets.*

15. ***Contract/ agreement contradiction analysis*** - *Most of the time we pay senior managers and lawyers big bucks to carefully peruse major contracts and agreements. Still, everybody is extremely busy, and not everything gets that kind of attention. Going beyond grammar checking to the point where:*
    - *inconsistencies and could be automatically flagged for checking;*
    - *automated recommendations are provided with respect to an agreement's format or approach;*
    - *different terms and conditions could be suggested;*
    - *special clients for whom special conditions and constraints apply would be checked.*

    Note that these capabilities could be generically applied to many other processes.

16. ***Live, real-time conversations in foreign languages*** - *While text-based semantic applications have their own challenges, real-time translation between human languages is harder yet, partially because of semantic challenges as well as stylistic issues, and the tight performance constraints of human conversation. At one time, on my spare time I was selling fully-vocabulary voice-recognition systems to doctors and lawyers, allowing them to input directly into Microsoft Word and other applications. The obvious thing to do would be to chain the voice-recognition to a real-time translation (partially assisted with the editing*

features already in the voice dictations interfaces which could be adapted to a dual purpose!), and then use computer-generated speech (actually, decent computer voices are one of the biggest technical challenges). Of course, "everybody knows" that the technology isn't there to do this, but I suspect that what everybody knows is way behind what the technology can do, even if only for niche applications. Verbal communication between two individuals who don't have a common language doesn't work very well either… probably way worse than what machine assisted verbal (or text) communication has been able to do for some time..

17. ***Descriptions of the styles and functioning of groups, managers, employees*** *- There is no end to the number of simple classification systems that people and specialists dream up. But these are arbitrary and generic. What might be the effect of un-biased, automated classification systems, that don't reveal confidential, private information, and which do not give definitive answers, but which might point us in interesting directions, and could potentially avoid some of the problems with traditional, rigid classifications? This might be even more interesting when applied to the DYNAMICS of changing organizations – in terms of personnel changes, re-organisations, major shifts in plans and the type of work or themes,*

18. ***Presidential audio tapes*** *- While only Presidents and such could afford full audio tracking of everything they say and hear, with real-time voice recognition with semantic learning and clean-up, you too could have the same service for all that you see and hear at work. Just think – you could be at the center of your own Watergate! More seriously, this would potentially be a vast, high-quality source for semantic processing and helping us to do our jobs, and remember exact details of conversations even 5 minutes ago. This could also be vastly superior to minutes of meetings. In a sense, I had tried to partially do this in the past by tying a high-quality electronic voice recorder to voice dictation software ("pre-semantic" version). Those systems have since been available for many years now, but I don't know how accurate and noise-robust they are.*

The list above is far from complete, and is not intended to be a prioritized selection of semantic applications. There will be orders of magnitude bigger and better ides out there on the web and in development right now. It would be useful to cull the results of a survey looking for such concepts – but not to have a complete list or to identify THE ideas of the future: more to have a more diverse feel for what might happen.

Terra incognito - Applications specific to the capabilities of social graphs and social sets

Here's a series of quick lists to ensure that I don't miss some major themes related to the workplace:

Scale of organisation:
(a) Individual's Workstation -
(b) Psychology – Human Resources
(c) Sociology - Teamwork
(d) Organizational

(e) Partnerships & Collaborations
(f) Marketplace, [International Trade, Relations, Organization]

Communications – from self through to the grand public
Project management
Administration
Finance, accounting
Human Resources
Health, Safety, Environment
Information resources, infrastructure
Real property, office, facilities
Supervisory
Middle Management
Senior Management
Legal
Change Management
Senior Leadership (CEO, DM etc)
Directors, governance, audit

Hybrid Computations scaled to [individuals through public]

Every organization IS an information processing system to a greater or lesser degree. Initially this was all manual, then databases tied together many individuals inputting, verifying, processing, and using information, with almost all of the standard, "easy" calculations and processes being entirely automated. Operating systems, email, Web 2 & 3, and first generation social media environments also assist in sharing and collaboration for [communicating, processing, sharing] information at all levels of abstraction.

Absent from all of these systems and processes is the utilization of the [structure, relationships, functions, dynamics] of the social graph

Immune systems scaled to [individuals through public]

Organizational Advisors and Counseling Assistants

An overall outcome might be to morph part of "Management" into "Organizational Advisors and Counseling Assistants"

19. **High dimensional swimming, jumping, swinging, flying, morphing through a network** - One side effect of this data-based approach is to identify [structures, relations, processes, dynamics, people, networks] that may help you to look at systems and themes differently, and ultimately better understand systems even if the new perspective isn't well-centered on your [focus, interests].

20. **Finding what you weren't looking for** - you weren't looking for, but which

21. **Mood, energy, unity/diversity** - fgfdg

22. **Credit, banking, computer [fraud, encryption, decryption]** – eg teleco wiretapping

23. **[Inferring, alerting] competitor and client strategies from interactions** –

    Publicly viewable <----> non-accessible (one side only)

24. **[health, dysfunction, cheating & game theory] as pertaining to [Networking, organizational, individual]**

    Outgoing - schizophrenia, timidity, contact, effectiveness, confidence
    Incoming - tuning/tuned to target [objectives, clients, markets]

25. **Marketing founded on social graphs/sets** -
    Real time shifts versus "vibrations' in target mkt
    Regionalism – culture, trends, preferences

26. Quasi-directed hyper-evolution of networks -

27. Project teams [build, sustain, evolve, dissolve] <-> quickmatch divers skillsets [management, professional, technical, sales/marketing, customer service/ relationship, finance, contracting & project management]

28. Match strengths and weaknesses -

29. Promote/ demote/ jostle/ internal market for services

30. Peer/ client assessments

31. Personnel appraisals

32. Business processes – eg electronic signing -> remap around bottlenecks, employees pick the manager who matches the tasks

    Now -> Manager has the funds and picks the team
    Instead -> team or individuals get/own funds/clients – pick the manager that fits best
    This is an alternative, not intended for all situations. On the whole, the classical approach is probably best suited to most cases.

33. Policy processes

    – now [political, top down, captive]

Competition – from Social Media to Social Markets

34. Internal/ external/ hybrid markets

Beyond Democracy; Markets –and-rights-based politics

Broad considerations, implications of using [social graphs, social sets]

Note that an important feature of several "Basic Themes" above is the AUTOMATED capabilities that should arise, partly based on [semantic, social graphs & sets] *capabilities.*

- *We are used to the automated processing of accounting information, or process control systems (historically PID analogue or digital controllers).*
- *"Semantics beyond search" invokes "automated processing" for free-format information (text, images etc) in their native format. We should expect more and more of this at ever-more-advanced levels of sophistication.*
- "Social graphs, social sets, and social media" - In this paper,

Humans can't see and compare, in [detail, structure, dynamics*] any more than a handful* of communications and networks between other individuals (not including themselves). *In contrast,* social graphs and social sets *(like semantic processing) COULD potentially cover every single individual, and all "tracked" interactions between them (the "all-seeing eye") AND it could process, abstract, and act on that information.* What, how, and why are discussed in later

sections – it's hard to succinctly describe because the entire area is so new and different. *Even a poor job with that kind of access and detail could go far beyond what any normal human could ever hope to do, even if we could all do a vastly superior analysis for ANY individual that we know well enough (typically limited to peers and subordinates of our own work teams, plus a few other individuals).*

Some people (I'm thinking of myself here) have emotional IQ's less than zero, and have NEVER developed a talent for analyzing and second-guessing people, and more particularly their social networks, and the dynamics thereof. *Organisational attempts to develop people* and teams *typically offer "conceptual frameworks" that provide simple rules, personality types, and behavioural recommendations for employees, project leaders, and managers. However,* "social graphs, social sets" offer a very different "hard data" basis for *group or organizational-wide analysis, with advice or development for people as a potential side-effect. Perhaps more importantly, these systems might offer a basis for rejecting the "politically-correct theories of the day", for far more substantive, group-specific analysis and results.* To my knowledge, analysis of the dynamics of social graphs and sets are simply not done to any significant extent in current organizational analysis, with the exception of hand-crafted, exhaustive, custom biographical papers and books. ***Perhaps "automated advisors and personal trainers" will arise from this,* with particular emphasis on managers and the design adaptation of people, teams, organizations,and processes.**

Is "Crisp Privacy" dead?

- **Semantics -** With personal email and folders inaccessible to automated indexing and semantic processing (leaving social sets and graphs aside for now), the privacy of individuals is a given as long as access is strictly limited. With the shared directories and applications, that is less the case. However, as soon as some individuals open their email and social media type sources, then this "containment of privacy" becomes problematic, even if thematic domains are not open. Anyways, something to think about – more so when organizational change, behaviour, dysfunction and exceptional performance tools are implemented.
- ***Social graphs and social sets*** *- To some extent knowledge of social graphs and sets has been quite limited in the workplace, beyond the immediate office environment, and beyond formal contact lists and specified [hierarchies, teams]. One could easily use emails (not just contact management systems) as a basis for building a [social graphs and social sets] framework and tools, but I am not aware of much work on that. Having much more thorough, high resolution information based on social graphs and social sets would provide a significant extension of the type and capabilities of office toolsets. It would also be far more revealing than traditional toolsets for some analysis, but again raising the important issue of "privacy".*
- Furthermore, *should potentially be able to* spit out high-level abstract results and recommendations WITHOUT violating privacy!

Mid-to-long-term plans and expectations

Some of the "semantic and [social graphs & sets] *applications" will likely be in use within a year or two in their simpler forms, others may require 5 to 15 years before they become commercially available, and a few applications may take a much longer time to mature. Others still may exist only in a hybrid man-machine form for a very long time.* ***But even if a tool is not immediately available, it is still important to be aware of the potentially arising capabilities and the requirements of their underlying systems,*** *which may help orient current development and implementation projects, especially with respect to issues described in the separate paper "SPINE – Systems design issues for social media".*

endsection

Part III - Foundation Concepts (for CONCEPTUALISTS)

As indicated by the title, Part III targets CONCEPTUALISTS, but it may also be of interest to [TOOL-BUILDERS, STAR-GAZERS]. I doubt that this Part will be of interest to readers who are [USERS, SYSTEM-BUILDERS], and I therefore recommend that they pass on this Part unless they have time to kill. Much of the material assumes a familiarity with advanced concepts and methodologies from the areas of Artificial Neural Networks (ANNs) and Computational Intelligence (CI).

REPEATED PHRASE: Many of the themes listed for semantics in "Semantics beyond search" also apply to social graphs and sets – in a sense, the semantic themes are simple metaphors (usually subsets) for the concepts in the connectionist/ computational intelligence context. In the points below, the material from "Semantics beyond search" are retained in *blue italics font*, and differences from a social graph/sets perspective are provided in normal black font. As you can easily see, much of the content applies to both areas, that is "Semantics" and "Social graphs and sets".

This paper is driven by a personal, biased interpretation of what [social graphs, sets] may signify as the "… HEART of social media …", and as a completely new component of modern software systems for the workplace. There are far more conventional (and limited!) ways of looking at [social graphs, sets], as well as completely different advanced ways of looking at them. However, those other perspectives are not covered in this paper, nor am I the right person to address them, partially due to the very limited time that I can put into this paper, but chiefly because there is little advantage to providing yet another conventional viewpoint when my chief advantage is the perspective presented here.

Furthermore, even within the perspective I bring, as described in this paper and this Part III, I do not present a [complete, coherent, prioritized] list of concepts, but rather a somewhat-random set of ideas to stimulate further thinking on some general non-conventional conceptual approaches to building systems that incorporate social media. Later, Part IV addresses a somewhat-random set of specific, non-conventional toolsets that one might apply to the construction of social media application.

Again, note that CONVENTIONAL approaches to [social graphs, sets] are not described in this paper.

Artificial Neural Networks (ANNs) - A context for social graph toolsets

As explained in the sub-sections below, there seems to be a great opportunity to apply concepts and tools from the area of Artificial Neural Networks (ANNs) to the [social graphs, social sets] of social media. It is certainly a perspective that is absent from the great majority of commentary about social media.

I have NOT provided a basic description of ANNs in this report, assuming a fairly sophisticated level of understanding of ANNs by the reader. Admittedly, this is a huge shortcoming in the current version of the document, but I feel that it is much more important to get my "value

added" concepts down, than to provide a basic-through-advanced primer on ANNs. Readers can refer to extensive web literature for that.

