The Growth of Cyberspace
and
the Rise of a Design Culture

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Social Theory and Social Computing
at the University of Hawaii, Honolulu, Hi

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I am a professor of communication but have a history of bridging several disciplines – social, computational, philosophical, and design. Therefore I feel quite comfortable at an interdisciplinary gathering like this one.

My thanks go to Sun-Ki Chai for inviting me and to Shih-Ling Lin for organizing the workshop

As the last speaker, I want to take a bird's eye view on its topic:

Social Theory and Social Computing

In particular, I want to take up the challenge articulated by Krystyna Aune, Associate Vice Chancellor at the University of Hawaii, who in her welcoming remarks expressed the hope that this workshop would be *conceptually, ontologically, and epistemologically disruptive* of customary practices.

Outline :

- What is space?
- What and where is cyberspace?
- How big is the current cyberspace?
- How has cyberspace grown?
- Artifacts in cyberspace
- In which sense has ours become a design culture?
- Three models appropriate for handling cyberspace in a design culture
- Some inadequate approaches
- Recap
- Brief comments on content analysis and text mining in cyberspace

What is space

To me, space conceptualizes the ability to move, act, create, describe, …

We move in numerous spaces: 3-dimensional geometric spaces
Mental spaces
Attitude spaces
Conversational spaces
Social spaces
Economic spaces
Cyberspace

Space, I must insist, exists only for actors who recognize possibilities and act in them: changing the location of their bodies, interacting with one another, or creating new artifacts

By contrast:
Modern physics has usurped, objectified, and universalized ordinary space conceptions. It theorizes space as a logical combination of several independently measurable dimensions,
e.g. super string theory requires 11 dimensions instead of geometry's three.

The discourse of physics excludes from its considerations the language of physicist. Therefore, it cannot recognize space as an artifact of physics.

What and where is cyberspace?

To me, cyberspace results from the human collective ability to articulate possibilities in which technological artifacts are designed, used, and conceptualized.

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- **Cyberspace consists of artifacts**
- Artifacts are mechanical or computational creations, ranging from simple tools, complex devices, computer software, the internet, and beyond
- Left alone, they decay by entropy (noise in transmissions)
- Once designed and entered into cyberspace, they are oblivious to their own histories, hence, cannot respond to what they mean to their designers and users

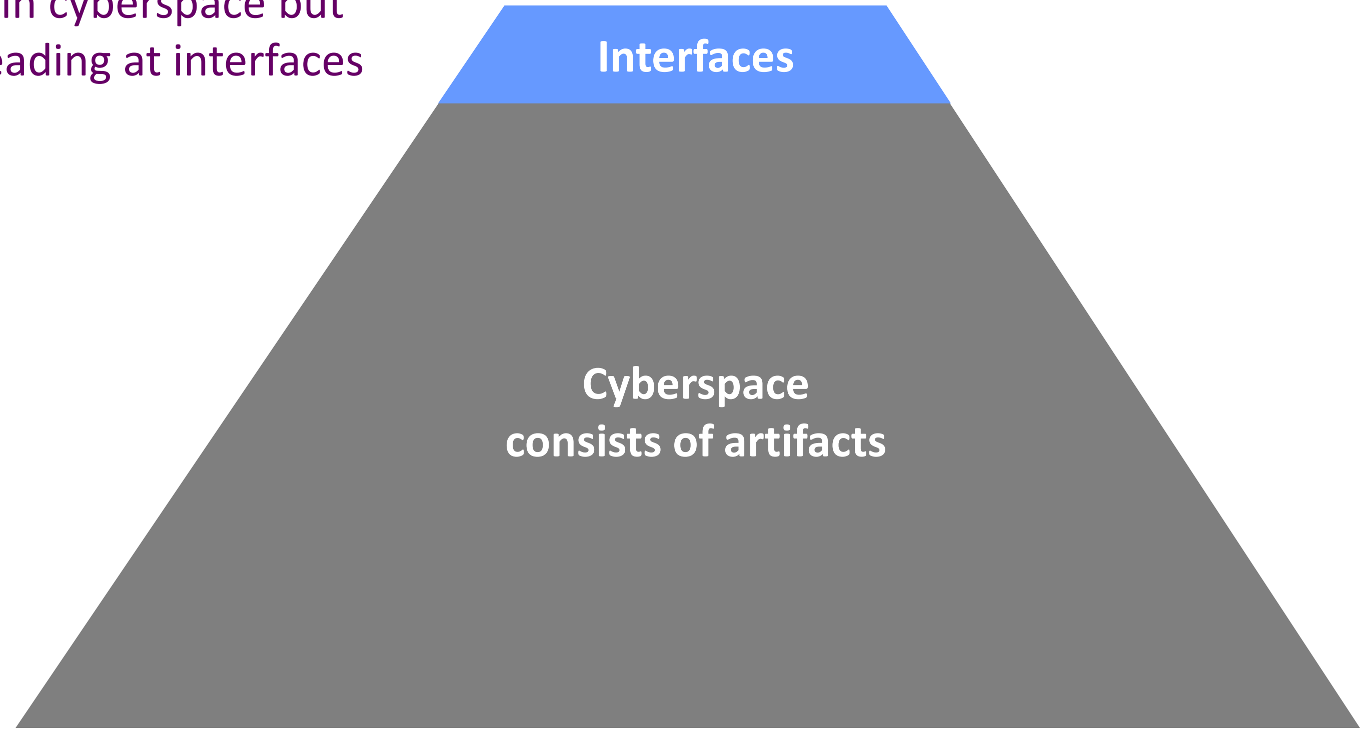
Graphically:

What and where is cyberspace?

To me, cyberspace results from the human collective ability to articulate possibilities in which technological artifacts are designed, used, and conceptualized. Thus

- The use of artifacts in cyberspace is determined by human actors at the **interfaces** with these artifacts
- Such use includes the attribution of social significance, for example, as providing information, having utility, or modeling something else. Information is not contained in cyberspace but arises in reading at interfaces

Graphically:

