

CS260

Human-Centered Computing

Course Outline

John Canny
1/21/09

What to expect

- A ***pragmatic*** perspective on HCI and designing “systems in context”.
- We cover many popular theories within HCI, and explore their application to design.
- Semester-long project should build on theories you’re exposed to, in a non-trivial way.
 - We’ll provide tools for doing this

What to expect

- Most of the topics we cover have had a fair influence on system design, some are “computational theories” e.g. Ethnomethodology ↔ Social network analysis
- We’ll cover many topics, but there will be a lot of common ground and we will try to build something new out of it.
- Our first step is pre-theoretical. We cover pragmatism which is a uniquely open-minded perspective, and has had a huge influence on social science theory.

Context: The 1860s

America is fighting an ideological war that is deeply divisive:



“..if civilization and progress are the better things, why they will conquer in the long run, we may be sure, and will stand a better change in their proper province—peace—than in war, the brother of slavery...it is slavery’s parent, child and sustainer at once..”

-Oliver Wendell Holmes

The 1870s

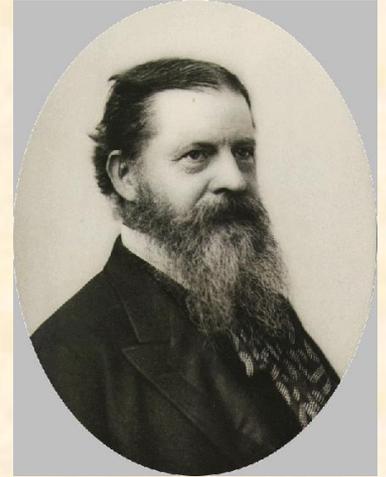
A “metaphysical club” forms at Harvard including C.S. Peirce, William James, O.W. Holmes and others.

These discussions lay the groundwork for pragmatism. Over time (many decades), these ideas were developed by these three and by John Dewey and George Herbert Mead.

Many of the key ideas were developed in the 1870s by Peirce, and then ignored until James’ essays 20 years later.

Charles S. Peirce

A mathematician first and one of the founders of modern logic. He contributed much to boolean, predicate and relational logic, and to quantification.



At the same time, his philosophical works were “outside the system,” and he saw the development of scientific and mathematical knowledge as social processes.

Coined the term “pragmatism” from the Greek word $\pi\rho\alpha\gamma\mu\alpha$ for “action” in an article in 1878.

Peirce's "How to Make Our Ideas Clear"

An essay from 1878, lays out the foundations for pragmatist thought. Difficult language, but very original:

Human behavior is based on ritual or habit.

Behavior involves cycles of doubt → action → belief

Doubt is a challenge or gap in belief. It triggers action (contemplation) about what to do in the circumstances.

The result is a belief (what to do in context) which over time becomes habit.

Peirce's "How to Make Our Ideas Clear"

Belief therefore has two key pieces:

- A context, which must be perceptible – what to do in "this" situation, where "this" can be remembered and recognized.
- A schema for action in that context.

Peirce's "How to Make Our Ideas Clear"

Pragmatic notion of "belief":

- Beliefs are different to the extent that holding them has different practical consequences for a person.
- If there is no difference in any situation, then from a pragmatist perspective they are the same belief.
- Several examples: transubstantiation,..., forces and accelerations

William James



Studied painting, chemistry, anatomy, natural history in several universities.

He completed his MD at Harvard in 1869.

He never practiced.

Shifted to psychology and philosophy, eventually landing a teaching position at Harvard in 1874.

James was the best-known popularizer of pragmatism.

He drew primarily on Peirce's ideas, but also Dewey and Schiller's.

James' Pragmatism

In "What pragmatism means" 1907, James discusses pragmatism as a meta-theory.

Observes that its approaches blunts many of the distinctions between various "-isms" and "-ologies".

"Science and metaphysics would work hand in hand"

...pragmatism agrees with nominalism, utilitarianism, positivism, but not rationalism.

"lies in the midst of other theories like a corridor in a hotel"

James: "What Pragmatism Means"

Pragmatism is "a method and a genetic theory of what is meant by truth"

Old theory -----> new facts
new theory

Science proceeds by "grafting" or layering new theory on old. He calls this the "genetic development of ideas"

Contrasts the "rationalist temper" vs. the "pragmatist temper"

James on Theology

One challenging aspect of James' perspective is its support for "non-scientific" belief.

For James, the value of an idea is its practical impact. If an idea leads to better behavior (determined by social consensus), then it is a valid belief.

So religious beliefs, superstition, cultural tradition, etc. are all ***potentially*** valid belief systems.

Similarly, scientific beliefs are not a-priori more valid or desirable. Their value must be demonstrated.

James Pragmatism

Shares the view that knowledge originates in experience of the world with empiricism and positivism.

