Three Lessons of Ancient & Modern Philosophy for Creative Human-Centered Computation

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Data Mining and Creative Times

- The world is flat.
- Returns to creativity are high.
- Data mining grows out of statistics, databases, and ML \( \rightarrow \) analytically creative activities.
- Category creation requires analytical & tabula rasa creativity.
- What qualitative thinking skills do we need to use & teach to create next generation of category creators?
Roadmap

- 3 things I won’t be discussing.
- Cold war mindset in an Internet world.
- How I changed my mind.
- 3 lessons from modern & ancient philosophy.
  - Searle and the construction of social reality.
  - Socrates/Plato and the importance of dialectic.
  - Aristotelian data mining and its application to social networks.
- People-centered design at the center of this creativity revolution.
3 Things I Won’t Talk About

- I absolutely positively won’t talk about the following three things:
  - GA scalability.
  - Human & computer agency and the 4-quads.
  - DISCUS, SAiNT & all that.
GA Scalability & Efficiency

![Graph with data points and lines representing different algorithms and convergence reaching a constant ratio of \( \sigma_N^2 / \sigma_f^2 = 0.1 \).]

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# H-C Agency in 4 Quadrants

<table>
<thead>
<tr>
<th>Inventive agent</th>
<th>Selective agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>computational</td>
<td>human</td>
</tr>
<tr>
<td><strong>Standard Genetic Algorithms</strong></td>
<td><strong>Interactive Genetic Algorithms</strong></td>
</tr>
<tr>
<td><strong>Computer Aided Design (CAD)</strong></td>
<td><strong>Human Based Genetic Algorithms</strong></td>
</tr>
<tr>
<td>computational</td>
<td>human</td>
</tr>
</tbody>
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(Original source: Kosorukoff & Goldberg, 2002)
DISCUS Combines Semantic, Social & Machine Reflection

IDM = Influence Diffusion Method
Cold War Mindset, Internet World

- Large, centralized corporations, governments, and institutions (including universities).
- Revolutions in 20th century in transportation & communications give us radically different world because of transaction costs & network returns.
- Neo-human-centered systems shaped by these forces.

Ronald H. Coase (b. 1910)
Humans as Error in the Loop

- During the Cold War, humans were an obstacle to the proper functioning of a system.
- Tom Wolfe’s, *The Right Stuff*, plot: tension between pilots and techies who would eliminate them.
- Cold War view: Humans are error in the loop, and error is to be eliminated.
Postmodern: Humans are the Loop

- Internet, human beings integral part of the system.
- Google as human preference engine. No humans, no Google.
- Brute facts of physics not dominant in postmodern systems.
- Examples:
  - What are the “physics” for Ebay?
  - What equations of motion govern Google?
  - What constitutive relations for MSOffice.
Lost in Space

- How do we design such systems?
- Engineers, scientists & mathematicians lost.
- No physics, what are the constraints?
- How do we model when all our models are gone.
- Data mining answer: collect and analyze data.
3 Lessons from Philosophy

- Creative Modeling for Tech Vision
  Covers qualitative and quantitative modeling appropriate to new category creation.

- 3 Lessons:
  - Dialectic in creative modeling.
  - Aristotelian data mining in creative modeling.
  - The construction of engineering reality.
Tabula Rasa: Curse & Blessing of Category Creator

- How do we design when we don’t know how to talk about what we are designing?
- Let’s start at the human beginnings of conceptual clarity.
- Let’s start at the beginning of formal philosophy.
- Let’s start with two key techniques from Athens.
What Examples of New Thought?

- Clearest examples are from philosophy.
- Presocratic → Socrates → Plato → Aristotle.
- Mechanisms of the new thought:
  - Socratic dialectic
  - Aristotelian data mining
Socrates and Dialectic

- Socrates was a pain in the neck.
- Walked around Athens asking everyone impossible questions.
- Then proved their answers were wrong, but rarely gave an answer himself.
- Nonetheless, Socrates’s method was useful.
- Conversation trying to probe what things really are (or might be).
- Questions were the rights ones. Whitehead’s famous remark.

Socrates (470-399 BCE)
The Probing of Dialectic

- Questions directed at the essence of things.
- What is the meaning of a common phrase? “What is virtue?”
- Answers often betray our lack of knowledge and understanding.
- Examine answers critically, often with more questions.
- Ask penetrating questions about the answers.
What's This Got to Do with Products?

- Questions & conversation is at roots of all new products.
- Research on tech visionaries shows that problem finding is the main activity of successful TVs.
- Spark of insight may come as flash, but dialectic necessary in new product creation.

- Three roles of questions:
  - Probe customers.
  - Probe organizational hurdles.
  - Probe product developers.
Probing Customers

- Focus groups are immensely powerful.
- Can be informal conversations with potential customers.
- Can be formal focus groups behind the one-way mirror or over web.
- The surprise of Nextumi: Search not solved problem.
Aristotelian Data Mining

- Called *The Philosopher* by some.
- Amazing range and scope of work.
- Created many of basic categories of college curriculum.
- Founded a school the Lyceum.
- We have 1/3 his output (2000 pages in 30 books).
- *Categories* and *Metaphysics*.
- Method very modern:
  - Empirical search for data.
  - Considered attributes, which he named.
  - Classified data according to his attributes.
- Can we break this down?