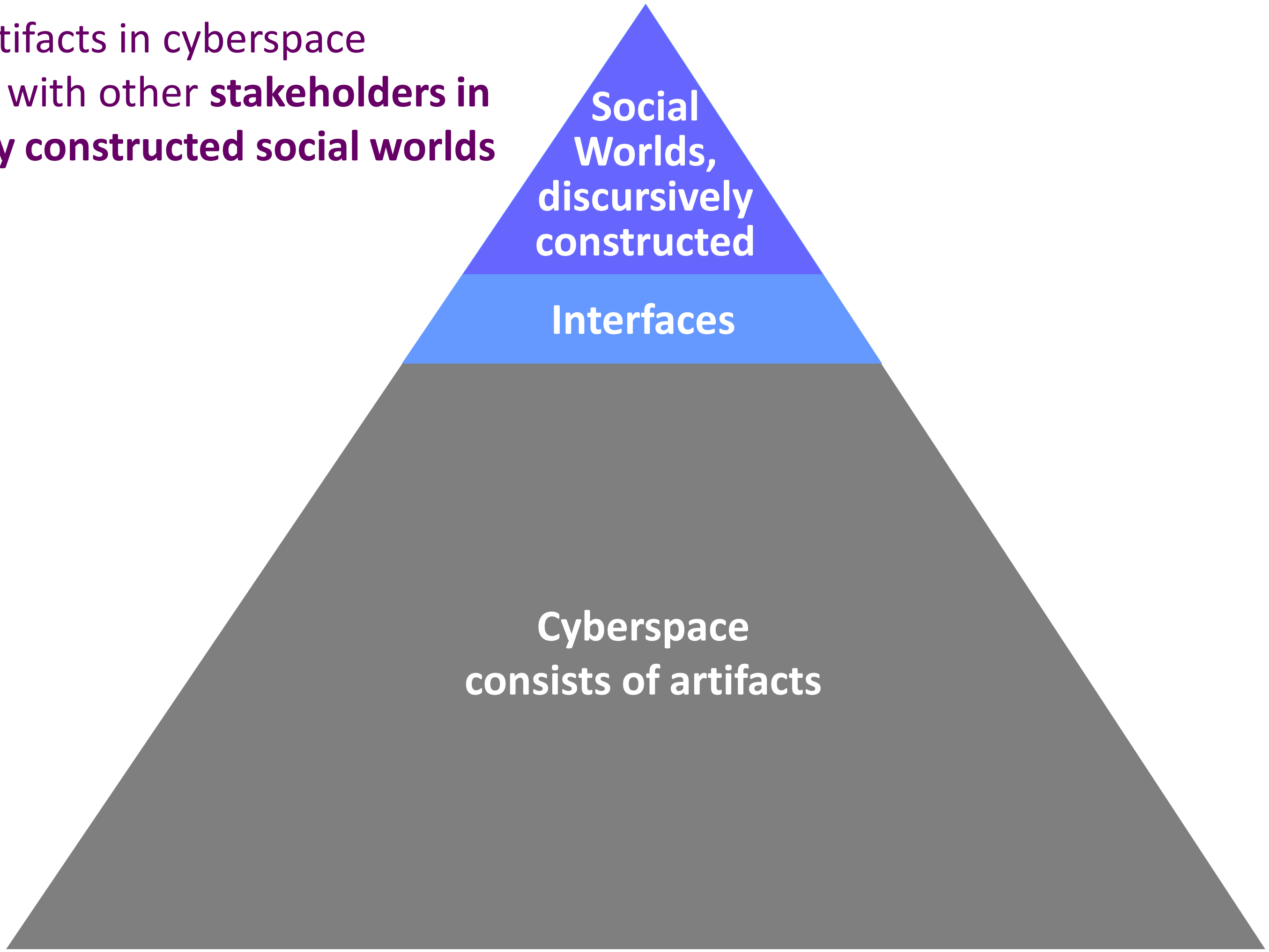


What and where is cyberspace?

To me, cyberspace results from the human collective ability to articulate possibilities in which technological artifacts are designed, used, and conceptualized. Thus

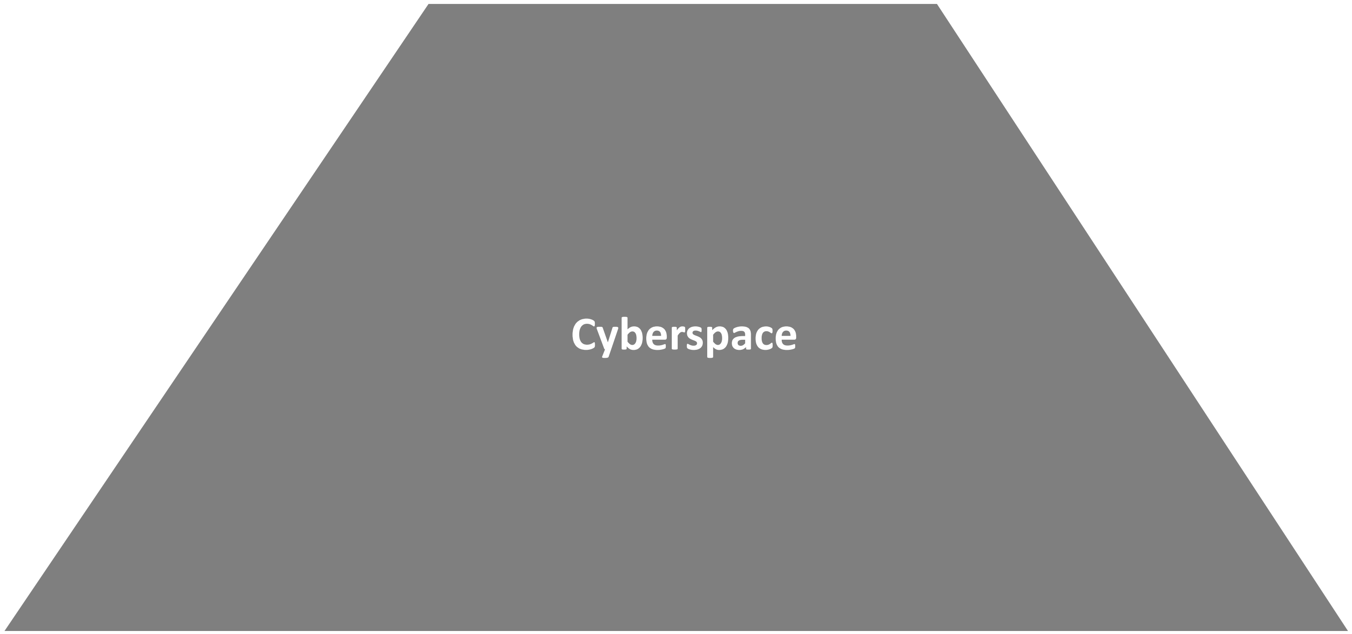
- Users of artifacts in cyberspace participate with other **stakeholders in discursively constructed social worlds**

Graphically:



How big is the current cyberspace?

A suitable **unit of measurement** could be any smallest "unit" that actors can distinguish and separately contemplate, address, manipulate or alter.



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A suitable **unit of measurement** could be any smallest “unit” that actors can distinguish and separately contemplate, address, manipulate or alter.

Examples: Furniture in a living room
The bricks with which builders construct physical structures
Characters on a keyboard
Telephone numbers of others one may call
Routes to take by car
Pixels of a digital image
Electronic signals
Molecules in controlled chemical processes
Individual bytes in a computer or digital storage medium

Arguably, the most basic unit of measurement is Shannon’s non-dimensional **binary digit** or “**bit**”. Bits allow us to count the number of binary choices available. Bits are also common in measuring the capacities of digital media, computers, and communication channels

Note:
The following *will not confuse* the number of binary choices with measures of information. Information is related to choices, but, as already mentioned, it arises in processes of reading textual matter. Information is not contained in cyberspace.