ANNs: Abductive logic approach to [social graphs, sets] (simile, metaphor)

Since 1988 I have followed the area of Artificial Neural Networks (ANNs,or NNs) as a passionate personal interest. It strikes me that there are at least some similarities between [Individuals, organizations, societies, civilizations] (IOSC) and ANNs, which should make the latter a useful paradigm (abductive reasoning basis) for [social graphs, social sets]:

- Both IOSCs and ANNs involve very large numbers of "[structured, hierarchical, networked] information processing elements" (in the form of "nodes" or "neurons" for ANNs, [people, organizations, markets] for IOSCs) with complex interactions that cannot be modeled by classical techniques.
- Both ANNs and IOSCs deal with [dynamical, self-optimizing, self-defining] systems.
- In the current author's opinion, both ANNs and IOSCs operate beyond the limits and constraints of [rational, logical, scientific] thinking – you need much better tools than these!.
- ANNs are one of a very few areas that provide a firm mathematical basis for analyzing [complex, non-linear, self-optimizing] - "[structured, hierarchical, networked] information processing elements". ***Where else can you find this basis?*** (Numerical methods for fluid dynamics etc do provide some basis, but this fall conceptually and practically VASTLY SHORT of ANNs.)
- Brain function and neuroscience are the origins and "holy grail" of neural networks, and there has always been a strong linkage to psychology, and "social applications"! In other words, one might expect ANNs to be a good starting point for building a profound undersanding of the potential for [social media, social sets].
- *[28Dec2011 Howell – must stop here for now…]*

There are also important differences when comparing ANNs to [Individuals, organizations, societies, civilizations] (IOSC):

- IOSC are enormously complex and "big", with huge differences between individuals or components
- While ANNs are powerful tools for dealing with [highly non-linear, chaotic, discontinuous, discrete] systems, IOSCs require techniques that go far beyond that.
- Interactions with the environment are key – and this is NOT NORMALLY a characteristic of ANNs other than simplistic "pre-programmed" responses to input signals. While there are ANNs that address these issues, it hasn't progressed so far as to provide a comfortable representation of what IOSCs can do (in my opinion).
- IOSC restructure, evolve, and change thinking quite "quickly" when compared to:
    - the scale of generations (culture, education etc)
    - the scale of years (organizational changes)
    - the scale of weeks (behaviour changes in response to extreme threats)
- In this author's opinion, IOSC have a "huge set of diverse [behaviours, personalities]", most of which are never expressed, but that can be triggered by events etc.

- *[28Dec2011 Howell – must stop here for now…]*

In this section I use the term "abductive logic" as being interchangeable with [simile, metaphor], and in the strict sense that is not correct. Pattern matching is another related concept area. There are more concise mathematical definitions of "abductive logic" that are quite different from my usage of the term "abductive" here. However, I prefer to use the phrase "abductive logic" in order to strongly emphasize its role as a not-often companion to deductive and inductive logic, and to retain the "linkage" to a basis of mathematical formalism that we expect in "logic" (but which I don't actually apply here!).

In spite of the obvious dangers of applying abductive logic, it is a very powerful approach to addressing problems, in the sense that conceptual frameworks, models, mathematical tools, and "problems and fixes" that have been successful in one area can be very handy in other areas and can greatly accelerate the process of understanding those other areas. "Dual systems", such as the parallels between mechanical and electrical engineering systems, are a great example of this power.

My guess is that abductive logic makes up a far larger portion of [rational, logical, scientific] thinking than scientists would like to think.

ANNs: an ultra-quick backgrounder

[28Dec2011 Howell - this will not be filled in at this stage…]
??? illustration of

Since the late 1940's enormous progress has been made with ANNs, thanks especially to decades of work out of the limelight by the pioneering giants of the field [Anderson's Talking nets, Grossberg & Carpenter]. From the start the area has involved an incredible diversity of backgrounds as an essential approach to making even basic advances: biology, neuroscience, psychology, mathematics, physics, engineering, computer science, information theory, and many others. Furthermore, ANNs have required combinations of:

- advanced theory development in mathematics was necessary (huge systems of [gentle non-linear, strongly non-linear, chaotic, discontinuous, discrete] * [dynamical, spatio-temporal] systems)
- extremely insightful observation of [natural, engineered, biological, neurological, brain] systems
- demonstration of [concepts, toolsets, applications] to challenging real-world problems
- hybridized approaches with [classical science models, evolutionary computation, other approaches as described in Parts II to V or elsewhere]

Note that ANN-based toolsets are listed in Part IV, albeit with next to no real explanation of what they look like, how they work, their mathematical basis, and successful (competitive!) areas of application.

ANNs: closing comments

But while the area of Artificial Neural Networks dominates the [concepts, mathematics, toolsets, systems] conceptual perspective of this paper, other non-conventional themes are also important. They are covered in the following sub-sections.

Computational Intelligence(CI) – non-ANN concepts

As with Appendix A, below is a sampling of my own exposure to concepts over the years which may or may not have an application to semantic processing of various types – and again, it is certainly not an exhaustive list. The list is specifically focused on Computational Intelligence tools – and not the "whole universe" of techniques that are useful for semantics. Subjects for which I took a tutorial, attended a special session/ plenary, or have discussed /emailed first-hand (all of the proceeding with the founder himself) are indicated by an asterix (*). Obviously, I tend to reflect my direct interactions with individuals, rather than having an overall view of activity in the field.

I have provided only a single reference for each concept, as that is all that I have time for now. As explained earlier in this paper, the themes will be covered more thoroughly in the paper on "Social graphs and sets".

My own guess is that the toolsets are at an extremely immature stage, and that toolsets will arise quickly based on radically new completely outcomes from the "machine learning" field. These will likely involve different "philosophies of thinking", and not just more effective extensions of scientific thinking, or of the current connectionist and evolutionary concepts.

This concept has already been introduced

Evolutionary Computation- A universal basis

Fuzzy Systems

Chaos Theory

Synchrony

Other basic concepts

[Rational, logical, scientific] thinking

It is not appreciated just how very constrained and limited [rational, logical, scientific] thinking really is. It is dependable ONLY where a very strict set of pre-conditions are satisfied, which is rarely the case with "moderately complex dead systems", and which should never be assumed to apply for living systems, let alone human systems. It is very strange how poorly this is understood, especially by scientists. A quick and incomplete list of pre-conditions is:

- All important independent, intermediate, and dependent variables are known
- All key variables can be measured "to a sufficient level of precision"
-

Having said that, it is also important to understand that, almost by Occam's razor, it may often be best to start with the simplest tools and see how they fare, before adopting more powerful techniques. The power of the latter comes at the price of being more difficult to master and more likely to be mis-understood and mis-used. Furthermore, approximate solutions from simple techniques can be excellent starting points for more complex and powerful techniques.

Another near-universal shortcoming is that only selective (and often inappropriate) use of various forms of "logic" are usually considered:

- Deductive logic is perhaps over-used, partly because of its relative simplicity and ease of extension. There is a great attractiveness to the concept of a "fundamental truth", and being the correct and unique proper answer to a problem. The frequent problem of "false frameworks of logic" (erroneous postulates, basic assumptions, inappropriate approaches to a problem domain) nhkljkluik
- Inductive logic gets inadequate emphasis.
- Abductive logic is used intuitively, but rarely recognized formally.
- I'll stop there, being a good example of someone who doesn't use a full range of approaches to logical thinking.

As examples of key issues that may be overcome by connectionist and approaches like Confabulation Theory:

- *Binding problem - "… The famous binding problem (von der Malsburg 1981) does not apply to confabulation theory because each of the attribute description symbols of an object is typically linked to many of the others pairwise by knowledge links (see Sect 1.2.2). In effect, a mental world object is any reasonably large subset of its pairwise-linked attribute description symbols. …" [Hecht-Nielson 2007, p8]*

Frames problem - "… I'm missing the quote here …" [Lendaris and Santiago 2005]

This contrast between AI and CI is well-delineated by Robert Hecht-Nielson in his description of the bounds of Confabulaqtion Theory (see "Semantics beyond search"):

"… quote about higher-level executive…

Bayesian statistics

Randomness

Sampling theory, information theoretics

Our behaviour is as pseudo-[random, sporadic] samplers of information streams. As the flow increases, the sampling becomes more sparse, and the ideas must "repeat-fire" in temporal groupings in order to disseminate. The more [important, valuable, wider-interest] concepts will tend to have a larger number and more frequent set of multiple repeat sources and [translators, morphers].

[Re-expression, morphing, de- & re-construction] helps to evolve ideas, rechecking helps to validate & learn.

This is like [communications, neural] networks.

Structure theory [Wlodek Duch etal]

Semantics

While semantics isn't the central theme of this paper (being discussed in a separate paper of this series (http://www.billhowell.ca/Social%20media/Howell%20111006%20-%20SPINE,%20Semantics%20beyond%20search.pdf)), it is important to mention it here at least as an important "companion subject" to social graphs & sets.

Semantics certainly did NOT arise from text searches, rather it has long been a fundamental area of study for languages and communication. While spelling and grammar-syntax "checkers" function very nicely in applications such as word processors, email programs, it is RELATIVELY easy to build effective pattern-matching systems to do this. Semantics has been a much tougher challenge.

Rather than belabour the point, I've dug up an old "hobby-test" that I did on a "Confabulation Theory", which is mentioned in:

24Aug11 Confabulation Theory for Cognition: "Next Plausible Sentence" survey

http://www.billhowell.ca/Neural%20nets/Howell%20110824%20-%20Confabulation%20Theory%20-%20Plausible%20next%20sentence%20survey.pdf

Computational Biology

Social graphs and social sets

The main "toolset emphasis" of this paper is the abductive application of Artificial Neural Networks (ANNs) to [social graphs, social sets] within social media applications and workplace systems. However, the reader can clearly see from this Part that many different "conceptual perspectives" can be used for thinking through the opportunities for social media. Only a sampling of these perspectives is presented here.

But one cannot have a high level of comfort dealing only with the conceptual level, when faced with building systems. The next part is therefore targeted at Toolbuilders.

endsection

Part IV - Technologies, and Toolsets (for TOOL-BUILDERS)

As indicated by the title, Part IV targets [TOOL-BUILDERS], but it may also be of passing interest to [CONCEPTUALISTS, SYSTEM-BUILDERS]. I doubt that this Part will be of interest to readers who are [USERS, STAR-GAZERS], and I therefore recommend that they pass on this Part unless they have time to kill. Much of the material assumes a familiarity with advanced concepts and methodologies from the areas of Artificial Neural Networks (ANNs) and Computational Intelligence (CI).

REPEATED PHRASE: Many of the themes listed for semantics in "Semantics beyond search" also apply to social graphs and sets – in a sense, the semantic themes are simple metaphors (usually subsets) for the concepts in the connectionist/ computational intelligence context. In the points below, the material from "Semantics beyond search" are retained in *blue italics font*, and differences from a social graph/sets perspective are provided in normal black font. As you can easily see, much of the content applies to both areas, that is "Semantics" and "Social graphs and sets".

This Part IV covers non-conventional, advanced toolsets which range from being:

- concepts at a very immature fundamental stage, but showing some promise; to
- established academic techniques; to
- well demonstrated advanced tools that are applied to diverse science or advanced engineering applications.

The intent in this Part is to list specific, well defined toolsets which may find application to [social graphs, social sets] as related to social media.

Keep in mind that this entire document is largely from my own perspective and background, rather than being a thorough review and prioritization / comparison of [social graphs, social sets] *technologies and their significance. But there are some advantages to being a somewhat personal viewpoint, in the sense that independent viewpoints:*

- *have a good chance of contrasting the consensus and conventional,*
- *raise questions that might otherwise be missed,*
- *discourage readers from taking an overly simplistic view of a subject, and*
- *prevent readers from believing that all issues have been settled and that the "truth" has been found (a common flaw in scientists thinking – this is a key "hobby theme" of mine).*

The concept lists are not sufficiently explained to clarify the concepts for readers who are not familiar with them, but I felt that it was important to provide "place-holders" for future follow-up, and for important conceptual context, rather than limit content to a few brief descriptions of selected themes.

Issues related to systems conceptualization and design (such as Technology versus user needs drive, unpredictable evolution and rapid roll-over of platforms, organizational and toolset diversity etc) are addressed in the separate papers:

- *Howell 2011 – Systems design issues for social media.doc*
- *Howell 2011 - How to set up & use data mining with Social media.doc*

Classical & Current social-graph toolsets

Here is a very incomplete, random listing of Classical and current toolsets for [social graphs, social sets] or for somewhat-similar applications.

[29Dec2011 Howell - I will not elaborate at this time…]

- Operating systems – eg group definitions, changes
- Enterprise systems – in particular business process models!
- Email systems
- Intranets – contact lists, experts, web, wiki, blog,
- Customer relationship Managers, Contact Managers
- Social media systems in use: Facebook, Jive (open source), IBM Connections, Linked-In, Twitter, etc
- ….

[28Dec2011 Howell – maybe more later, but I'm running out of time]

Missing "classical" pieces of the puzzle

Note that there are counterparts to many points below in "Part I - Semantic applications to the workplace – random thoughts".

- ***Saliency, priority & "Un-spam" filters*** - *We are all drowning in rivers of information every day, even if we can "tune" it to all be relevant to our job responsibilities. How can we "filter this" down to a manageable amount according to the saliency, priority, and quality of the information? My guess is that "random sampling" and "re-iteration over time of key points" will be a critical part of any successful system to do this. (see also "Random Math" in •"Appendix F – Dead Math, Random Math, Live Math, and Social Math").*

- ***Rare event detection/ tracking*** - *(see "Where's Waldo? " in Part I) Some objectives require picking out non-obvious clues from an ocean of data flowing by. For example, the search for Osama bin Laden is a task for which key information will be coded or will require inside knowledge to appreciate its significance. Meanwhile a great deal of the flow of information is false or erroneous, perhaps by deliberate action of the "enemy". Another example (this time from case based reasoning) was NRC's project to help the diagnosis of maintenance problems of aircraft. Tracking down causes of a rare event by analysis of related failures and analysis of coincidental status and activities worldwide is a key capability.*

- ***Important novelties*** - *I am not aware of concepts and examples that have an ability to pick out new and evolving [themes, situations, etc] that will be important to an individual or organization via automated environmental scans.*

- ***General knowledge bases*** - *As per my comment on "data-mining" tools above, My suspicion is that even now massive "general knowledge or domain-specific knowledge bases" are being built that will have a huge impact on the effectiveness of semantic and related tools application to real domains.*

- ***Power tools for building specialized knowledge bases*** - *My guess is that fast, effective tools for building specialized knowledge bases will become critically important. Presumably this will be able to automatically cull through an organisation's information in native format. The ability to quickly correct/ edit/ augment this will be especially important. Tools for identifying inconsistencies and gaps in knowledge will be especially important as well.*

- ***Structure semantics*** - *Information in spreadsheets and databases has a structure beyond the semantics of the text within them. Some of this may also deal with hierarchies and other specialized organizations and structures.*

ANN & other CI toolsets – potential significance for [social graphs, sets]

While my descriptions below can only be considered to assume that the reader already knows what I am writing about, as the descriptions are so short. But this is the most important section of Part IV, given that so few have even touched on these subjects. As an author, this is where I can contribute the most in terms off items that aren't already well-covered in publications and the media.