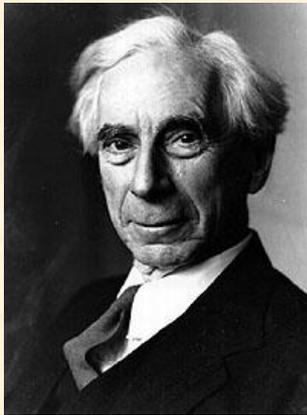
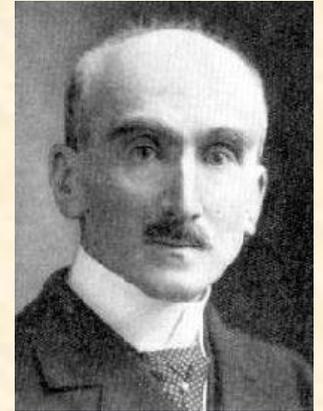
But includes the “social world” as an essential feature. This is how “practical” is defined, and where practical action happens.

For this reason, pragmatism has had a huge influence on social science.

In Europe...

In 1900 there were two leading philosophers in Europe.

Henri Bergson was a predecessor of Merleau-Ponty and Piaget, and an ally of the pragmatists.



Bertrand Russell was a logician, and the author of "A History of Western Philosophy".

Bergson died young and his influence faded

In Europe...

By the turn of the century, mathematics had finally completed some critical “housekeeping” of its foundations.

In David Hilbert’s 1900 Math Society address, he proposed a bold program for the mechanization of mathematics and physical sciences.



Automobiles, Flight, the Paris exposition, heralded the way to a “technology century.” The 1914-18 war removed any doubt. Bergson did not survive it.

And in Russia...

Post-revolutionary Russia was establishing itself as a Marxist state.

Its intellectuals set about creating an ideal society. This was the era of

Sergei Eisenstein in film,

Stanislawsky in acting ("method"),

Rodchenko, Kandinsky in painting,

Shostakovich in music,

Mikhail Bakhtin in literature.



Lev Vygotsky

Vygotsky was an extraordinary scholar who studied Law, and taught Literature, History of Art and Psychology by age 22.



For many scholars of this time, Marxism provided a unifying framework for scientific, social science, and aesthetic discourse.

Vygotsky took it very far, developing theories of knowledge, development, and education that were profoundly influential. His other major influence was William James.

Vygotsky - Education

Vygotsky is (with Piaget) the leading education theorist of the early 20th century.

Vygotsky's social theory of learning –

Like Piaget he insisted that children learn by constructing their own understanding of the world they experience.

Unlike Piaget, he insisted that “the world” experienced by children is a social, rather than a natural one. i.e. games, toys, and books are social constructions that embody social norms and expectations for the child.

Vygotsky – Genetic method

Another of Vygotsky's key ideas is his "genetic" domains:

1. Onto-genesis: Development by an individual
2. Socio-historical: Development of the society
3. Phylo-genesis: Development of the (human) species
4. Micro-genesis: Creation of ideas & concept learning

His social theory involves the interplay between 1. and 2.

Thus Vygotsky's approach interleaves methods that would be regarded as both scientific and humanistic.

Vygotsky – Mediation

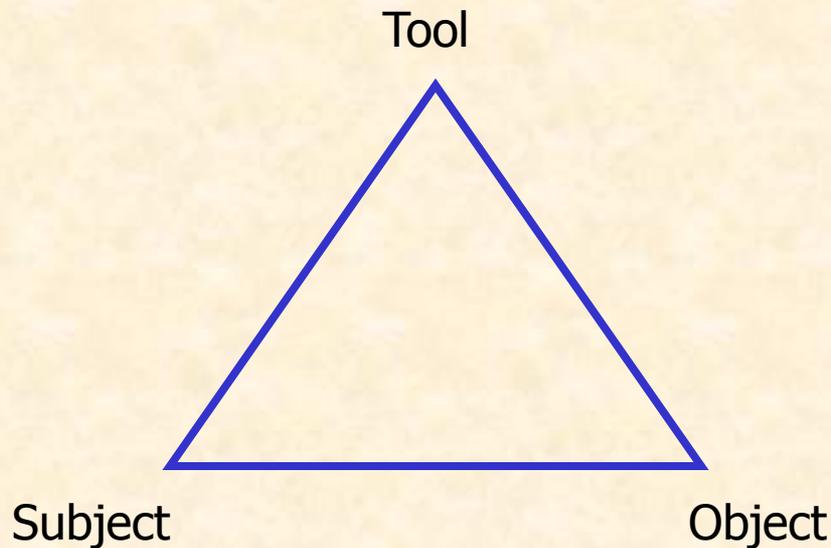
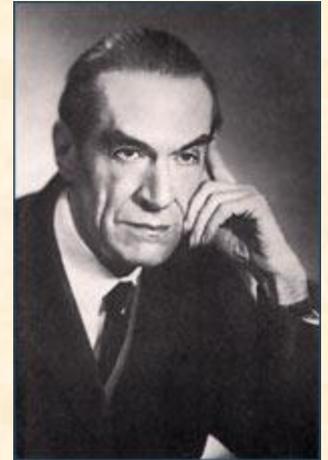
Perhaps Vygotsky's greatest philosophical contribution was his formulation of "mediation" – the intelligent use of tools for a purpose.