How big is the current cyberspace?

Proceeding in steps:

- 1 byte is an atomic unit of data in a computer = 8 bits
- A contemporary 400 gigabyte personal computer can store $400 \cdot 10^9 \cdot 8 = 3.2 \cdot 10^{12}$ bits
- With an estimate of one billion 400 gigabyte computers (personal and midrange servers), we have $10^9 \cdot 3.2 \cdot 10^{12} = 3.2 \cdot 10^{21}$ bits collectively available
- Considering the speed of computation, say 3 GHz=$3 \cdot 10^9$ $^{\text{changes}}/_{\text{sec}}$, during one year (1 year = $\pi \cdot 10^7$ sec) we could compute about $3.2 \cdot 10^{21} \cdot 3 \cdot 10^9 \cdot \pi \cdot 10^7 = 3 \cdot 10^{38}$ bits

So: **the size of current cyberspace is ≅ 10^{38} $^{\text{bits}}/_{\text{year}}$**

How big a number is that?

How big is the current cyberspace?

To gain some perspective, consider:

1 bit			$= 2^{1} = 2$ possibilities
1 byte	= 8 bits		$= 2^{8} = 256$ possibilities
1 Decabit	= 10 bits	$= 10^{1}$ bits	$= 2^{10} = 1024$ possibilities
1 Hectobit	= 100 bits	$= 10^{2}$ bits	$= 2^{100} = 10^{30}$ possibilities
1 Kilobit	= 1000 bits	$= 10^{3}$ bits	$= 2^{1000} = 10^{301}$ possibilities
1 Megabit	= 1000 Kbits	$= 10^{6}$ bits	$= 2^{1000000} = 10^{301029}$ possibilities
1 Gigabit	= 1000 Mbits	$= 10^{9}$ bits	$= 2^{1000000000} = 10^{301029995}$ possibilities
1 Terrabit	= 1000 Gbits	$= 10^{12}$ bits	$= 2^{1000000000000} = 10^{301029995664}$ possibilities

Size of cyberspace $\cong 10^{38}$ **bits/year** $= 2^{100000000000000000000000000000000000000}$ **possibilities/ye**

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Size of cyberspace $\cong 10^{38}$ **bits/**$_{\text{year}}$ $= 2^{100000000000000000000000000000000000000}$ **possibilities/**$_{\text{ye}}$

Earth as a computer $\cong 10^{95}$ bits/$_{\text{eons}}$ $= 2^{10^{95}} = 10^{3 \cdot 10^{94}}$ possibilities/$_{\text{time since earth solidified}}$

Everything material (countable) stops much before 10^{100}

How big is the current cyberspace?

Isn’t there technology outside the easily quantifiable digital world?

Sure.

In everyday life we decide on larger meaningful units, *chunks*, for example, we buy whole cars not thousands of parts that need assembling. We look at a photograph holistically, not pixel by pixel. We buy useful software, have no clue of the codes by which it runs, but can conceptualize it adequately in human user terms. However, we could analyze these chunks in very small units in principle and engineers, graphic artists, and software programmers do this in the practice of designing them. Many of these distinctions were unthinkable before digitalization and massive computations in the social world

Today, nearly everything is available in digital form.

- Money has become an electronic accounting algorithm. Trading of stocks and bonds is done on the internet
- Physical buildings exist also in architectural drawings, calculations, images , and permits, long before or as they are being constructed and their digital versions are preserved, perhaps beyond the life of a building
- Political events, elections, demonstrations, revolutions are electronically conveyed and most people would not know about them without their ability to access representations of them in cyberspace
- Education, scientific research, and much of intellectual activity is digitalized

How has cyberspace grown?

Today $\cong$ **10^{38} bits/$_{year}$**

100 years ago and 500 years after Gutenberg:
Assuming10,000 dailies published annually with 10^5 characters each and 1 character of the alphabet amounting to about 5 bits or about $5 \cdot 10^9$ bits per daily plus an equal amount for books concurrently available, our cyberspace had a size of about $\pi \cdot 10^7 \cdot 5 \cdot 10^9 \cdot 2 = \pi \cdot 10^{17} \cong$ **10^{18} bits/$_{year}$**

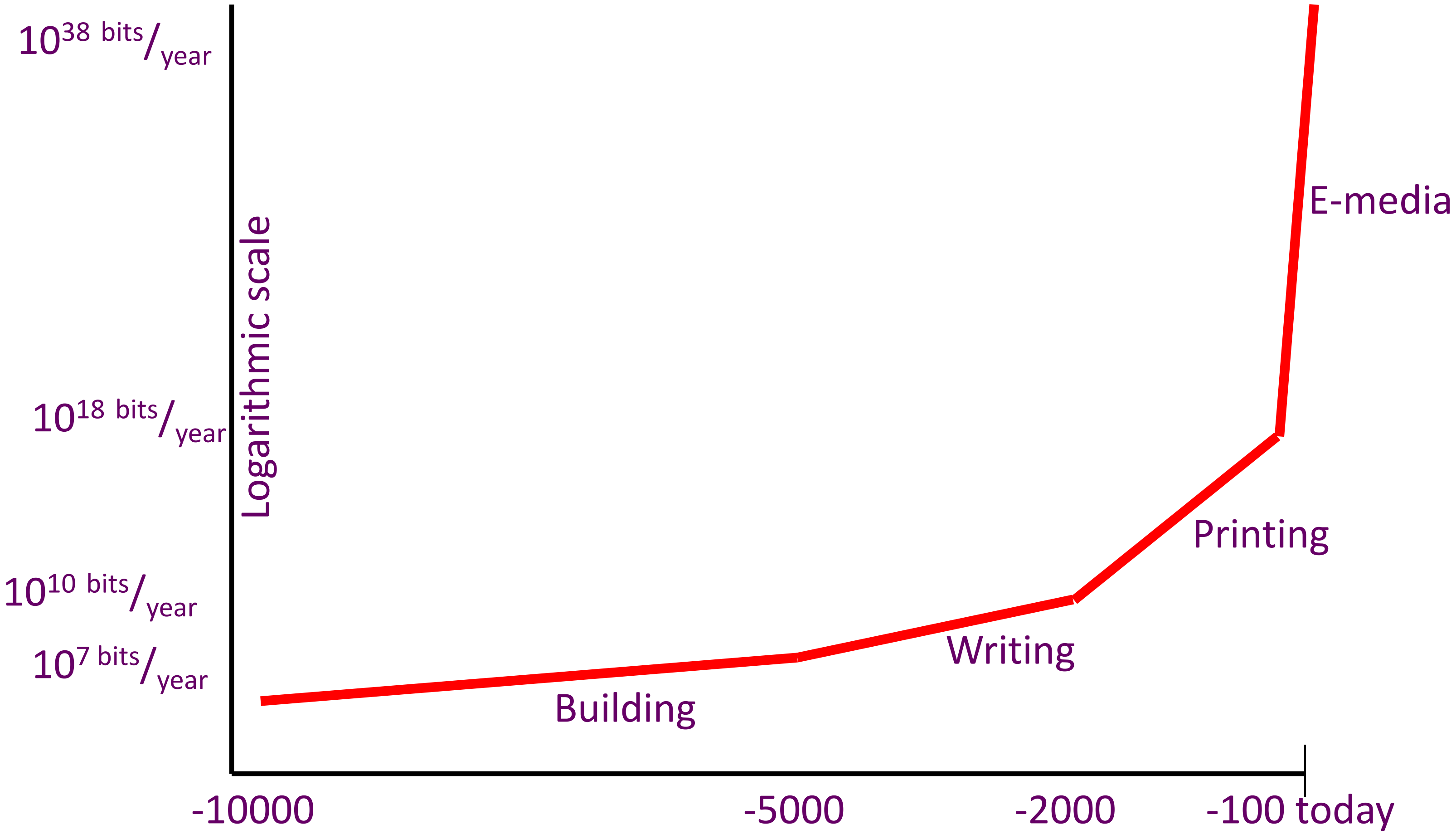
2000 years ago and about 2600 years after the first coherent text was composed:
The library of Alexandria held between 40,000-700.000 documents of, say,10^4 characters each. Assuming 5 times as many documents kept in the world means $5 \cdot 5 \cdot 10^4 \cdot (4 \cdot 10^4 \div 7 \cdot 10^5) = (10^6 \div 1.8 \cdot 10^{11}) \cong$ **10^{10} bits ,** which could be read in one year