Neural Networks

There is a large selection of software for implementing various kinds of "classical" neural networks. However,

Computing with words [Zadeh 23Jun2003]

Hebbian learning [Donald Hebb, McGill ~1940's or 50's?]

The information theoretic dereviation of Hebbian learning by Harold Szu of the US Office of Naval Research was a hugely impressive bit of work – easy for Szu, but important in the implications for information theoretics and to give a sound explanation of why Hebbian learning from psychology is so important, and is still used today.

Neuro Linguistic modeling [Perlovsky]

Network reconnection & brain recovery from insult [Thivierge 05Dec2008]

Reservoir Computing

Several related concepts fall under this very interesting theme:
- Liquid State Machines
- Neural Gas Models
- Echo State Networks [Jaeger 2001] ,
- Extreme Learning Machines (ELM – * Huang Guangbin, Signapore),

A key point is that the huge computational power of forward or recurrently connected ANNs is very difficult and long to train and optimize. However, with Echo State & Extreme Learning Machines it has been found that one may use random-fixed-weighted, complex "reservoirs" of neurons, and add linear output layers with trainable neurons to get lightening fast training using linear algorithms!

THIS IS HUGELY IMPORTANT!!!

I haven't followed this for three years or so, but an obvious progression would be to use assemblages of "functional networks" that are brutally powerful and fast for families of functionality.

[30Dec2011 Howell – out of time, have to stop here…]

Bayesian statistical theory versus Confabulation (?Michael Rogers of Microsoft?, * Robert Hecht-Nielson)

Swarm Intelligence (I forget the founder's name – I've met him a couple of times) and **Collective Intelligence** – as in robotics (Mikalainen's Plenary at IJCNN 2006 in Vancouver)

Stochastic chaos, synchronization, & the brain [Freeman 14Jun2009]

Repeated sampling & confirmation
- repeated sampling to confirm, redirect, cancel hypothesis

Evolving Connectionist Systems (Nik Kasabov)

This also has shown HUGE promise!! No time to comment…

Non-conventional concepts NOT included in this section:

Part VI concepts (see that Part!)
Quantum computing
Everything else…

endsection

Part V - Workplace systems perspective (for SYSTEM-BUILDERS)

As indicated by the title, Part V targets SYSTEM-BUILDERS, but it may also be of interest to [TOOL-BUILDERS]. I doubt that this Part will be of interest to readers who are [USERS, CONCEPTUALISTS, STAR-GAZERS], and I therefore recommend that they pass on this Part unless they have time to kill.

REPEATED PHRASE: Many of the themes listed for semantics in "Semantics beyond search" also apply to social graphs and sets – in a sense, the semantic themes are simple metaphors (usually subsets) for the concepts in the connectionist/ computational intelligence context. In the points below, the material from "Semantics beyond search" are retained in *blue italics font*, and differences from a social graph/sets perspective are provided in normal black font. As you can easily see, much of the content applies to both areas, that is "Semantics" and "Social graphs and sets".

[27Dec2011 Howell - To make Part V useful, I would need to add example, design principles, lessons learned, case studies etc]

This Part is intentionally brief, as it is covered more substantively in separate (and very incomplete!) reports: "Howell 2011 – Systems design issues for social media.doc" and "Howell 2011 - How to set up & use data mining with Social media.doc". Furthermore, as mentioned in the latter report, systems design is not my area of expertise nor experience, and to really develop the theme I would need a great deal of input from one or more rare thinkers on systems design (perhaps "unknown lights" in the area of [O/S kernel, GUI foundations, Enterprise-Web architects, etc]).

Having said that, at a long time user of large systems, huge [limitations, constraints, mis-perceptions] in [practice, thinking, anticipation] are the norm, often yielding systems that fall far, far short of their promise, and which waste enormous amounts of time on those who work with and use the systems. I have the strong feeling that social media will never go far unless some very simple initial failures of systems-level thinking are corrected, and of course that principle applies all the "way up the abstraction chain".

It may not be possible for progress unless the existence of the "mental blocks" is recognized. Why this occurs in quite another matter that is addressed in a preliminary fashion elsewhere. But to me, "mental blocks" and the [fashions, cults, religions] of thinking are the norm for homo sapiens. The "religions of scientists", so viciously defended throughout all of the period of civilization (taking a very general definition of "science" here, not precise as with Lucio Russo's definition), are perhaps the best documents, not being so different from their intellectual cousins in theology.

A partial description of the situation is given in the introduction to "Howell 2011 – Systems design issues for social media.doc":

> *"… In discussing social media with IT/MIS professionals, it has been my experience that they tend to look at the new capabilities as yet another relational database system to fit into the Business Plan and standard systems analysis tools that they have become accustomed to. To me, these approaches are well suited (or well-practiced, which isn't the same thing) to "stagnant, established" technologies that are extremely well understood, and which are highly predictable.*

But they are poorly suited to breakthrough technologies with very different conceptual and theoretical capabilities and impacts, and which by definition are immature and rapidly changing. …"

Key systemic issues that limit the growth and power of social media

Even the very simple issues listed below are still poorly appreciated by IT specialists and end users in spite of several decades of examples, and several decades of "crippled applications" that were severely limited in potential simply because basic concepts were not understood nor appreciated. Think of how often "collaboration" is limited to a barrage of emails back and forth to members of a community or project, then think of how messy it is to track and check that information when you don't have the time to file, summarize and arrange it.

The wording in [blue, italics] font below has been taken from "Howell 2011 - How to set up & use data mining with Social media.doc". As mentioned in that document, the list is very incomplete.

Key "low level" recommendations are:

1. ***Allow END-USER specification of access control*** *for "sources" [files, directories, web-pages, wiki-pages, blogs, [Facebook, LinkedIn, etc], Twitter, etc], including access [vetting, review] capabilities such as [general and automated policy, automated classification assist, automated warning – detection, automated auditing, manual review/ auditing etc]*
2. ***Provide fully-pre-indexed search capabilities*** *– hopefully with Google-like algorithms & semantics, in native-file format (this latter is somewhat debatable perhaps (only for semantics, not for text!), but it is a huge advantage and has long existed (20+ years) for text indexing). A key trick here (for the future) is to "index" structured information (hierarchies, spreadsheets etc) PLUS social graphs and social sets!*
3. ***Cover a broad range of "sources"*** *[files, emails, wiki pages, web pages, blogs, spreadsheets, databases, [Facebook, LinkedIn, etc], Twitter, etc] - ALL NRCan electronic content is the "theoretical" objective. In practice, it is best to start with the "easy" sources, and leave the tough challenges for later once the overall concept is established in practice.*
4. ***Implement "Information Redundancy Reduction" systems****, addressing/ including:*
    - *Information indexing and chunking*
    - *Information reduction through abstraction (these are explained in the document)*
5. ***Select a variety of tools*** *that broaden the scope and type of indexing provided, looking especially for capabilities to "index" social graphs and social sets (structure is critical, and so are dynamics!)*
6. ***Provide tools to cull information from general information streams****, in a manner to improve the [Saliency, Pertinency, Priority, Critical Novelty] of what the user sees.*

[16Nov2011 Howell – The above list is incomplete. Also, recommendations for the "use" of data-mining with social media have not been prepared yet…]

7. **Data rights, strategic positioning with information** (view of host) - Facebook etc ?say that they won't disclose user information (in raw form) to others, BUT they don't mention their

analysis / use of the results (sell to 3rd parties etc). Given that the DATA is hosted on their servers, this has put them at an intense advantage strategically within society – better than governments in most areas! As I've stated several times before, Microsoft's Outlook gives it a dominant position with business and government email, but the emails themselves and their attachments are NOT directly accessible by Microsoft. Smaller businesses may be using Google's gmail, Yahoo email, or other email hosting (free) services. Those arrangements will provide an opportunity for the hosts to do very powerful analysis. But it is Google that seems to be positioning itself best for now, given:

- Google Search - is the dominant search engine on the web,
- Google MySpace social networking software - its basic implementation of "end user definable access for files, directories, web pages, wiki pages, etc" may encourage small businesses to use its product rather than linked-in or Facebook.
-

However, even given Google's current positioning, over the years an impressive number of market/concept initiators large and small have been crushed by Microsoft's "late market entry" strategy of copying or buying competitors in a targeted market space, rather than developing concepts on their own or entering markets at the initial stages. Microsoft now understands operating systems much better than its first 30 years, and may be able to better relate to key capabilities the others still don't seem to understand yet.

… more to come …

Analysis of immature and unstable [concepts, tools, applications, systems]

Prior to over-viewing foundation concepts, all of which are at various stages of conceptual development and uncertainty, it may help to consider the implications of building [concepts, toolsets, applications, systems] from immature and unstable starting components. This has direct and immediate implications for this paper, which considers only a small fraction of potentially useful concepts related to social graphs and social sets. In other words, the reader cannot expect complete and conclusive coverage of the subject of [social graphs, social sets] in this paper.

As mentioned in the related paper "Semantics beyond search", it is my assumption that the most important social media capabilities will be neither predictable nor well understood in their initial stages. This isn't such a brave statement given that our use of current technologies is hamstrung by not fully recognizing important long-standing capabilities and constraints (see the previous section).

Concept development is best described as a evolutionary process in an open competitive market, with most of the key breakthrough ideas coming from non-institutional sources (eg some [hacker, student, academic] on a computer at [home, school/ university, company]). Within that context, the current document is a limited, random look at several potential tie-ins between semantic technology concepts and work-environment applications (see the section "Social [graphs, sets, media] applications to the workplace – random thoughts"). A thorough literature review has NOT been done, and most of the thinking is based on my own hobby interests at home, combined with news items that have arisen within the "SPINE" project at work.

With respect to building social media capabilities into government IT systems, given their very immature state at present, rather than focus on specific ideas it is more important to consider **3 themes**:

1. Identify & cull a wide diversity of concepts that are being proposed or implemented around the world; and given this understanding…
2. Plan and develop IT systems to allow for the easy integration of new toolsets, processes and systems, many of which will be completely unknown and unpredictable at the time of integrating current capabilities (such as Facebook, Twitter, etc) into government systems. In this light, it is more important to design our IT systems to be open to accommodate new unexpected capabilities, rather than to provide a shopping list of semantic or social graph capabilities to select from.
3. Allow for "multiple conflicting developments" – demonstrations to try out many ideas and see what works. It for to easy to over-emphasize analysis and planning when both are of limited effectiveness.
4. Open, evolving data and file standards for representing [social graphs, social sets] and [derivatives, hybrids] can do a lot to make it much easier to hybridize toolsets within systems.

Leading into mid-to-long-term plans and expectations

[This section is condensed from "Howell 2011 – Systems design issues for social media.doc", criteria and constraints of IT systems to achieve openness, flexibility, reliability, and robustness.]

Even if a tool is not immediately available, it is still important to be aware of the potentially arising capabilities and the requirements of their underlying systems, which may help orient current development and implementation projects, especially with respect to:

1. ***Openness & transparency*** *- keeping new systems open to new capabilities that will emerge.*
2. ***Planned obsolescence*** *- We normally want big, expensive systems to last, but being realistic about it, that only occurs with technical, application, and market maturity.*
3. ***Expensive action*** *- Development of new [concepts, toolsets, applications, processes, systems] is expensive. This situation does NOT match "standard operational" mindsets, management, funding, and processes!*
4. ***Stand back and watch*** *- Even a passive approach does NOT mean inattention – as changes to data, functions, processes and systems might be easy to implement with time such that later purchase of a new social media system has an "organically grown, compatible" environment of information and systems to feed off.*
5. ***Local autonomy*** *- ALL of the issues here are strongly affected by the perspectives of "local groups" within an organization.*
6. ***Growth versus steady-state*** *- As illustrated by the now-current "Shared IT services" across the federal government of Canada, there are tremendous economies with the standardization and centralization of systems, so there is always a strong pressure to do this where possible.*

7. ***Theory and planning versus Evolution in a competitive environment*** - *Management theory still falls short of the lessons of evolutionary theory (and often ignores cheating/game theory as well).*

While the call above is to anticipate that major changes will occur, and to plan flexibility and adaptability into current systems in consequence, the other side of the message is that it may not be worth doing TOO MUCH preparation and adaptation, as the chances are high that anticipatory actions will be unsuited to changes that actually occur over time. Simple approaches may help somewhat (see section "II.3 Simple, starting principles"), and the process of thinking about changes may make it easier for small parts of the organization to pick up opportunities at the right time for them, even if the rest of the organization will only follow much later.