And among tools, language is the most important mediator.

Human use of mediation develops, individually and socially, following genetic principles.

Vygotsky and Leont'ev - Activity

Another important contribution was the "Theory of Activity," mostly developed after Vygotsky's death by Leont'ev.



Activity Theory

Activity theory has been paradigmatic through much Soviet social science. It is also well-established in the social sciences in Scandinavia, and has been widely applied.

It is used in social science, HCI, computer-supported cooperative work, and learning research in groups in both Europe and the US.

Activity theory fits well with Vygotsky's other principles – the genetic method, mediation, and consciousness.

Structuralism in linguistics

Around 1900 in France, F. Saussure was founding the “structuralist” school of linguistics.



In Saussure’s version of semiotics, a “sign” comprises a “signifier” and a “signified” (a concept).

Note that “signified”s are not thought of as “things in the world”.

A linguistic approach

In the strongest interpretations of structuralism, mental concepts, and thought itself, depend on language.

In one example, Saussure contrasts the English words "river" and "stream" with the French words "fleuve" and "riviere".

They seem similar but a French fleuve flows into the sea while a riviere flows into a fleuve. So there is no corresponding *concept* for an English speaker to either fleuve or riviere.



Post-structuralism

Although most of his work pre-dated the movement, Bakhtin is often considered a post-structuralist.

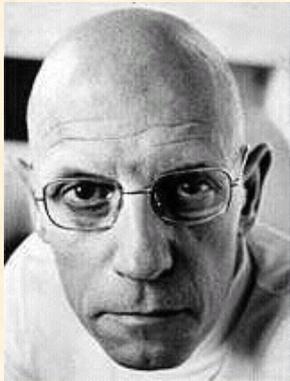
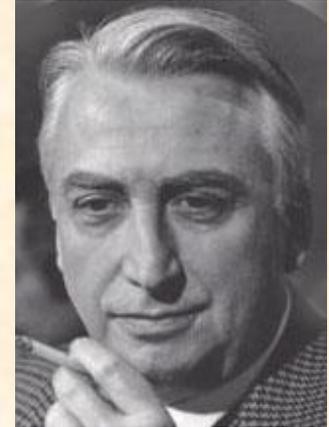
Julia Kristeva: "Intertextuality"
– texts always borrow from other texts



Jacques Derrida: there is no "hors-texte"
– corpora are always open
: deconstruction
– socio-historical analysis

Post-structuralism

Roland Barthes: "Writerly and Readerly texts"
– the reader (re-)creates meaning



Michel Foucault: a book is a "node within a network" of texts...

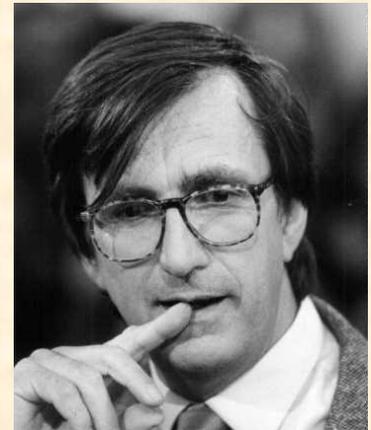
Claude Levi-Strauss: Authorship as "bricolage"



History of Science

But surely there are some facts that are just “true”, and e.g. science should escape the “slipperiness” of post-structuralist analysis?

Bruno Latour built his career studying the process of “construction” of knowledge in science. He showed it was a social and political process and involves protracted *negotiation* of truth.

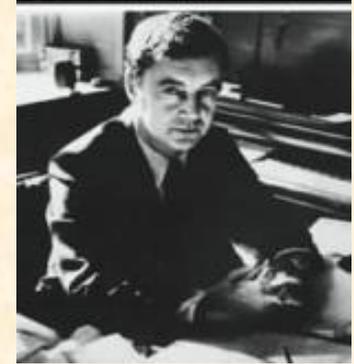


He is also a pioneer of “Actor-Network Theory” – a generalization of social networks.

Personality and Social Interaction

If meaning and concepts are socially constructed, what about personality, social roles and social Interaction?

These questions were studied by Erving Goffman.