5000 years ago:
The great Cheops pyramid in Egypt had $2.3 \cdot 10^6$ stones, took 20 years and 10^5 men to build. Considering the human population, at that time about 10^9, of which, say, 10^7 had the time and ability to build structures:
$2.3 \cdot 10^6 \cdot 10^7 / 20 \cdot 10^5 \cong$ **10^7 bits/$_{year}$**

10000 years ago: (Hunting – gathering society) **<< 10^7 bits/$_{year}$**

Note: these are very rough estimates. However, their order of magnitude is indisputable

How has cyberspace grown?



Quote: *Civilization advances by extending the number of important operation which we can perform without thinking about them*

Bertrand Russell. *Introduction to Mathematics*, 1911, Ch. 5

The artifacts in cyberspace

Some artifacts that populate cyberspace:

- *Data*, texts, and images, organized in files. By themselves, they are inactive patterns, stored in retrievable media that afford categorization (indexing, bookmarking), readings and use.
  Internet archive (2004) $\cong 10^{15}$ bits; Library of Congress (2008) $\cong 10^{16}$ bits; Printed matter in world (2002) $\cong (2.7\text{-}4.4)\cdot 10^{19}$ bits
- Operating systems and auxiliary *software* for manipulating data files, managing connections, transmissions, networks, coordinating various software applications, various models (of the world), and supporting human-computer interfaces. Say, 20% on all computers $\cong 2\cdot 10^{20}$ bits
- *Assistants,* operationalizing routine human activities e.g., searching, networking, surveying, executing programmed decisions, protecting one's space from intrusions
- *Systems* that limit use to privileged users, e.g., in the military, banking, privacy
- *Self-replicators* – viruses, worms – designed to be largely outside user's control

Most of the unattended cyberspace is available for coordinating computers, creating fast and often short lived *networks*

The artifacts in cyberspace

What have artifacts in common?

- They are **designed** by someone, not found in nature (neg-entropic)
- They occupy space
- Their location is largely uncertain and irrelevant to their users
- They are intended to resist entropic decay during their tenure in cyberspace
- They are combinable, can be brought into interaction with one another
- They are installed, activated, monitored and used from human-computer interfaces
- Only a very small portion of these artifacts is revealed on these interfaces

  Consider:
  - One 4-color computer monitor makes about 10^6 bits available at 200 Hz. $\cong 10^8$ $^{bits}/_{sec}$. With 10^9 users $\cong 10^{21}$ $^{bits}/_{year}$ = $1/10^{17\ th}$ of the size of cyberspace
  - Of this amount, individual human users can translate into actions (attribute significance to) only a variously estimated small fraction of what is available on a monitor: Reading $\cong 140$ $^{bits}/_{sec}$; typing $\cong 28$ $^{bits}/_{sec}$, – evidently enough to monitor and manipulate ones artifacts, but << 10^8 $^{bits}/_{sec}$

This leaves most of cyberspace inaccessible to human users

In which sense has ours become a design culture?

There can be no doubt that the enormous size of cyberspace and the nature of society have co-evolved.

There is a tradition of distinguishing stages in the development of society by naming the dominant organizational forms or philosophical doctrines of their time. E.g., the mythical dark age followed by the age of enlightenment (renaissance). Marx's feudalist, capitalist, socialist and communist societies. Industrial and post-industrial eras. Information society

I do not propose a theory of social development but suggest that all too often, present societal conditions are ill-conceived and prematurely labeled.

- Contemporaries may not recognize the sea changes that underlie current societal conditions. Even social theorists, capable of systematic comparisons, may be blind to the macro effects of their micro participation. I suggest that the idea of our society as *a global information society* addresses only a surface phenomenon conceptualized in terms of a bygone era: the renaissance idea, true for all humans alike, that rational decisions require correct information .
- I contend that the most outstanding feature of contemporary society is its use of cyberspace, which has penetrated all spheres of contemporary life: the ability, willingness, permission, and value to discursively construct one's identity jointly with others, the worlds in which we can live together, and various social and material artifacts that support our lives therein.
  Let me be specific:

In which sense has ours become a design culture?

What is design?

Design is any activity that changes existing conditions to preferred ones.

Herbert Simon, The Sciences of the Artificial, 1969

My Definition: *Design converts discursively created possibilities into desirable futures*

We all are designers of our identity, our social worlds and the artifacts we live with:

- Wearing personally desirable clothes
- Reconfiguring one's computer, installing the software of ones choice
- Organizing a meeting such as this
- Managing an organization, creating a business
- Participating in a political campaign to elect a promising candidate for office
- Surfing the internet
- Texting with friends, communicating on Facebook, and partaking in social networks
- Programming a new application