Aristotle (384-322 BCE)
In Aristotelian data mining we seek list of essential qualities that delineate products or services.

Notion of genus and species comes from Aristotle.

Things divided into groups of like kinds.

Can be subdivided further.

At the bottom are particulars or substances.

10 categories: substance, quantity, quality, relation, place, time, position, state, action, and passion.
Aristotelian Product Spaces

- Consider space of existing products that are related or similar.
- Look for different exemplars that represent different types of products.
- Taking viewpoint of the customer here.
- May need separate decomposition for design.
- Consider, for example, social networking space.
Facebook
Flickr
What Common? What Different?

- Can we make a list of attributes that separate the space?
- Can use J. S. Mills methods or methods of modern data mining.
- Attributes:
  - Mode of communication (email-IM-mobile-wall)
  - Sense of community (ind-group-friends)
  - Gate to community (edu filter-anybody)
  - What shared (text-docs-photos)
Some Techniques with Attributes

- Dimensionalization of spaces very helpful to high-level thought.
- Listen to discussions and try to dimensionalize quickly.
- 3 techniques that come to mind:
  - Cartesian products
  - Expert systems
  - Hypertrophy of the dimensions
Dimension Hypertrophy

- Are there missing categories on the dimensions?
- Did we capture all the modes of things shared?
- Example, text-photos-docs: What about videos?
- Is that a good idea?
YouTube & $1.65 Billion Buyout
Construction of Engineering Reality

- Mill Prof of Philosophy of Berkeley.
- Philosopher of language and mind.
- Early work took off from Austin’s work on speech acts.
- What does language have to do with it?
- Helps us understand social and institutional facts, separate physics from the social.

John R. Searle (b. 1932)
Objectivity versus Subjectivity

- Have existence versus knowing, as well as objective versus subjective.
- Examples:
  - Mountain: existence → objective
  - Pain in toe: existence → subjective
  - Pain in toe: knowledge → objective
- Ontological subjectivity does not prevent epistemological objectivity.
Structure of Social Universe

- Mind creates an objective social reality.
- Example, money:
  - Trivial physics: money not money because of material existence.
  - Money, money because of our intentions.
- Other examples: language, government, universities.
- Object fits description because we think it does.
- What is ontology of the social and the institutional?
Building Blocks of Social Reality

- Need 3 new elements:
  - Collective intentionality: we intend.
  - Assignment of function: function is never intrinsic, always observer relative.
  - Constitutive rules.
Constitutive Rules

- How to distinguish between brute facts and institutional facts.
- Types of rules:
  - Some rules regulate: “Drive on left side of road.”
  - Some rules regulate and constitute: Rules of chess both regulate conduct of game and create it.
- Constitutive rules form: X counts as Y in C.
- “Move two and over one” counts as a knight’s move in chess.”
Web Life: Institutional Complexity

- Go on Google, search for online book seller, sign in to Amazon.com using account ID, order a book, using a credit card, get recommendations from recommender system & order some of those books, too.
- Get confirmation message via e-mail account, and books delivered by FedEx.
- Refers to string of institutional facts.
Institutional/Physical Landscape

Institutional Design Complexity

Physical Design Complexity

High

Low

High

Low

Institutional Design Complexity

Buildings

Alloys

Google

Non-Engineered Objects

SN Sites
The web has changed a lot.

Interconnected, software reconfigurable systems enable brave new world of institutional facts:
- Easily constructed.
- Easily propagated (viral marketing).
- Easily iterated (systems upon systems).

Forms basis for discipline of “postmodern systems engineering.”
Data mining rooted in analytical creativity.
Category creation requires tabula rasa creativity.
Beginnings of systematic qualitative modeling in Athens.
Distinguish brute, social & institutional world with Searle.
Better human-centered computation via new discipline of postmodern systems design.
More Information

- **TEE**, the book.  

- **TEE**, the blog.  
  [www.entrepreneurialengineer.blogspot.com](http://www.entrepreneurialengineer.blogspot.com)

- **TEE**, the course.  
  [http://online.engr.uiuc.edu/webcourses/ge498tee/index.html](http://online.engr.uiuc.edu/webcourses/ge498tee/index.html)

- **MTV**, the course.  
  [http://online.engr.uiuc.edu/webcourses/ge498tv/index.html](http://online.engr.uiuc.edu/webcourses/ge498tv/index.html)

- **Engineering and Technology Studies at Illinois (ETSI)**  

- **2007 Workshop on Philosophy & Engineering (WPE)**  
  [http://www-illigal.ge.uiuc.edu/wpe](http://www-illigal.ge.uiuc.edu/wpe)

- Illinois Genetic Algorithms Lab  
  [http://www-illigal.ge.uiuc.edu/](http://www-illigal.ge.uiuc.edu/)