Workplaces systems implementing [social graphs, social sets]

Relatively simple "Customer Relationship Management" systems (or "Contact Managers"), and the positively primitive systems for managing access control within [operating systems, relational databases, Enterprise systems] provide examples of systems that work with something resembling [social graphs, social sets]. But even those examples, and social media systems themselves, fall far short of an overall systems perspective of using social media in the workplace, which for practical purposes is an almost non-existent concept outside of the social media community itself.

"Static" [social graphs, social sets] in workplace systems

It is easiest to start discussions that are specific to social media, with "static" [social graphs, sets] (again, as in the rest of this paper I avoid the phrase "social networks", as this is in common usage and denotes very different connotations). Here, by "static" I mean that the information processed is static, but also that the architecture of the [social graphs, sets] is invariant. By ignoring the dynamics we can more easily focus on the structure and various representations that have been used. In this Part, we are not concerned so much with how social media toolsets represent and use [social graphs, social sets], but instead are focused on how overall systems in the workplace can help "extract" and "apply" [social graphs, social sets] * [from, to] the entire range of workplace [data, applications, processes, systems].

While the list below is perhaps more related to "workplace applications and systems", the reader should be thinking about systems-related issues of taking advantage of these sources, and what kind of barriers must be overcome or eliminated in order to capitalize on them.

Facebook, Linked-In, Twitter
My guess is that the vast majority of social media [data structures, toolsets, applications, systems] have been developed for the market leaders and their competitors. Already there are a huge range of new toolsets for their analysis, only a few random examples that I have run into are listed below:

- Frequency and impact of posters - Interesting "towering bubble charts" have been illustrated by ?consultant at DRDC workshop?.
- Social network graphs that self-configure for different perspectives and user-input – Nexalogy?
- Management of market/public perceptions - As "actors" in a marketplace (business, political, other) learn to analyze and control social media perceptions, trends, and impacts, tools are evolving for organizations to actively protect, and repair, their on-line image. ? Gardiner example?)

Email
The easiest application to address is email, as it inherently contains critical basic information to construct not only "static" [social graphs, social sets], but "dynamic" as well given the dating information and routine threading linkages such as "RE:", "FW:" etc. My guess is that excellent toolsets/ systems exist for building and interpreting [social graphs, sets].

Web-page analysis
Very interesting tools for network analysis have been used for decades to analyse the World Wide Web:
- Wildlife census tools –
- Hub and expert analysis (IBM) –
- *[27Dec11 Howell - I don't have time to list even a small subset, and to describe …]*

[27Dec2011 Howell – out of time…]

Workplace systems implementing "Dynamic" [social graphs, social sets]

Outside of the application of Artificial Neural Networks (ANNs), which is a fairly "exotic" field from the perspective of the workplace, I don't know of any examples of systems that pro-actively exploit dynamic [social graphs, social sets]. Here, "dynamic" I mean that both the information processed and the social media architecture can be time-varying, or that we focus on capitalizing on the temporal changes of both the information and [social graphs, social sets]. Remember that when we are using dynamics:
- timing of information and its flows are critical
- while static structures [graphs, sets, hierarchies] can represent relationships and functionality, nonlinear dynamic structures can additionally represent:
    - temporal sequencing (including logic itself)
    - synchrony (causal or otherwise)
    - *[27Dec2011 Howell - elaborate later…]*

Key potential advantages of dynamic [social graphs, social sets] are to [identify, model-predict, control, optimize, evolve] systems that must deal with and environment that itself is highly dynamic. In other words, dynamic [social graphs, social sets] have the potential to deal with

real systems of any complexity (i.e. essentially ALL real systems that are challenging), which we now represent by static simplifications that are rigid and somewhat ineffective.

So how does one handle sub-systems of this nature within the “normal” workplace IT environment? I don’t know, and can only suggest that provision be made for accommodating “controlled, yet open” access to [social graphs, social sets] in a dynamic, robust manner so that end users, suppliers, etc can build on it. The other (more normal) approach is to wait until suppliers come along with a platform that fits what is needed for the future. I know that’s way too general to be of much help, but there’s no sense in waving my arms about too much at this point.

One thing for sure, we can expect all sorts of surprising challenges related to [stability, privacy, security, credibility] related to [self-directed, self-optimizing] dynamic [social graphs, social sets]!!

endsection

Part VI - Far beyond current toolsets (for STAR GAZERS)

As indicated by the title, Part VI targets [STAR-GAZERS], but it may also be of passing interest to [CONCEPTUALISTS]. I doubt that this Part will be of interest to readers who are [USERS, TOOL-BUILDERS, SYSTEM-BUILDERS], and I therefore recommend that they pass on this Part unless they have time to kill.

REPEATED PHRASE: Many of the themes listed for semantics in "Semantics beyond search" also apply to social graphs and sets – in a sense, the semantic themes are simple metaphors (usually subsets) for the concepts in the connectionist/ computational intelligence context. In the points below, the material from "Semantics beyond search" are retained in blue italics font, and differences from a social graph/sets perspective are provided in normal black font. As you can easily see, much of the content applies to both areas, that is "Semantics" and "Social graphs and sets".

Even more than previous Parts of this paper, I strongly recommend the reader to AVOID this chapter unless they really are interested in "impractical conjectures" which may not be of any use any time soon to the [development, introduction, integration] of social media capabilities into the workplace.

Unlike previous Parts of this paper, this Part gets into concepts that do not, in my opinion, have a "substantial" working theoretical basis, and toolsets that can readily be adapted for applications. Furthermore, topics like "machine consciousness" have often given me the impression that the rhetoric and arm-waving vastly surpassed any firm conceptual foundation, making it difficult for me to warm to the subject.

However, having been dragged into [attentiveness, cognition, psychology, consciousness] over a couple of decades by friends, I have at least been able to appreciate SOME of the work that has been done, and why it will likely be critical for future "machine systems". Many researchers don't have the luxury of simply "dismissing" whole conceptual areas on the basis that they are not sufficiently advanced to be "comfortable" – they are faced with the challenges of building systems that clearly would benefit if those concept areas could be advanced. Additionally, one might say that these are "true" areas of research, where even the starting foundations need great inspirational ideas. One has to start somewhere, and it is a valuable exercise to see how far research can get with the newer toolsets at hand.

Given that a major objective of this whole paper is to encourage and help developers to "keep their minds, tools, and systems open" to future [conceptual, toolset, applications, systems] evolution, this Part may be seen as having gone "too far", as it may be pointless to make pragmatic allowance now for systems whose availability and timing are unknown, but certainly several generations of social media systems away. In that sense, this is a strictly "for fun only" portion of the report.

Quick roadmap for Part VI

The following classifications will help to clarify the context of ideas in this Part, and what we are trying to achieve. I've borrowed the terminology from the successive waves of "Intelligence" in machines. Keep in mind that with each advance as shown below, scientists and mathematicians thought that we had solved the problem of Intelligence, and that in a very short time robots would be feeding us breakfast in bed. Like intellectual maggots eating our way through layers of an onion, each breakthrough to the next layer reveals much larger and more complex challenges, and that we were further from out original goal than we seemed to be at the start!! That will certainly apply as a principle if breakthroughs occur as anticipated below.

- [Rational, logical, scientific] thinking - has already been described, along with its limitations,
- Semantics - brings you to what I would call a "lower-level" or "simple" Cognition, or more specifically, a "description" of Cognition.
- Artificial Intelligence (AI) - classical AI (à la godfather Marvin Minsky of MIT, and up to at least the 1990's end of the Fifth Generation Computing initiative of Japan)
- Computational Intelligence (CI) (as discussed in Part II and IV, and in particular, connectionist systems) addresses higher-order [adapting, optimizing, competing] systems
- Sentient Intelligence (SI) - This is (for my usage!) a stolen term, in which I include:
    - [conscious, self-aware, self-defining, goal-setting] systems;
    - [attitudes, behaviours, personalities]; and
    - [morals, cultures, religions] – to guide the previous concepts.

  I don't think that "Sentient" is the right term, nor that the short description of it that I have provided in the previous sentence is complete or consistent, nor that the ["conscious", "attitudinal", "moralistic"] attribute groups should be grouped together under the single title of "Sentient". However, this is a start.

All of these concepts can be considered either as "machine systems" or "human-machine hybrids. One might anticipate that capabilities will evolve from "human only", to "hybrid human-machine", to "machine only", depending on scientific-technical capabilities and advantages in relation to their costs of [development, implementation, operation, maintenance].

Part III and IV addressed non-conventional, and yet fairly well established and proven, concepts and toolsets, mostly from the Computational Intelligence (CI) perspective. The intent in this Part is to pick up from there and address the potential for much higher-order levels of function, and I suggest that we should NOT use the term CI for this area. All academic areas like to "capture" emergent higher-order concepts as simply extensions of their domain, but that is usually incorrect, and is likely to have a negative (at the least confining) impact on the growth of new or different concepts. It is better to clear mark major transitions in concepts and toolsets by using a different term or phrase – and here I am arbitrarily borrowing the phrase "Sentient Intelligence" to make that distinction.

To set the stage for the ultimate themes of this Part, let's roll through concepts which have evolved in stages towards the ultimate themes.

[Rational, logical, scientific] thinking

I start with an explanation of why [rational, logical, scientific] and classical AI thinking is completely inadequate for these higher levels, in spite of having become a mantra of scientists. I then discuss going beyond CI, using concepts that are currently within CI, but I think should be considered separately

Artificial Intelligence (AI) perspective

According to the simplistic classification of "Intelligences" at the start of this Part, [rational, logical, scientific] thinking corresponds roughly to the classical Artificial Intelligence (AI) area. Even though it is common now to use the AI phrase to include both AI and CI, I find that there is still value in maintaining that split, which is very descriptive, and which is an important distinction to be aware of.

The [rational, logical, scientific] basis of thinking was described in "Part II – Foundation Concepts: Basic concepts", where it is shown that it is actually a very constrained and limited form of thinking that is dependable ONLY where a very strict set of pre-conditions are satisfied. That is RARELY the case even with "moderately complex dead systems", and should never be assumed to apply for living systems, let alone human systems which are an entirely different matter! It is very strange how poorly this is understood, especially by scientists.

Artificial Neural Networks (ANNs) and Computational Intelligence (CI) perspectives

Approximate dynamic programming and systems self-optimization *-*
This whole area seems to be much better suited to connectionist approaches than symbolics, but as with the example of Confabulation Theory, perhaps hybrid approaches will have particular advantages, and there is no reason to expect that symbolic-only approaches won't have niches (large niches perhaps, because they tend to fit the "way we like to think that we think" – fuzzy systems (versus neural networks) are like that).

Cheating theory and game theory *– Normal symbolic logic is for "dead systems in stationary environments", and therefore is a poor fit for living systems or human systems, which by nature tend to be non-stationary (unpredictable) and competitive. This is partially explained in "Appendix F – Dead Math, Random Math, Live Math, and Social Math". However, we are familiar with the application of expert systems and their descendants to games like chess. The use of semantics for understanding or composing human-language questions and responses is a first step, but what about the role of semantic tools for the formulation and evolution of strategy and tactics in more open environments? Is there more to this?*

A major example of this type of system might be the "strategy games", made popular by Sim City, but also used seriously as training and practice tools by the military. How do/can advanced semantics play a role with these systems?

Market, Social theory drive & development - It's not hard to imagine that automated and semi-automated social media toolsets may become a major, serious driver of the development of superior theories for human interactions, and [philosophies, approaches, styles, systems] that enhance these interactions in different ways according to different objectives and criteria.

Memory molecules [Widrow 14Jun2009]

No time to develop this very interesting topic and to refer to Widrow's paper…
See Howell's comments in Appendix D

Machine and Hybrid Consciousness

Machine consciousness - *While this subject seems completely wild, there have been very interesting, if somewhat limited, results in this area [Taylor 2006], and the need for this capability becomes MUCH clearer with some of the advanced capabilities mentioned in this paper.*

He reader will know that it's crazy to just focus on one theory of consciousness, given the huge diversity of work on the subject. But that is what I have done in this section, preferring to give one "coherent" point of view, and one that I prefer, possibly because of biases due to my engineering background. John Taylor's work combines concepts from neural networks, advanced control theory, and psychology to build quantitative model to advance our understanding of what consciousness is, how it might be implemented in machines, and what the impacts could be. Taylor was one of the three founding Editors-In-Chief of the top-ranking "Neural Networks" journal from ?~1998 to ~2008?. He has also been a key leader and driver in the field of neural networks research, and in the building and running of the International Neural Network Society (INNS). I tried to buy his personal copy of his book referenced below at the 2006 World Congress of Computational Intelligence in Vancouver, but that didn't work, and I had to wait for an order through Amazon.

As an interesting aside, Taylor's control theory developments were strongly influenced by Paul Werbos' concepts, who also first derived the mathematics of "ordered derivatives", now called "backpropagation" as a dominant means of training neural networks. "Ordered derivatives" were central to Werbos' PhD thesis circa 1974 on "linguistic assimilation" (including Quebec, for which his model indicated NO chance of linguistic assimilation). Werbos himself credits Sigmund Freud's theories of psychology for some of his key inspirations.

Persistent Individual [cognition, conscience] *– How often could we use the knowledge and expertise we once had in school, university, or a previous job, but the details and even some of the main principles are fuzzy or gone? Can we provide "mental memory/cognition crutches" that help overcome this, perhaps leveraging somewhat off our previous knowledge to fill in gaps quickly? Or can tools built to assist "naïve users" be built, and serve both needs?*

Pass-along of Individual [cognition, conscience] -

Organisational cognition and conscience *- With the more advanced tools, there is a whole range of cognition to consider:*

- *collectivity of individual experts – this is what we have now, including general knowledge, expertise, polices, guidelines, business processes etc.*
- *Organisational cognition (not individual) – this may become the "real Organisational cognition", as a separate entity to thee "collectivity of individual experts"*
- *Hybrid individual/organisational cognition (REQUIRES Organisational cognition to start, except in the trivial sense, or for very "local" events/issues/themes*

This puts a whole different meaning behind "organisational knowledge and culture"!