Designing is common and fundamental to being human

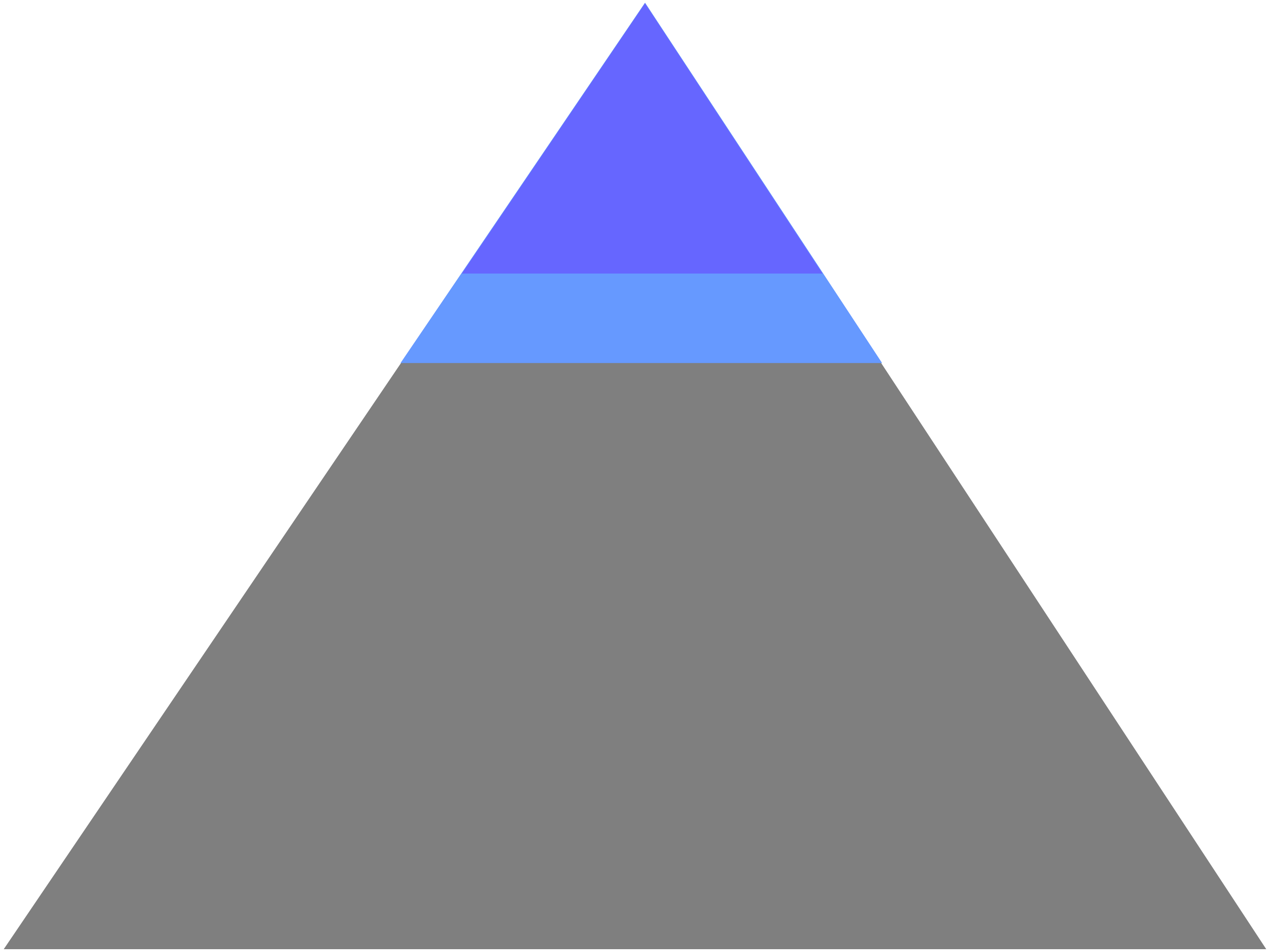
Professional designers propose novel artifacts of use *to others.*
Such design activity is a social process, affecting the future of communities and requiring stakeholder networks to realize artifacts

In which sense has ours become a design culture?

- Perhaps for the first time in human history, the size of cyberspace has exceeded the number of choices that existing human populations are capable of making
- Members of contemporary society are offered far more meaningful choices than ever before. There is more freedom:
    - To acquire and use artifacts in unintended and novel ways
    - To interpret texts variously – denying information content universalisms
    - To search for, find, and connect with nearly everyone
    - To oppose social theories and conventions (rendering them invalid)
    - To create new ways of doing business and engage in novel political actions
- The extraordinary increase in the number of options and its wide distribution has made social structures more fluid and transitory
- Voluntary participation in social networks increasingly replaces subordination to hierarchical authority structures
- The value of constructing social reality, of determining one's future, is retiring the value of accepting and understanding how things are
- Organizations compete by innovation, not for power
- Social scientific inquiries into what exists (or existed in past data) has become increasingly impotent in predicting what is going on in a design culture

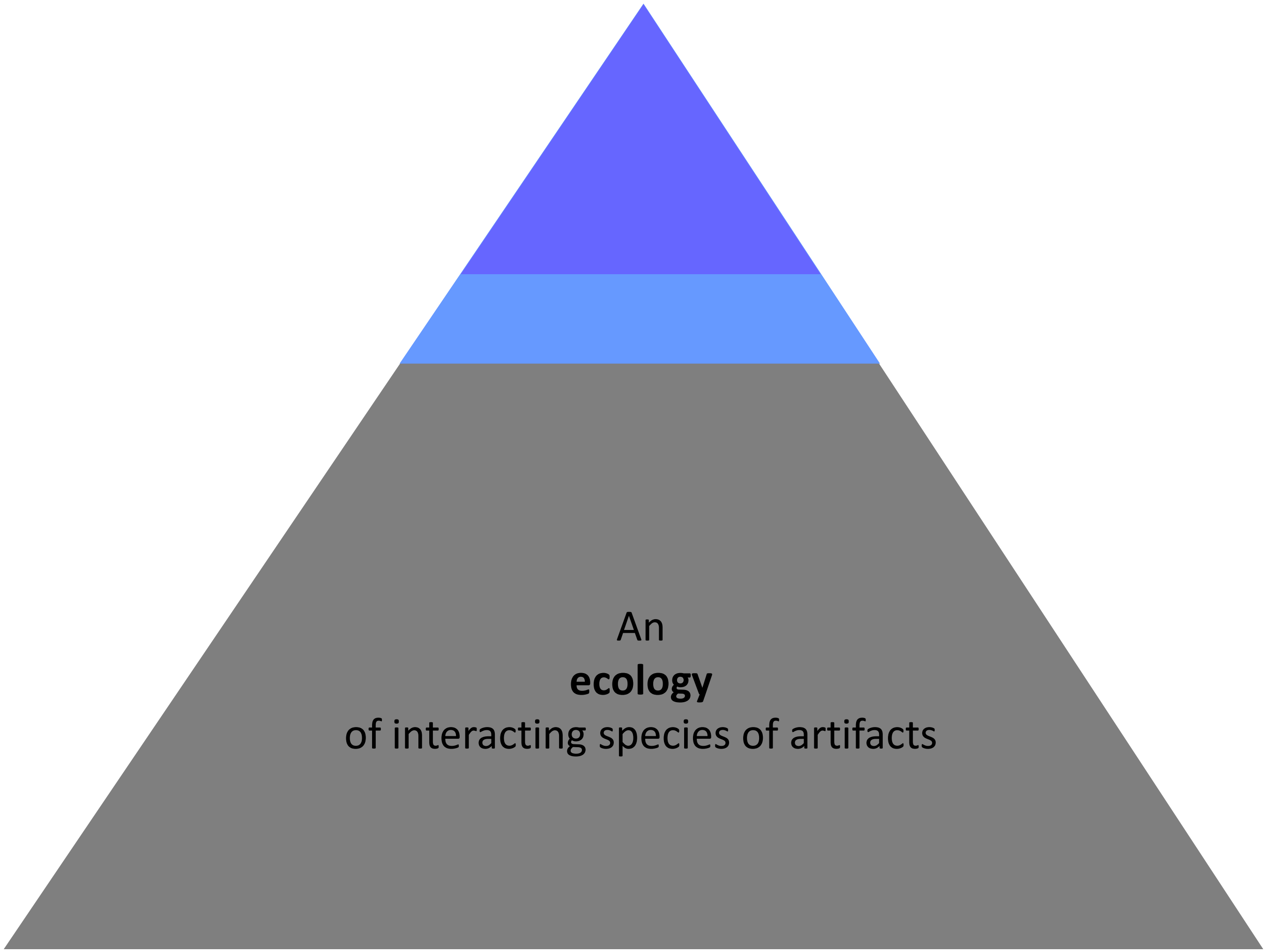
Understanding a design culture means participating in it