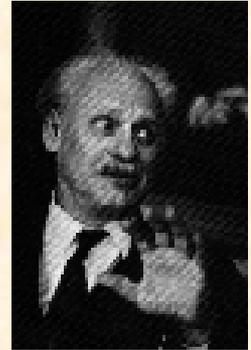


Goffman developed a “dramaturgical” approach – social behavior as a performance. “Impression management” is one of the primary goals.

Goffman also developed a “linguistic method” to understand social relations.

Language as Symbolic Action

The notion of texts as a kind of symbolic action runs deep through the works of Kenneth Burke (who wrote “Language as symbolic action”).



This perspective provides an intuitive description of activity:
An activity is a “theme” within a factual narrative of some subjects’ actions over time.

Thus we have a strong link between two fields: human modeling and text analysis.

How can this possibly relate to information system design?

It takes several years to answer this question.

We will do what we can in this course...

Computational Linguistics

Computational linguistics began with a mathematical view of language: Language was a kind of universal informal logic.

By attaching the right meanings (formulae) to terms, reasoning would be possible.

This is a sharp departure from language theories in other social sciences, which were emphasizing the importance of context and negotiation of meaning between two speakers.

Statistical Linguistics

The entire frontier of computational language today is statistical and pragmatic (in the linguistic sense). i.e. it is driven by real texts that are “representative” of the social language being studied.

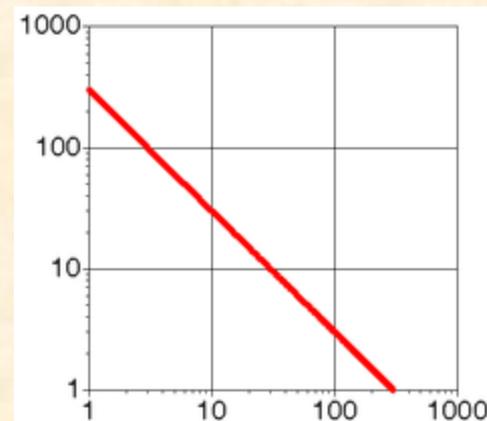
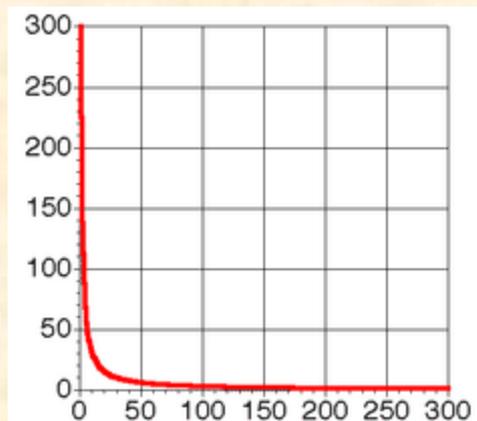
This happened for purely empirical reasons, and does not appear to link to the bulk of (non-structuralist) linguistics.

On the other hand post-structuralist views provide much more compelling explanations of basic phenomena in language.

The statistics of words

Almost all texts exhibit a peculiar distribution of word probabilities called a “Zipf” distribution.

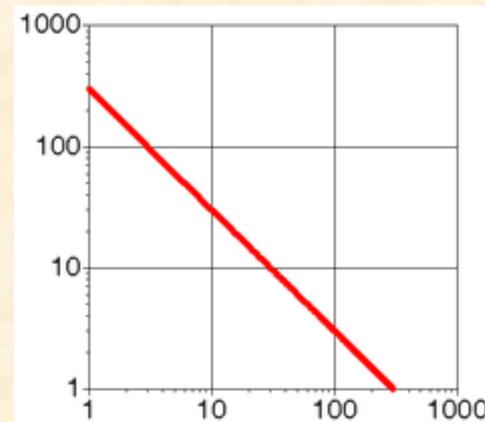
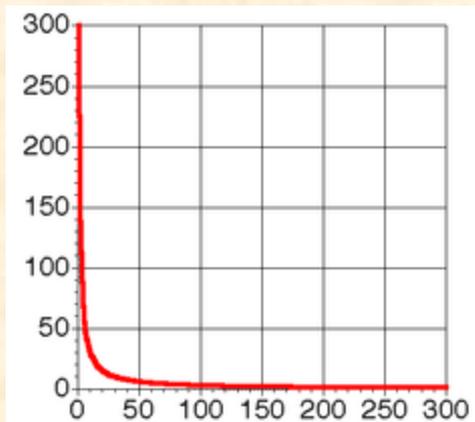
This is very difficult to explain in behaviorist terms, but follows naturally when writing is treated as a socially-situated “genetic” practice.



The statistics of the web etc.

Many other social artifacts follow a Zipf distribution, including the web.

They follow from a generative process in which artifacts are appropriated by authors in proportion to their encounters with the artifacts in life.



Summary

Pragmatism approaches questions of truth and belief in terms of practical impact.

It also acknowledges the social world as the “stage” where practical action happens.