[Cognition, behaviour, personality] modeling

Autonomous mental development?

Behaviours

Personalities

Team specialization

Codes of Conduct

Religion, ?what else?

Confabulation Theory

Cheating theory, game theory

Clarion [Ron Sun 20??]

Evolution – searches, exploits opportunities, confounds threats
Connectionist – breaks free of the "frames problem", entrapment in "false frameworks of logic"
Cheating theory, game theory – principles discovered by evolution

1. Emergent ["rules", cross-organisational teams, structures, roles, flow-of-motivation and profit, …]

2. Non-genetic DNA as a basis for higher order capabilities

3. Functional [networks, hierarchies, graphs, sets]
   Long time NN "style" - > relatively general, unstructured
   However, functional probably more powerful – best mix of general and specific in a big blender, eg Jun Wang WCCI08 Hong Kong chair

4. Tie-ins with semantics and communication, inspiration

5. Policy – now [political, top-down, captive], future = ???

6. Consciousness
   Individual machine
   Community & hybrid consciousness

Sentient [Systems, Environments, Markets]

Agent-based systems

Lamarckian heredity, the brain + behaviour switching/ modification [Meaney, M. Szyf, 2005] [Mattick 2003]

"… The objective of our group is to destroy the central dogma of all biology – genetics. …" [Mattick 2003]

BILL HOWELL's IJCNN2006 paper – see the Appendix!

Are computational models of any use to psychiatry?

Getting back to the introductory paragraphs of this Part where the utility or capability of [ANNs, CI] are called into question, I thought it useful to include comments by experts from the area. I took the title of this section from the first article cited, thinking it was a great question to pose. I will refrain from adding my own reactions to the results of others – feeling that the reader is best left to form their own conclusions and impressions without my bias and interference!

"Are computational models of any use to psychiatry?"
Quentin J.M. Huys, Michael Moutoussis, Jonathan Williams, August 2011 "Are computational models of any use to psychiatry?" in Editors Vassilis Cutsuridis, Kenji Doya, Wlodek Duch, Tjitske Heida "2011 Special Issue: Neurocomputational models of brain disorders", Neural Networks, v24, issue 6, p544-551, ISSN 0893-6080 www.sciendirect.com

"… Abstract: Mathematically rigorous descriptions of key hypothesis and theories are becoming more common in neuroscience and are beginning to be applied to psychiatry. In this article two fictional characters, Dr. Strong and Mr. Micawber, debate the use of such computational models (CMs) in psychiatry. We present four fundamental challenges to the use of CMs in psychiatry: (a) the applicability of mathematical approaches to core concepts in psychiatry such as subjective experiences, conflict, and suffering; (b) whether psychiatry is mature enough to allow informative modeling; (c) whether theoretical techniques are powerful enough to approach psychiatric problems; and (d) the issue of communicating clinical concepts to theoreticians and visa versa. We argue that CMs have yet to influence psychiatric practice, but that they help psychiatric research in two fundamental ways: (a) to build better theories integrating psychiatry with neuroscience; and (b) to enforce explicit, global, and efficient testing of hypothesis through more powerful analytical methods. CMs allow the complexity of a hypothesis to be rigorously weighed against the complexity of the data. The paper concludes with a discussion of the path ahead. It points to stumbling blocks, like the poor communication between theoretical and medical communities. But it also identifies areas in which the contributions of CMs will likely be pivotal, like an understanding of social influences in psychiatry, and of the co-morbidity structure of psychiatric diseases. …"

Other comments:

[30Dec2011 Howell – I've run out of time and cannot add to this…]

OK, I lied in the introduction to this section

I will add some of my own thoughts here, but as general reactions, and not necessarily specific to any of the external comments provided above.

Small-world universal function approximators

endsection

References

[05Sep2011 Howell – incomplete, missing some information for ~5 or so references. Missing papers for data mining, of which I reviewed several some years ago. The listings below are dominated by Connectionist themes, which are not the central theme of the paper.]

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[2] Dictionary.com 11Aug11 "Semantics" http://dictionary.reference.com/browse/semantics

[3] Facebook developers reference site ("… the heart of Facebook …") ?hyperlink

[4] David .B. Fogel, (editor) Evolutionary computation: The fossil record: Selected readings on the history of evolutionary algorithms. Piscatoway, NJ: IEEE Press, 1998 Excellent primer on evolutionary computation

[5] David B. Fogel, Blondie 24: Playing at the edge of AI. San Diego, USA: Academic Press, 2002. p301 for comments on learning and evolution Awesome lesson on concepts much closer to profound machine learning than classical AI/ expert systems type of approach

[6] Walter J Freeman 14Jun2009 "Cortical Mechanisms of Memory Formation and Readout" Proceedings of International Joint Conference on Neural Networks, Atlanta, Georgia, USA, June 14-19, 2009 p882-889 Extremely interesting (and important) discussion of perception, black noise and memory. A separate paper in a post-conference workshop covered synchrony issue.

[7] Donald Hebb of McGill ~1940's or 50's? - Hebbian learning (couldn't find refrence quickly…)

[8] Robert Hecht-Nielson 2007 "Confabulation Theory: The mechanism of thought" ISBN 978-3-540-49603-8 Springer-Verlag Berlin Heidelberg 245pp, accompanied by computer DVD for learning

[9] William Neil Howell "Genetic specification of recurrent neural networks: Initial thoughts", Proceedings of WCCI 2006, World Congress on Computational Intelligence, Vancouver, paper#2074, IEEE Press, pp 9370-9379, 16-21 July 2006

[10] Bill Howell 2006 "Genetic specification of recurrent neural networks" http://www.billhowell.ca/Neural%20nets/Howell%202006%20-%20Genetic%20specification%20of%20neural%20networks,%20draft%20concepts%20and%20implications.pdf - Draft concepts and implications of CNGM are discussed in this early version of the paper that is in the proceedings of the IJCNN 2006 Vancouver conference. Note that this is a very rough, intermediate draft that I probably won't get around to cleaning up. However, this does wander into IMPLICATIONS, from the perspective both of the mind/brain, and of sort of a "philosophical" perspective on the analysis of complex systems. Not that it's terribly well described here.

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[13] Edgar Koerner 14Jun2009 "Brain-like Intelligence Inside - Towards Autonomously Interacting Systems" IEEE Proceedings of IJCNN 2009, International Joint Conference on Neural Networks. Atlanta, paper#0700, Plenary talk

[14] Marshall McLuhan 1962 "The Gutenberg Galaxy: The Making of Typographic Man" University of Toronto Press. Actually, many of MacLuhan's concepts that are most relevant to Social Media are in other papers and books. I need to go back to those sources for the next version of this paper

[15] Gary Marcus 2008 "Kluge: The haphazard construction of the human mind" Houghton Mifflin Co., Boston, New York21pp

[16] Gary. Marcus, The birth of the mind: how a tiny number of genes creates the complexities of human thought, New York: Basic Books, 2004. This book (along with Pinker's "Blank slate") is an essential read, and its concepts and Marcus' current work are a basis for the current paper.

[17] Iain Marlow 14Jul11 "Boosting the performance of performance reviews" Interview of Mr. Debow at the company Rypple, about Loops software, Globe & Mail (as pointed out by Ken Hunt 15Jul11) http://www.theglobeandmail.com/report-on-business/managing/on-the-job/boosting-the-performance-of-performance-reviews/article2097832/page2/

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[27]John Taylor 2006 "The Mind: A users manual" John Wiley & Sons, Chechester, West Sussex 286pp My favourite model of consciousness - much like engineering control or game theory
[28]Jean-Philippe Thivierge 05Dec2008 "Synchronization in the Brain: Deciphering the Development, Damage, and Recovery of Neural Interactions" This seems to be similar to a presentation Thivierge gave at NRC in Ottawa in ~2008-2009 period that I attended (he's now at NRCC, Ottawa)
[29]I.C.G Weaver, N. Cervoni, F.A. Champagne, A.C. D'Alessio, S. Sharma, J.R. Seckl, S. Dymov, M. Szyf, M.J. Meaney, "Epigenetic programming by maternal behavior". Nature Neuroscience vol 7, no8, Aug. 2004, pp847-854 great paper, in ~Feb2009 a Globe and Mail article mentioned he was getting private funding for seeing if childre from disturbed / abusive families might be helped in this way, What about psychological trauma of soldiers?
[30]Paul .J. Werbos, "Neurocontrol and supervised learning: an overview and evaluation", and "Approximate dynamic programming for real-time control and neural modelling". in D.A. White, D.A. Sofge (editors), Handbook of intelligent control. New York: Van Nostrand Reinhold, 1992. This is a classic that introduces the framework for later work on ADP, Much more mordern reviews were done by Danil Prokorov, Don Wusch, and others
[31]Bernard Widrow 14Jun2009 "Cognitive Memory: Human and Machine" Proceedings of International Joint Conference on Neural Networks, Atlanta, Georgia, USA, June 14-19, 2009, p3365-3372 Bernie's plenary re-iterated "memory molecules" as REQUIRED for long-term memory, Most hated it, but a mid-career great neuroscientists who does the wet work, said that Widrow is correct in stating that long-term memory CANNOT be sustained via synaptic modification, which is the current "scientific religion"
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Endsection

Appendices

The first (very incomplete!) Appendix A describes issue related to the preparation and intent of the paper. This is probably more interesting to me (for comparison at some time in the future) than for the reader.

Examples of capabilities related to this paper's discussions on [Social graph, social sets], are provided in the subsequent Appendices. Much of the material is simply selected and quoted from the original publications (as indicated by green font), which is not the "normal thing to do", but:

- it was the only option given the time remaining on this very incomplete report
- a key point is the selection of relevant, and at the same time somewhat entertaining and stimulating, material
- there is a huge advantage to seeing a concept through the original wording of the author that has done the work
- Most readers won't have the ANN & CI background, and don't have the time to chase down references. It is better to provide quoted background (which is easier to do with today's high-quality scanning/ Optical Character Recognition), than to leave readers totally in the dark.

endpage

Appendix A - [Objectives, Approach, Status, Missing Pieces] of this paper

[29Dec2011 Howell - there is no time left to elaborate on this beyond what you see…]

This report took 36.4 hours of my time, from 06Oct-30Dec2011. Most of that time (29.0 hours) occurred during 15-30Dec2011.

What's missing?

- The paper assumes an advanced level of understanding of Artificial Neural Networks (ANNs) and Computational Intelligence (CI). Very few readers will have that, and I expect that most of the report will be mumbo-jumbo to them.
- The easiest part of the paper, and that which will be of interest to the greatest portion of potential readers, who will be USERS of social media, is the Introduction and Part II
- Relatively little has been done to tie the concepts listed in the paper to [social graphs, social sets] of social media.
- Lists of concepts aren't explained - Appendices B, C, and D illustrate "starting points" only for explanations of just a few concepts. The explanations are cursory (even at 2-3 pages!), so obviously, doing much more complete explanations for ten times as many concepts would require a great deal of time and pages.
- Current thinking by others in the area of ANNs and CI has NOT been sought, other than a cursory set of requests to contacts. It was far more important for me to get some initial thinking down, THEN possibly compare to others when the time arose, IF the opportunity arose.
- Many potential readers will be USERS – unfortunately, I didn't have priority time to clean up and explain the lists of potential Workplace Applications in Part II.
- A great deal of other pieces of the report are missing, but that's the end of the project!

Objectives of this report

The main objective was to provide an "alternate and potentially very powerful" perspective of the potential capabilities and impacts of [social graphs, social sets] as they relate to social media, emphasizing Artificial Neural Networks (ANNs) and Computational Intelligence (CI). This was approached from the basis of my own personal awareness.

This paper does NOT include a survey of direct applications or conceptualization by other authors in the areas of ANNs and CI, as that would be a subsequent step for me. That next step will not occur, as this work is being terminated at its current incomplete status, according to time commitments for the project.

Readers should avoid using this report as a confining framework, or as an authoritative and comprehensive source. On the other hand, try to avoid "jump-to-conclusion-itis", rejecting or

ignoring themes that are neither familiar nor comfortable (I always have trouble controlling my reflexes with this!). Nothing is settled, and the real world is very, very different from the way we perceive it, in spite of advances (at times mis-advances and retreats) of the knowledge base of homo sapiens.

Intended and Anticipated Reactions from the readers

My expectation is that this paper will have a rather rare "community of interest", being a highly specialized perspective for a conceptual development community centered around the [component, function, process, architectural] foundations for social media environments. These foundations will be [hidden, "under the hood"] even to much of the social media development community.

It is virtually impossible that another individual, even from the same [neural network, computational intelligence] background, would have the same basic approach, select the same basic concepts, or present the same "non-existent applications" as I have. In short, there is no expectation that the reader's [interests, priorities, opinions] match this document.

Intended reactions

The first and easiest reaction that I am hoping for, would be [comments, corrections, from diverse sources on the list of "Social [graphs, sets, media] applications to the workplace".

-

[30Dec2011 Howell - no time to continue …]

Anticipated reactions

Insomnia and headaches are at the top of the list of expected reactions to this document. Fair enough, I'm no Shakespeare.