Three models appropriate for handling cyberspace in a design culture



Three models appropriate for handling cyberspace in a design culture

(1) Within cyberspace: **An ecology of interacting species of artifacts**, partly observed at user interfaces



Three models appropriate for handling cyberspace in a design culture

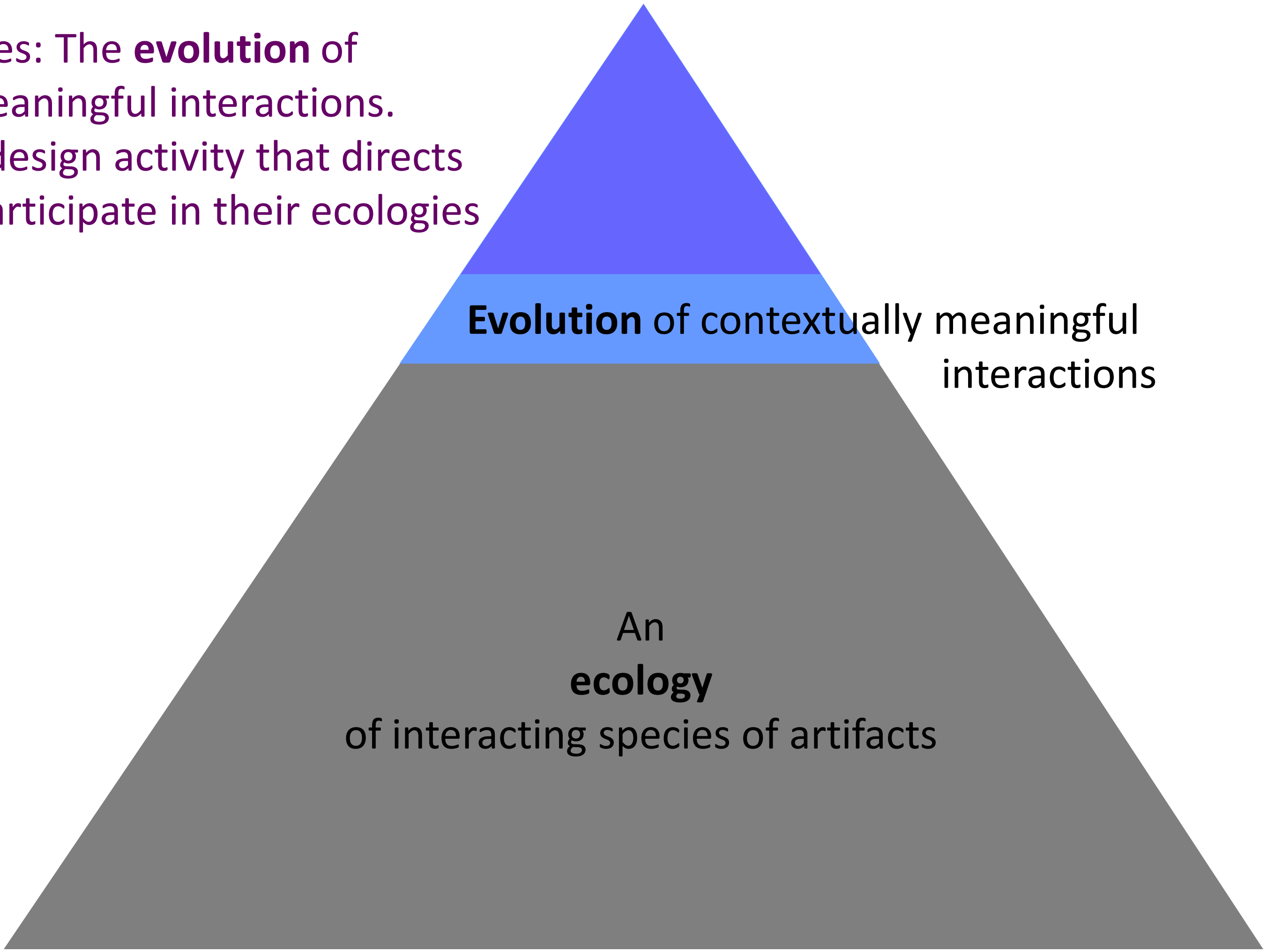
(1) What constitutes an ecology of artifacts?

- Artifacts occur **as species**, classes of identical or very similar artifacts, e.g., search engines, operating systems, software applications, occupying niches on their users' machines. Species are maintained by replacing defective artifacts
- Artifacts move into (or find) **niches** provided by human habits of use
- Artifacts **interact** with one another
  - **Cooperatively** by forming mutually supportive cooperatives, e.g., various software applications for Microsoft Word, gadgets for the iPod, additional hard drives for PCs
  - **Competitively** when one is retired and replaced by another that does something better, faster, or has more features
- Artifacts tend to **evolve** into increasingly resilient **super species** of artifacts, empires, not necessarily designed as such by anyone but resulting from how users collectively connect them
- Unlike ecologies of animal species, ecologies of artifacts depend on how the **individual members** of stakeholder networks interface with their artifacts in cyberspace – all from their individual computers
- Yet, an ecology of artifacts cannot reveal itself on individual interfaces

Three models appropriate for handling cyberspace in a design culture

(1) Within cyberspace: **An ecology of interacting species of artifacts**, partly observed at user interfaces

(2) Within interfaces: The **evolution** of contextually meaningful interactions.
Interfacing is a design activity that directs
How artifacts participate in their ecologies



Three models appropriate for handling cyberspace in a design culture

(2) **Within the interfaces** between cyberspace and stakeholder networks, activities essentially are **collective design activities**.

Specifically they are:

Interactive

- Users' conceptions of cyberspace derive from and enter the language used within their stakeholder communities
- Users' conceptions unfold into sequences of meaningful interactions that simultaneously alter the computational artifacts and observations of them

Evolutionary , progressively cultivating desirable artifacts and interactions:

- Creating or recognizing presently available possibilities
- Eliminating possibilities that are incomprehensive or presently undesirable
- Realizing (making real) those possibilities that matter
- Leaving enough possibilities for future considerations

Constructive

- Building on existing artifacts by improvement, re-combination or fusion (learning)

Reflexive

- Acquiring an understanding of artifacts in the very process of designing them
- Shaping the very stakeholder network that shapes their stakeholders

Three models appropriate for handling cyberspace in a design culture

(2) **Within the interfaces** between cyberspace and stakeholder networks, activities essentially are **collective design activities**.
Studies have identified the involvement of three individual human intelligences:

Contextual

- The ability to read texts much like the members of one's community reads them
- Being accountable for one's actions to members of one's community, e.g., for the proper use of artifacts, adequate reading and interpretation of text as informative
- The ability to coordinate one's understanding and actions with members of one's community, e.g., the ability to participate in stakeholder networks

Economic

- The ability to budget one's attention to different activities of daily living, including spending time on the internet, with friends, and work for income
- The ability to make use of resources available through cooperation with stakeholders or spend resources to oppose them

Creative

- The ability to deviate from established practices, improve, innovate, combine existing artifacts or practices into unprecedented forms

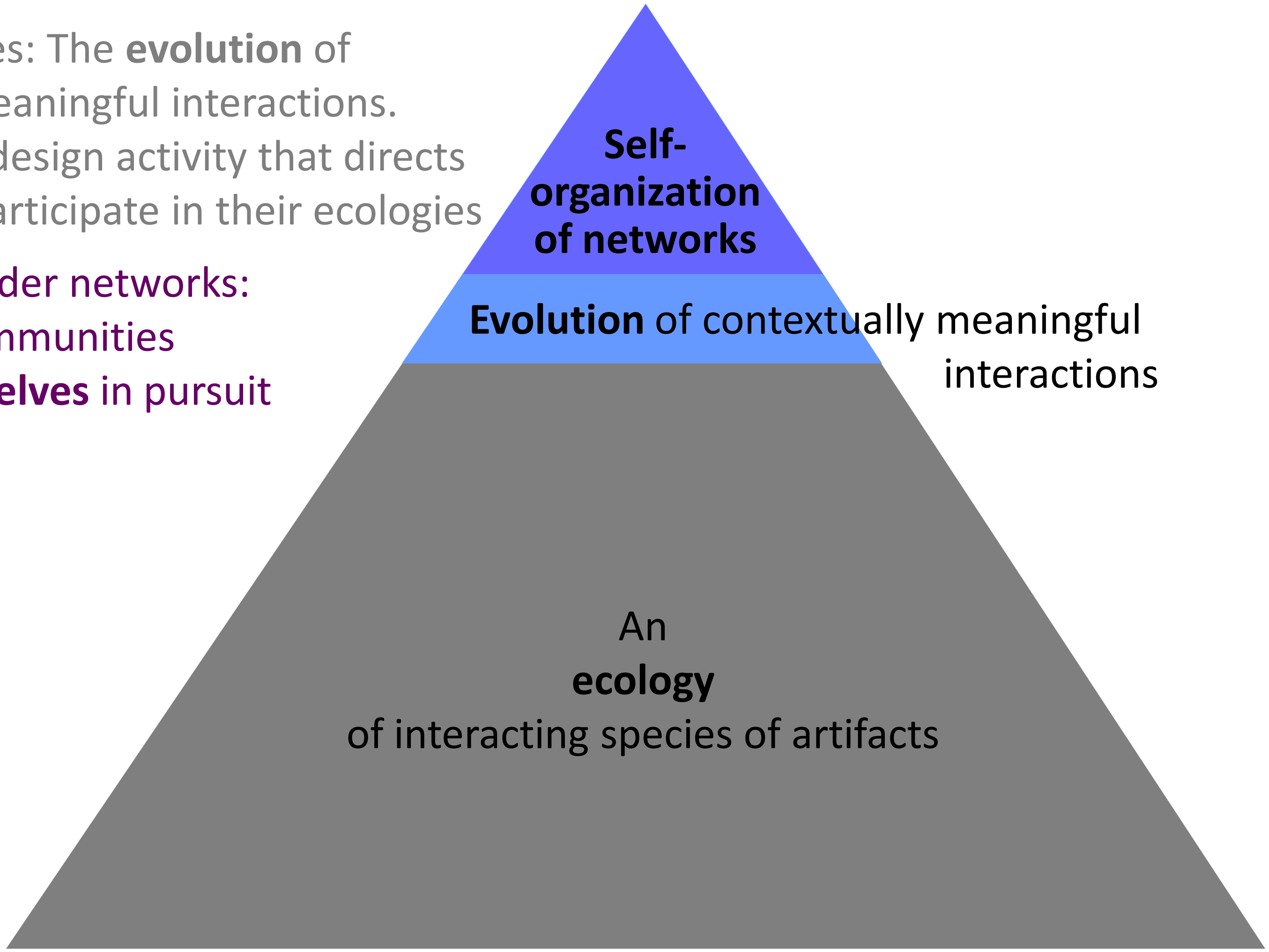
These intelligences are common to all humans but not representable algorithmically

Three models appropriate for handling cyberspace in a design culture

(1) Within cyberspace: **An ecology of interacting species of artifacts**, partly observed at user interfaces

(2) Within interfaces: The **evolution** of contextually meaningful interactions. Interfacing is a design activity that directs How artifacts participate in their ecologies

(3) Within stakeholder networks: Stakeholder communities **organize themselves** in pursuit of their stakes



Three models appropriate for handling cyberspace in a design culture

(3) What are stakeholder networks?