More seriously, for a variety of great reasons the comprehensive reading of this material, and its reception is likely to be close to null for most of the social media developers and community:

- Disinterest – but for specific reasons
- Violates the mindsets of specialists in [network administration, database-MIS-Enterprise systems, Web 3.0 etc, ,
- Concepts as presented aren't practical with tools at hand. Of course, this is the whole point of this paper!

  "… Without [understanding fundamental requirements, developing basic toolsets, providing frameworks of how to integrate], social media applications and systems, as part of the larger information systems environment, are likely to far too highly constrained to reach anywhere close to their potential. …"

However, having said that,

Amateurs aren't fettered by the same intellectual programming, practical constraints, and "social intellectual" self-image that usually prevent professionals from seeing their own area of expertise in more broad and powerful ways. After all, it's easy for a science fiction author to write another, quite another to actually build the systems that bring the dreams to reality in a manner that is [effective, survivable/ robust, economical, competitive].

Approach used for this paper

Status of the concepts discussed in this paper

How real are the concepts discussed in this paper? It is perhaps best to answer that the concepts for each Part are at various stages of development and implementation. All concepts are related to active areas of research, and in some cases the concepts are applied to very real projects in related domains (not necessarily social media!). But in general the reader should not take the material presented as a reliable guide to what [concepts, toolsets, systems] will be successfully used in practical systems.

How complete are the concepts discussed? Easy answer – not at all. This paper should be looked at as a random, arbitrary, incomplete and biased selection of concepts. The concepts are my own distillation/bias based largely on exposure to the [Artificial Neural Network (ANN), Computational Intelligence (CI)] areas since 1988.

Related Reports by the same author

Note that NONE of the reports is complete, some having progressed to only 1/5th completion. In the time available for the SPINE project, I considered it far more important to get a "conceptual outline" down, than to go to completion with the concepts and explanations, and to do a full, quality write-up.

Reports for the SPINE project:

Howell 2011 – Systems design issues for social media.doc (18pp)
Howell 2011 - How to set up & use data mining with Social media.doc (15pp)

Howell 2011 – Semantics beyond search.doc (30pp)
Howell 2011 – Social graphs, social sets, and social media.doc (46pp as of 12:00 27Dec2011)

Personal (hobby) reports

Howell 2006 - Genetic specification of recurrent neural networks (18pp 100)
from 2008, updated in 2011 for SPINE:
Howell 2011 - Confabulation Theory, Plausible next sentence survey.doc (31pp)

endsection

Appendix B – John Taylor's prescriptions for machine consciousness

John Taylor 2006 "The Mind: A users manual" John Wiley & Sons, Chechester, West Sussex 286pp

While it's unusual to make extensive quotes, and I have not provided sufficient explanations of concepts in the quotes below, I feel that the quotes are general enough to be useful to readers, and to perhaps whet their appetite to look further into the subject area. (Actually, many of the related publications are highly mathematical, with strong dosages of results from philosophers and cognitive psychology).

Several of my "summary sentences" in Part VI refer to this Appendix B. Following are quotes from John Taylor's excellent book, which is my favourite model of consciousness. It is much like engineering control plus game theory.

Attention motor control model for attention (page 108)

Here is a diagram of Taylor's model for consciousness:

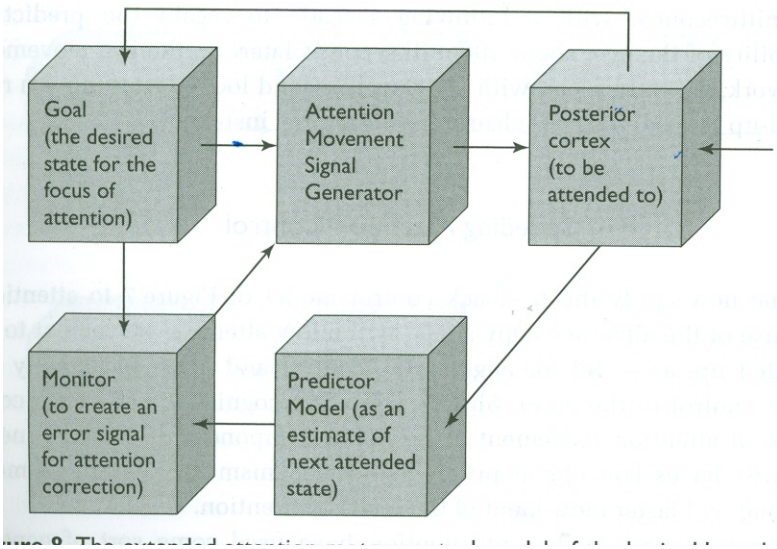

Figure 8 The extended attention motor control model of the brain. Here there is identity of the modules of Figure 7 to those in Figure 8, but now they are relabelled to be related to the various functional components of attention movement, as well as being able to be sited in various brain sites.

This later developed into CODAM and other concepts. I have not provided the overall description of how this concept works, but quotations below address a couple of Taylor's key concepts regarding consciousness that I wanted to emphasize.

Figure 9 (page 109) is another perspective, useful for a more functional understanding of Figure 8 of Taylor's book (shown immediately above).

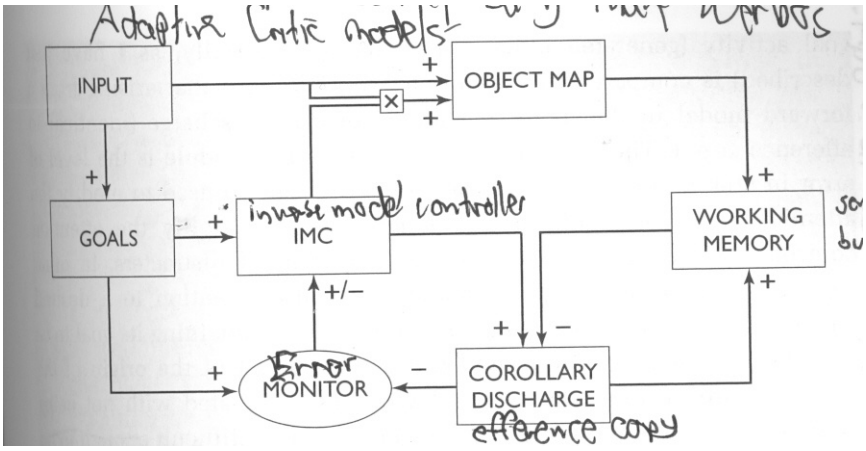

Figure 9 The more detailed feedback control model for attention. IMC = attention movement signal generator (where IMC denotes 'inverse model controller', the technical term in engineering control theory for the movement signal generator module); the + or - signs indicate excitation or inhibition exerted by the connection to the given module to which the arrow points; remember that the term 'collorary discharge' (with its own buffer module in the figure) is to be identified with 'efference copy' (which means the same as corollary discharge). The corollary discharge site (its buffer to hold activity for later use) is shown to be connected in an excitatory fashion to the sensory buffer (working memory) site, although inhibitory connections to other components are also needed to prevent distracters from emerging into reportability. Once the threshold of reportability has been reached, an inhibitory signal is sent out from the working memory site to cancel related activity on the IMC and the corollary discharge buffer, so they can start to process new inputs to reportability. The error monitor sends an error signal to the IMC to boost attention, so corresponding to attention being a scarce resource, not able to be shared easily among different tasks if errors are occurring in a given attention task (say, due to distracters, as in.the attentional blink). There is now evidence arising (especially from recent data on the attentional blink) of the existence of both the various sites in Figure 9 as well as their proposed connection's.

The ownership principle (p125)

"... The ownership of conscious experience is created by the attention copy signal being held on its own buffer site for use in speeding up the attention copy signal being held on its own buffer site for use in speeding up attention and to make it more robust against a variety of errors. ..."

"… **Ownership and Agency: Components of the Self** (p125-126)

To explore ownership further, the self has a variety of components, involving subjective as well as objective character. Here we are concerned with subjective aspects of self going under the descriptions of ownership and agency, as recently discussed by the American philosopher Sean Gallagher. He notes that it is important to distinguish between these two concepts. I can consider that I am the agent of a movement of my arm as I move it. On the other hand, if my arm is moved passively by someone else, I can realise that is so, but still know that it is my arm that is being moved. Thus, agency and ownership are distinct.

This distinction is especially revealed by the possibility of error, a feature I have mentioned earlier, but will repeat since it is crucial to my discussion. It goes like this: I cannot be in error when I claim that my

arm moved. Similarly I cannot be in error that it is I who feels pain. It is not sensible to ask 'Are you sure it is you who feels pain?'. This important feature of conscious experience is what has been termed 'immunity to error through misidentification with respect to the first person pronoun', originally by the American philosopher Sidney Shoemaker in 1968. Such an error, shown through careful experiments, can occur over the attribution of agency. This was done by tests on subjects viewing their gloved hand moving. An experimenter's hand can replace (by suitable image tricks) the subject's own hand without them realising, provided the movements made by the experimenter are not too different from those of the subject. On the other hand it is difficult to conceive of attributing to someone else the inner conscious experience involved with ownership.

It is a reasonable thesis that the most primitive form of self-knowledge is that o~ the ownership of the movement of attention. This can arise in any animal with the most simple attention control system. It is not even necessary to possess a frontal goal module (possibly due to lack of frontal cortex), since attention could still be moved by sudden external stimuli. As noted earlier, such low-level attention movement control occurs for rapid inputs even in humans: these stimuli gain nearly automatic access to the attention movement controller, as known by many studies of attention shifting. Such externally caused movement can also occur without the need for peripheral feedback. It is therefore much more rapid than the internally created variety. This mechanism of ownership, proposed here as arising from the copy of the attention movement signal, helps explain the continued consciousness of subjects who have lost all sense of proprioceptive feedback (that for the positions of the limbs from specialised nerve cells in the muscles) by de-afferentation of the relevant sensory input nerves. Such people should have suffered severe deficits in their sense of self if, for example, there was a solely bodily basis for that; they did not. Thus the case of a person who suffered a viral attack that destroyed his proprioceptive system was investigated, by the British doctor Jonathan Cole and his French colleague; they reported that the subject, on coming round from the viral infection, found himself as if 'floating' in his hospital bed. Yet they never said he felt any reduction in his 'I'. The 'I' is apparently above all that bodily thing; it needs to be to create a more soul-like aspect to the inner self.

The claim I am now making is that the buffered attention copy signal produces a conscious experience of ownership, breathing the light of inner experience into temporally extended neural activity. It is that which creates the sense of '1' that is not destroyed by de-afferentation. Any robot thereby equipped would no longer be a zombie: it would have an inner feel of the ownership of the amplified input brought about by the short-lived attention copy signal on its own buffer. The claim is based on the related one, which I earlier called the 'contents of consciousness principle', that the content of consciousness arises from temporally extended activity on a suitably well-connected sensory buffer site. I posited earlier that this created the experience of the content of consciousness in the buffer site of Figure 8 in the earlier contents principle. For the coupled monitor/buffer sites of Figure 8, I now propose that the new item of information arising in the process of moving your attention to a new stimulus is a copy of the signal causing your own movement of attention. It is this item that I claim is the spark of 'how it is like for you to be conscious'.

Thus the crucial feature of the information flow in the architecture of Figure 8 is that the sense of ownership is created by the buffered attention copy signal, it being held for a suitable length of time before being annihilated by the amplified signal representing the attended object arriving at its buffer. I claim that this process grants immunity to error through misidentification of 'I', unless there has been an almost total breakdown of the attention control system. This can be seen for the undamaged system: the sense of ownership engendered by the attention copy signal on its buffer can only be cancelled by the appropriate afferent input amplified by the original attention movement signal itself turning off the 'ownership' attention copy buffer signal.

In other words, the attention copy signal on its own buffer stands like a sentry at the gateway to the sensory buffer, giving initial support only to those trying to enter the gate that are exactly like the goal stimulus activity. But once the amplified posterior cortical stimulus has achieved reportable access to its sensory buffer - 1t has broken through to awareness - the sentry has its orders changed (by destruction of the sentry's buffered activity by the correct sensory buffer activity). It is now ready to receive a new order (a new attention copy signal from the attention movement generator]. But the brief period of holding the previous attention copy on its buffer produced, it was claimed by the 'ownership principle', the experience of ownership in the subject of the about-to-be-experienced content of consciousness, arriving, with its associated and concomitant activities in relevant posterior cortical sites.

Putting it in a different metaphor, the pre-echo of the attention movement signal is its copy. Holding that for a suitable time on a buffer site will lead to a feeling of presence - that of the attention movement signal itself. This pre-echo feeling will engender an experience of 'presence' in relation to the about-to-arrive attended object activity: the experience will therefore be one of ownership of that object activity. …"

Crucial requirements for intelligence (p261)

"... Thus, I propose that we could only build a conscious machine provided it was based on some sort of attention copy-type model of attention control.

There must therefore be several ingredients to a conscious machine:
1. A perceptual system able to have percepts of object stimuli coded in some manner.
2. A suitably powerful attention control system, able to filter out all distracting stimuli so as to activate a representation of the target stimulus.
3. A mechanism to cause the movement of an attention amplification signal from a previous stimulus code to the desired one.
4. A further mechanism to use a copy of the attention movement control signal to speed up the movement of attention to the desired stimulus. ..."

"... These are somewhat technical requirements. But yet I claim them to be crucial to be satisfied in order to be satisfied in order to have consciousness present in the system. And none of them necessarily crucially involves self-monitoring. So there is a considerable discrepancy between this neuroscience-based approach to building a conscious machine and that of the engineer. Yet there is a monitor in the attention copy model of Part II, so that error correction is certainly present there. However, consciousness is not to be achieved by looking into oneself - by the inward eye, so to speak. It is important to be able to monitor one's actions and thoughts. But it is not inclusion of that faculty which would be sufficient in a machine to allow it to experience consciousness. Instead consciousness is to be created by attention using a copy of one's attention movement signal to help speed up and make error-free the brain activity codes of stimuli being attended to. That is the attention copy approach to the mind that described in some detail in Part II. It came with a lot of neuroscience support. With that as a blueprint, I claim we could seriously start building a conscious machine. ..."

Current machines fall far short of human intelligence (p263)

"... There are presently no so-called intelligent machines that can think, plan, imagine, reason, or be creative along the lines I am suggesting. Thinking involves consciousness: that is still not in any machine. Planning can be done at a low level by a variety of machines, but the plans are still of a low

level. Moreover, there still is no machine that can plan adaptively - use in its plans things that it has just learnt. No machine can imagine - again that needs consciousness (for there to be an 'imaginer' who is having the experience of the images). Reasoning machines exist at the simplest level, but again have little flexibility. All in all, the present intelligent machines possess little of what we normally call intelligence. They are marvels of machine learning, machine pattern recognition, and various other machine powers. But they are light years away from any intelligence of a human order. ..."

endsection

Appendix C - David Fogel's "Blondie 24"

David B. Fogel, Blondie 24: Playing at the edge of AI. San Diego, USA: Academic Press, 2002. p301 for comments on learning and evolution

David Fogel's book is a great introduction to Artificial Intelligence (AI) and Computational Intelligence (CI) for those familiar with neither. Most AI type papers, even from fairly recent times, won't show an awareness of hugely important fundamental issues raised by Fogel and his colleagues. The book provides awesome lesson on concepts much closer to profound machine learning than classical AI/ expert systems type of approach. But in any case, the book is a fun, informative, and surprising read.

Predatory Machines? (pages 200-205)

"… The second game I'll illustrate here involved an opponent rated 1,771, in the upper ranks of Class B. The complete set of moves is listed in the notes. Our opponent played white; the neural network played red. As we neared the end of the game, I was certain that there had to be a bug in our neural network. It seemed to be making a series of sloppy, if not stupid, moves. In the end, it had the last laugh on me. Skipping ahead to move twenty-nine, the neural network was up by two checkers. h had a king and five checkers, while its opponent had a king and only three checkers. Figure 40(a) shows the board after the neural network's twenty-ninth move: 22-26. Our human opponent then played 2-6, moving his king to threaten our checker on 10.

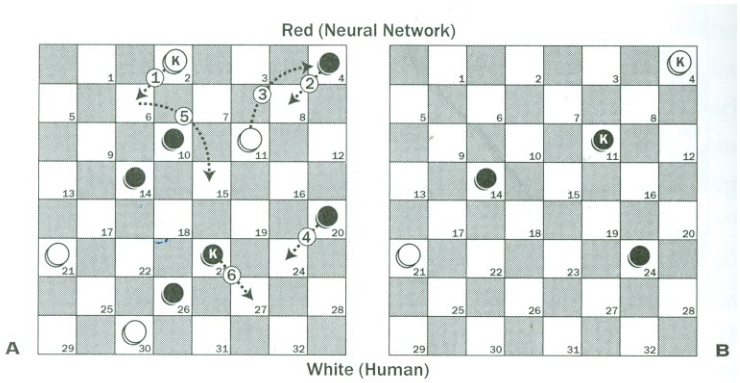

FIGURE 40
A The position before the human opponent, playing white and rated I ,77I, moved 2-6. The opponent's king on 6 then threatened the neural network's checker on [0. Rather than flee, the neural network moved 4-8, sacrificing a checker and setting up an interesting sequence of events.
B The position after the neural network double jumped 27-I 8-I I. The neural network's king on I I now pinned the human opponent's king on 4. Simultaneously, the neural network's checker on I4 pinned an opponent's checker on 2 I. Game over.

When I first saw our opponent's move, my initial reaction was totally negative. The logical play for the neural network seemed to be to flee 10-15. That move would stave off being captured for a turn but would be of no real help, because I expected our opponent to then move 6-10. The play would threaten both the neural network's checkers on 14 and 15, ensuring a capture of one checker.

I went from feeling negative to abysmal when I saw the neural network's next move: 4-8! What was this? If you look at figure 40(a) again, you'll see that by moving 4-8, the neural network not only freed up the human to jump 6-15 but also gave him the option to jump 11-4 and get a free king!

I was sure there was a bug in our program now. This was really depressing. Our opponent jumped I 1-4 as predicted, but then the nightmare got worse. Instead of trying to save its checker on IO, the neural network moved 20-24, simply giving up its checker on IO. "Oh, my." Our opponent took the forced jump 6- 15, and then the neural network moved its king 23-27. I was left shaking my head. Looking at figure 4 I (a) and following the moves above, you might be shaking your head too. Not only had the neural network given up two pieces, giving our opponent a free king, but now it had moved its only king away from protecting the red checker on 26. White would be forced to jump 30-23. **That's when the fun started. The human took the forced jump of 30-23, but this move now gave the neural network the double jump of 27-1 8-1 I! After surrendering pieces left and right, the neural network now delivered the mortal blows.**

Figure 40 (b) shows the situation. White's checker on 21 was trapped against the side. White's king, which had seemed like a gift, was now pinned in the corner. The rest of the play was a mere formality. **I had to laugh because I had been so sure that the program was screwing up, and now the sacrifices all seemed so sentient.** Two moves later, the game was over. …"

Male chauvinism (pages 274-278)

"… The Congress on Evolutionary Computation came and went, and we were back to playing checkers on the Internet, trying to complete our assessment of the best-evolved neural network from generation 840. Our rating was higher than 2,000 now and was posted with our name for everyone to see.

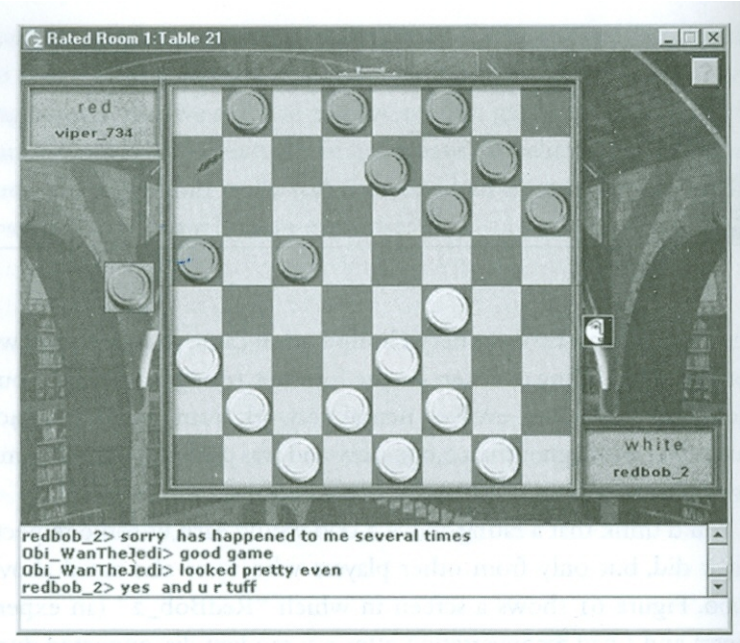

FIGURE 61

A screen showing a game between RedBob_2 and viper_734, during which I kibitzed as Obi_WanTheJedi. RedBob_2 complimented our level of play. By permission of Microsoft Corporation.

You'd think that a rating above 2,000 would earn us some respect, and it did; but only from other players who were also rated above 2,000. Figure 61 shows a screen in which "Redbob jz" (an expert player) and I had a conversation after my modem disconnected during our match. RedBob_2 found a new opponent, and I kibitzed on their game to apologize for getting disconnected. RedBob_2 was very complimentary of my level of play-all due to the evolved neural network, of course.

Whereas opponents with expert or higher ratings were gracious in both victory and defeat, for our victims with ratings between 1,800 and 2,000 it was the same old story: We'd beat them and end up on the receiving end of a series of expletives sent flaming through the chat box. After a while, we grew tired of this behavior and decided to conduct a little experiment.

Introducing Blondie24

Kumar and I figured that most of these sore losers were guys. Most women don't swear at you when they lose. What if we changed our name from Obi_ WanTheJedi to, say, Blondie24? What sort of response would we get then?

We'd need a cover story for Blondie (from now on, I'll use "Blondie" and "Blondie24" interchangeably). How did she get to be so good at checkers? We brainstorrned and came up with her persona: Blondie is a twenty-four-year-old mathematics major, currently enrolled at the University of California at San Diego. Her parents named her' after the comic strip character, and yes, she's a natural blonde. Bloridie's very athletic and enjoys surfing and skiing, but she broke her leg last winter in a skiing accident. While recuperating, she had ample time to get really good at checkers. Oh, and yes, she's single, extremely attractive, and looking for a boyfriend.

There's no provision for switching your screen name on zone.com, so Kumar and I logged on simultaneously, he as Obi_ WanTheJedi and I as Blondie24. He proceeded to lose games to me on purpose. At first, he made every mistake he could think of, giving up checkers as quickly as he could. If only Blondie's real opposition would be this cooperative and lose this quickly, we joked.

Then we realized that we were doing things the hard way. Instead of playing games out by hand, with Kumar committing the checkers' version of suicide time after time, all he had to do was hit the "resign" button. It wasn't long before Blondie24's rating rose to 2,030, where Obi_WanTheJedi's had been before we started this little adventure. With that, we retired old Obi_WanTheJedi. What followed was an amazing lesson in human psychology, and a great deal of fun.

Now instead of being flamed while we were trouncing our weaker opposition, we were being asked out on dates; One guy from across the country even bet Blondie a free dinner that he'd win. (He didn't, and I have no desire to collect.) A typical conversation went something like this:

> "Where are you?"
> "San Diego. And you?"
> "Los Angeles. Can we meet?"
> "Uh, I don't think so."
> "Are you-really 24?"
> "Yes.Your move."
> "I bet you're hot."
> "You wouldn't be disappointed. =) but it's your move."

I figured that using the "=)" smiley face would be more feminine than the typical ":-)" or the more aggressive "%")." It seemed to work. Kumar and I were completely convincing as Blondie24, 100

percent successful in our effort to play out the first half of Turing's test - two guys pretending to be a woman who was really good at checkers.

It's not an overstatement to say that we were on the receiving end of some rude or crude remark just about once in every three games. Not being a woman, I hadn't been exposed to this side of male behavior. Ladies, I empathize. Do we men always behave like this?

I had fun commiserating with the women who played on the website. In the guise of Blondie, I'd end up chatting about the other guys on the site, comparing notes about how they behaved and what jerks some of them were. Men would often come to kibitz on our games, and if we couldn't take any more of their vulgarity, one of us would turn off the kibitzing feature and summarily dismiss them from the room. I'd usually remark, "Girl power! =)" whenever I did that, which brought back sympathetic smiley faces or the acronym LOL for "laughing out loud."

While many of the checkers room regulars were apparently interested in more than just a game of checkers with Blondie, the better opposition was as complimentary as ever. Figure 62 shows a typical screen that captures the comments of another player, again in the expert category: (I've redacted the screen to remove the opponent's name, because it may completely identify him.)

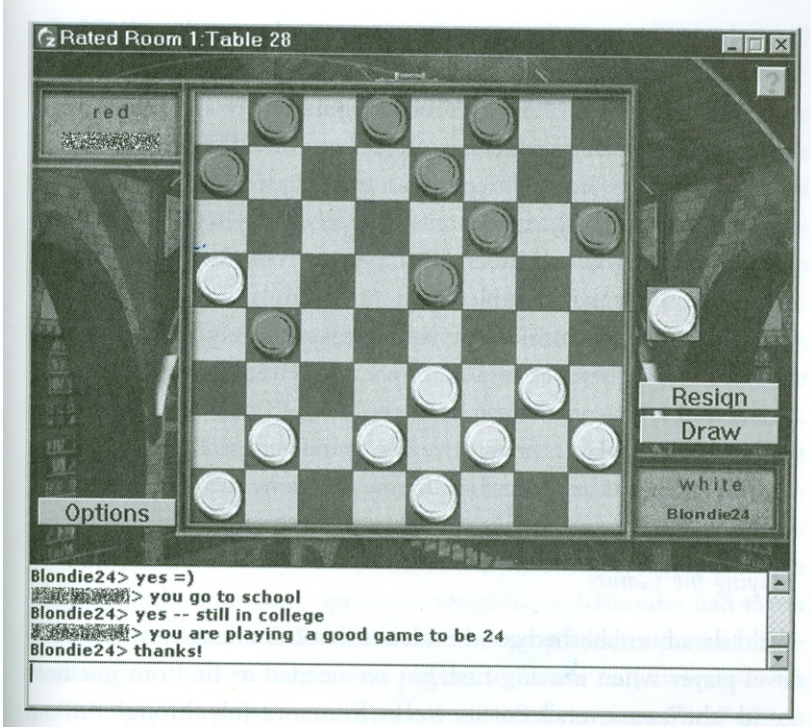

FIGURE 62

Some nice comments from an expert-level player on zone.com. By permission of Microsoft Corporation.

Blondie was often told how well she was playing for her age and that she should practice and enter tournaments. It was all very flattering, and it was nice to see such a spirit of camaraderie. The really good checkers players truly love the game, and they'll go to great lengths to help others excel and enjoy the game too. …"

Appendix D - Bill Howell's "Genetic specification of recurrent neural networks"

- William Neil Howell "Genetic specification of recurrent neural networks: Initial thoughts", Proceedings of WCCI 2006, World Congress on Computational Intelligence, Vancouver, paper#2074, IEEE Press, pp 9370-9379, 16-21 July 2006
- Bill Howell 2006 "Genetic specification of recurrent neural networks" http://www.billhowell.ca/Neural%20nets/Howell%202006%20-%20Genetic%20specification%20of%20neural%20networks,%20draft%20concepts%20and%20implications.pdf

Below are some of my comments from a draft version of my publication several years ago on very advanced forms of Artificial Neural Networks (ANNs). The article ties in well with several of the "Toolsets, and Concepts" mentioned in Parts III & IV of this paper. Don't look for my follow-on papers – I have been distracted (by history, and by the catastrophic failures of climate science – what I call the "Kyoto Premise" baloney).

Draft concepts and implications of CNGM are discussed in this early version of the paper that is in the proceedings of the IJCNN 2006 Vancouver conference. Note that this is a very rough, intermediate draft that I probably won't get around to cleaning up. However, this does wander into IMPLICATIONS, from the perspective both of the mind/brain, and of sort of a "philosophical" perspective on the analysis of complex systems. Not that it's terribly well described here.

Unfortunately, I haven't tied the material in this Appendix to the [social graphs, social sets] of social media, but I hope that the reader is able to see the "connections" (that was an accidental pun).

"… Abstract – Computational Neuro-Genetic Modeling (CNGM) is discussed from the perspective of building Artificial Neural Network architectures starting with substantially pre-defined modules and processes (DNAANNs). This is equivalent to assuming that DNA code in a neuron can ultimately specify function, process and some level of data abstraction beyond the immediate role of genes to produce proteins or to regulate processes, and using that basis as a metaphor for DNA-ANNs. A robust and diverse set of ensembles or modules of DNA-ANNs is sought that is sufficient for a given problem domain, and that generalizes well. The potential advantages that might be derived from highly evolved, fine-grained hybrid genetic/connectionist systems, and some of the implementation challenges that they could present are discussed. …"

DNA beyond genes and immediate regulatory function

"… Conventionally, "genes" might have been thought of as being "assembly language programming" for proteins, almost in a literal sense. This process involves finding the appropriate starting point on the DNA, culling out non-protein-coding sequences of mRNA (introns, part of npcDNA) from coding regions (exons) as indicated by spliceosomes. The mRNA is then used in ribosomes for the assembly of proteins. Occasionally, "decision points" occur in gene sequences that can result in different final proteins, depending on the regulatory function of a small component of npcDNA.

Additionally, a protein or enzyme may have different functions in different cell types, meaning that there is some degree of "overloading" (multi-functional roles) for some genes. This concept is revisited in Section III.

However, for a long time researchers have suspected that the role of DNA goes much further than merely coding for proteins, that life was not merely a combinatorial soup" (Mattick J.S. Mattick, “Challenging the dogma: the hidden layer of non-protein-coding RNAs in complex organisms” BioEssays, vol 25 pp930-939, Oct. 2003) that coincidentally gave rise to the tremendously detailed, complex and specific anatomy and physiology of the cells and of entire organisms (Mattick J.S. Mattick, "The hidden genetic program of complex organisms", Scientific American, pp60-67 Oct. 2004. See also http://imbuq.edu.au/groups/mattick, Ast G. Ast, “The alternative genome” Scientific American, vol 292 issue 4, Apr. 2005, pp58-65, Eddy S.R. Eddy, “Non-coding RNA genes and the modern RNA world” Nature Reviews Genetics, vol 2, pp 919-929, Dec. 2001, Gibbs W.W. Gibbs, "The unseen genome: Gems among the junk" Scientific American, vol 289 no 5, Nov. 2003 pp46-53).

Moreover, while it seemed that there should be a greater role for DNA than simply as "assembly language programming", it was also clear that the "genes" of eukaryotic organisms (having cells with a nucleus as opposed to prokaryotic organisms with non-nuclear cells) account for only a small portion of the total DNA. For example, earlier estimates were that only ~1.5% of the 3.2 Giga base-pairs of amino acids in human DNA codes for proteins (less now, given the lower estimates of today's total gene counts!), and yet most DNA is transcribed to RNA! Furthermore, (Mattick J.S. Mattick, "The hidden genetic program of complex organisms", Scientific American, pp60-67 Oct. 2004. See also http://imbuq.edu.au/groups/mattick) points out that there is a poor relation between an organism's complexity and the number of protein-coding genes, but there is a more consistent relation between an organism's complexity and the amount of npcDNA. His description of the Cambrian period bio-complexity explosion (~1 Gy ago), and the rest of his analysis provide a substantial basis for going beyond the "central dogma of biology", that DNA only codes for genes and or their direct regulation. Highly complex architecture argues for the need or advantage and power of precise plans and “drawings” that are highly specific, either in the case of human buildings or biological systems. …”

Memory molecules

Note that Part VI mentions the name Bernie Widrow, who has worked on this concept. Francis Crick (I’m not sure if this is the DNA double helix Nobel prize winner) and others have also considered this – back to 1974 and probably much earlier.

“… Researchers have long conjectured about a more direct information processing role for DNA in the brain. Several researchers over time have proposed that DNA would have excellent characteristics as a "memory molecule", providing enormous information storage capabilities (B.F. Vanyushin, N.A. Tushmalova, L.V. Gus'kova, "Methylation of brain DNA as an index of participation of the genome in mechanisms of individual acquired memory", Doklady Akademii Nauk SSSR, vol219, pp742-744, November 1974. translated by Plenum Publishing, New York,

1975.-D.H. Adams, "Triplet code-indepenent programming of living systems organisation by DNA: the link with intelligence and memory", Medical Hypothesis, vol44, pp419-427, 1995.), but this could not be substantiated by experiments. However it should be noted that conventional genomics, which relates genes to proteins and regulatory functions, is vastly easier than trying to relate DNA coding to brain structure, function and information content, neither of which can be directly measured in detail. That problem will get much worse as higher and higher levels of abstract brain function are addressed. …"

Lamarckian heredity and multiple inheritance

"… Lamarckian heredity is understood here to mean changes in DNA code or its "express-ability" which occur during an individual's life through learning or adaptation, and which may or may not be passed on to the next generation. This contrasts with the normal biological process of Mendelian heredity, where DNA coding or its expression are assumed to change only at conception (and from mutations, or errors during normal cell division). Both are still components of Darwin's general theory evolution – as with punctuated evolution etc.. Further thoughts on this topic include:

- In non-biological domains Lamarckian heredity has always been there, but goes by different names (eg education, organizational change/ development and management theories and fashions). In each of these areas, lessons learned ARE passed to the next generation of employee, spin-off companies, other countries looking for a constitutional framework etc. Lamarckian style co-evolution is particularly evident in competitive marketplaces. ;

- Does Lamarckian heredity apply biologically? Epigentic changes for the functioning of the mind during an individual's life are discussed in several references (Marcus G. Marcus, The birth of the mind: how a tiny number of genes creates the complexities of human thought, New York: Basic Books, 2004. This book (along with Pinker's "Blank slate") is an essential read, and its concepts and Marcus' current work are a basis for the current paper., Meaney I.C.G Weaver, N. Cervoni, F.A. Champagne, A.C. D'Alessio, S. Sharma, J.R. Seckl, S. Dymov, M. Szyf, M.J. Meaney, "Epigenetic programming by maternal behavior". Nature Neuroscience vol 7, no8, Aug. 2004, pp847-854M.J. Meaney, M. Szyf, "Maternal care as a model for experience-dependent chromatin plasticity?". Trends in Neurosciences, Vol.28 No.9 September 2005.), but there still does not appear to be adequate direct evidence for multi-generational changes. It's still very early though, and the toolsets for studying this subject are improving rapidly.

- However, it's interesting to consider constraints with the genome. Mitochondrial DNA is completely separate from nuclear DNA, and it doesn't change through sexual mixing of coding. Perhaps here the life-threatening constraints (and requirement for optimal or competitive use of energy) are too severe to allow for much diversity. Somewhat less severe, but still high constraints on diversity might apply to critical functions (organs, the heart etc). But many features aren't particularly critical within certain bounds (height, weight), and cosmetic features are only loosely constrained, and indeed might be purposefully variable as indicated by much higher mutation rates for some of these features in some organisms.

Pushing this to the ultimate extreme, it would seem that abstract thinking would be extremely free to mutate, crossover, and to undergo Lamarckian hereditary changes, as redundancy could handle dysfunctional "pods", and great diversity would have a good chance of still being useful in some manner.

- Lamarckian advantage - Consider for a moment the impact of Lamarckian heredity for the brain and thought. Passing on even small doses of learned or evolved pods (whether epigentic or DNA code, whether data, structure or process), could be of incredible advantage to a population. This applies especially to where the new mental capability is highly dependent on pod structure (architecture, weights etc) that enable certain types of learning or mental capabilities much more than if an individual didn't posses those capabilities.

- Explosion of mental complexity - Think back to John Mattick's comments regarding an explosion of complexity in the physiology of life, perhaps due to non-protein-coding DNA (npcDNA). Did humans go through something similar 40 to 100 kyear ago with language and other intellectual and social capabilities? Has this happened several times in history (over the last 7 to 8,000 years) in different regions?

- Perhaps by taking a Lamarckian perspective, we can push the frontiers of evolutionary theory (and not just Lamarckian heredity concepts).

- A pod may become a "member" of many systems/ classes at the same time, sort of like multiple inheritance, but this is more like a multiple allegiance, or floating allegiance.

- Lamarckian heredity allows great flexibility, but in the end may not differ much from learning/ evolving ANNs unless the inheritance can be easily passed to other DNA-ANNs. Migrating pods from one DNA-ANN to another might be very difficult in general. …”

endsection

Appendix E - Gary Marcus' "Kludge" and "The birth of the mind"

[Marcus 2008]

Gary Marcus is a linguistics professor at New York University, who did his PhD under well known linguist Steven Pinker. Both are closely associated with Noam Chomsky. His book "Kludge" challenges the mainstream idea in linguistics that language is a near-perfect communications capability, arguing instead that it is a Scotch tape and bubblegum bag of tricks that makes the best of what is available with existing cognitive processes and systems. What Marcus does not state, but which is obvious, is that if language capabilities are immature, there will likely be huge increases in capabilities, perhaps though large step changes over time. Evolutionary step-changes in human capabilities, genetically or epigenetically anchored or not, cannot be excluded. Presumably, technologies could potentially help drive this, but I doubt that people would be so comfortable with the thought?

Marcus' second book, "The birth of the Mind" is much more closely related to [social graphs, social sets] than to the area of semantics. …

[30Dec2011 Howell - quick comments as I am out of time…]

I love Marcus's book. But I suspect that the mind is defined by a HUGE number of non-genetic DNA, and furthermore that epigenetics transforms DNA coding in cells in a manner that allows for "general purpose programming". But I have no time to elaborate…

endsection

Appendix F - IEEE Computational Intelligence context for the Semantic Web

Given the time constraints, I won't develop this theme beyond copying a recent posting…

Note the following theme from an IEEE Computational Intelligence Society (IEEE-CIS) call for papers on the theme of the Semantic Web. Again, the brick wall that traditional approaches often meet is being addressed here by Connectionist and Evolutionary techniques. However, it isn't always the fanciest and most powerful techniques that work!

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3.5 CFP: IEEE Computational Intelligence Magazine: Special Issue on Semantic Web Meets Computational Intelligence
Posted by: Kay Chen Tan (eletankc@nus.edu.sg)
Date submitted: August 15th, 2011

IEEE Computational Intelligence Magazine
Special Issue on Semantic Web Meets Computational Intelligence

Call for papers

The Semantic Web (SW) carries out the vision of a global web of data usable for both human and machines. This web, consisting of inter-connected instance data annotated with possibly expressive ontologies, promises a huge opportunity for web-based applications in many domains. As an open, decentralized, and complex system, the building and development of the Semantic Web bring up a number of new problems to which traditional Artificial Intelligence approaches (Description Logic, Logic Programming, Ontology Reasoning, etc.) are not effective and feasible. More and more researchers from the Semantic Web community are aware of the importance of introducing computational intelligence methodologies and approaches (e.g., including neural network, fuzzy logic or evolutionary computation) to study the complexity of such a huge web of data.

The goal of this special issue is to discuss on current trends in the marriage of the Semantic Web and Computational Intelligence. The specific topics solicited for this special issue will cover all aspects of computational intelligence research, including, but are not limited to,

- Fuzzy logic and uncertainty reasoning for Semantic Web
- Neural network and machine learning for Semantic Web
- Evolutionary computation for Semantic Web
- Hybrid approaches of EC, NN, and fuzzy logic for Semantic Web applications

All papers submitted to this special issue will be rigorously peer-reviewed by experts in the field. To ensure timely publication of this issue, the following timeline will be used for this special issue:

Manuscript Submission Deadline: October 15, 2011
Notice of Review: November 15, 2011
Final Manuscript Due: December 15, 2011

We look forward to your submissions to this special issue!

Guest Editor:

Huajun Chen (Zhejiang University, China)

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