Stakeholders – individuals, communities, as well as organizations:

- **Have specialized stakes** in the development or maintenance of particular artifacts, are capable of asserting their interests in them, and investing their resources in support or opposition to what they mean to them
- **Are motivated by the possibilities** they see in furthering an idea (a design proposal), improving their own situation, or securing favorable positions within their community or stakeholder network – values or attitudes are secondary
- **Organize themselves into networks** of stakeholders pursuing common stakes, which, in collaboration, can achieve more then any one individual stakeholder can, e.g., in systematically transforming an idea into an artifact that works. Self-organization has been informed by co-orientation theory, suggesting that communication is always about something shared, and that language involves con-sensual coordination of actions. Some networks persist over longer periods in time being fuelled by new ideas, others disappear after accomplishing their objectives – always leaving something behind
- **Individuals** may appear to act on their own, e.g., as computer users, but **are accountable to the members of their communities or stakeholder networks.** They derive the concepts of their interfaces by discursively participating in stakeholder networks, and affect the ecology of artifacts through creative actions

Three models appropriate for handling cyberspace in a design culture

(1) The **ecology** of interacting species of artifacts
(2) The **evolution** and cultivation of contextually meaningful interfaces
(3) The **self-organization** of stakeholder networks

Share their definability on **possibilities**:

- The possibilities in cyberspace that allow artifacts to be designed and used
- The possibilities that appear on the human interfaces with computers and give rise to the design, implementation, and responsible use of computational artifacts
- The possibilities of self-organization of social networks around a common stake. Stakeholders are capable of articulating their stake, defining each other discursively, and negotiating the networks of their cooperation around their stakes, which are possibilities in language and discourse

Human behavior in these models is not predictable in the strict sense of continuing patterns observed in the past. In a design culture, present possibilities and ideas of desirable futures – both **discursively constructed** – are the attractors of novel behaviors

Contemporary cyberspace is too big, the ecology of its artifacts too massive, and the stakeholder networks too fluid to be modeled by mechanisms that reflect an earlier culture of obedience to authorities, compliance with consistent ideologies or rationality, and willingness to give up ones freedom of choice for income

The problem is not better models but participating in designing the phenomena of interest

Some inadequate approaches (modes of explanation)

- Using **linear causal** or **computational** explanations for the growth of technology, digital media, etc.

  The essential feature of cyberspace is its *variability* – providing users spaces of possibilities and uncertainties that can give rise to novel artifacts and purposeful interactions. Technological developments and use are *not causally determinable* and notoriously unpredictable. They arise from what humans *can* and then do create

- Ascribing **human agency** to computational artifacts

  Artifacts in cyberspace follow algorithms. They may well be complex mechanisms but nevertheless are deterministic. Insensitive to their own histories and design, they *operate in the spaces of their programmers and users,* not of their own. They may assist users but only *within the reflexive loops of human agency*

  Computational assistants have neither contextual, economic, or creative intelligence, which are essential for human agency, including interfacing with computers

  Modeling humans in terms of attitudes or values they allegedly possess and assuming they would react predictably to messages expressing them cannot explain the ordinary use of language much less the creative expansion and use of artifacts in cyberspace

Some inadequate approaches (modes of explanation)

- Assuming **information content universalism**, the idea that messages contain information whether one understands them or not, culminating in the claim that we live in a global information society

  This assumption follows from the misguided use of the well known container metaphor, which blinds researchers to the diverse *significances that users bring to data and to the behavior of computational artifacts*. The use of this metaphor fosters intellectual imperialism and blinds researchers to culturally diverse readings

- Subscribing to a **representational conception** of language and discourse

  Since Wittgenstein and subsequently Austin, Searle and Rorty, we know that the conventional conception of language as symbolic or representational covers only a small part of language use. Representational notions are implied in the use of computational artifacts *as models* of something modeled and in scientific theories *about* something theorized.

  The kind of futures that design activities envision do not represent anything (yet) but may motivate stakeholder networks to form with the possibility of realizing them.

  Undoubtedly, language drives design culture and discourse makes it happen. If one wants to know what will happen, one needs to participate in languaging desirable futures into being.

Some inadequate approaches (disciplinary explanations)

Uni-disciplinary perspectives always tell only part of any story. Cyberspace is complex and escapes traditional approaches, usually ignoring what is significant to its human users

- **Natural scientific models** represent what exists from the perspective of detached observers. Such models are not self-reflexive, deny scientists' involvement in what is modeled, cannot cope with natural language use, and are blind to discursively established futures that design activities bring forth
- **Sociological models** are able to describe social networks, power relations, and social transformations as long as they persists, are recurrent or ergodic. They do not shed light on how one can deviate from norms, what participation can bring about
- **Economic models** formalize the rational use of a common currency (common values) or the implications of shared irrationalities. They fail when there are many locally managed "currencies," such as the attention individuals pay to diverse artifacts in cyberspace and in social life – which is what determines internet use
- **Cognitive models** concern phenomena that are abstracted from individual language use (e.g., decision making, reasoning, routine interfacing), are constructed in the conviction that cognitive universals exist, supposedly underlying all human behavior, but are unable to account for the creative participation in cultures and the self-organization of larger social systems, using conceptions conveyed in language

Recap

- Cyberspace is not a metaphor. It has a quantifiable size and contains artifacts
- Its historically unprecedented growth has by far exceeded the capacity of human populations to track the possibilities it offers them, ushering in a design culture
- The accelerated dynamics of this design culture casts serious doubts in the usefulness of enlightenment sciences which seek to generalize the stabilities of an existing world. In a design culture, the point is to construct viable alternatives
- Information emerges in the use of artifacts and requires contextual intelligence by which readers relate to their community. Information is not contained in cyberspace
- Faced with numerous possibilities, interfacing with artifacts in cyberspace calls for interactive, evolutionary, constructive, and reflexive (participatory) design models
- By claiming stakes in a proposed future, commanding resources to realize, improve or oppose it, stakeholders organize themselves into cooperative networks that are motivated by concerns for these futures and disappear with these concerns
- In cyberspace, artifacts are designed purposefully, utilizing contextual, economic and creative intelligences. However, an ecology of artifacts is driven by collective human involvement. Ecologies in cyberspace exceed individual comprehension
- To understand relevant parts of cyberspace is to participate in the design of artifacts that demonstratively survive the ecological interactions they face

Recap (Recommendations)

Some recommendations for modeling social phenomena in a design culture:

- When the modeled phenomena are routinely performed or mindlessly executed, then computational algorithms may well account for them and simulations as well as statistical accounts of such phenomena may well succeed. Where design is involved, I doubt the validity of predictions with the help of computational models.
- Modeling social phenomena without reference to the discourse that constructs or performs these phenomena says more about the conceptions of the modeler than about the phenomena modeled
- Algorithmic models of human participation in social phenomena tend to draw on old social theories – Marx' determinisms, Parson's functionalist action theory, all assuming that humans are programmed to react to stimuli and behave predictably once their attitudes are known. Today, such easily programmable theories are highly unrealistic.
- Generally, models serve purposes for which the modeler ought to assume responsibility. When they inform policies that affect the modeled, models need to account for their effects on the modeled or become invalid. I.e., models of social phenomena should be reflexive.
- My strongest recommendation: **Do not theorize or model social worlds in which you couldn't live.** I.e., life in a design culture cannot be modeled by omitting the use of discourse in directing ecological, evolutionary, and self-organizing processes

Brief comments on content analysis and text mining in cyberspace

I was asked to comment on content analysis, sentiment analysis, and opinion mining or text mining more generally. Time did not permit me discussing these comments. Following are the slides I intended to draw on.

Brief comments on content analysis and text mining in cyberspace

- Both apply measurement models to large bodies of data, texts, and images
- Both serve stakeholders' interests in the sources or users of such data, not in understanding cyberspace
- Their findings become uncertain when such data are in flux, e.g., websites, blogs

Text mining (and its relatives, including computer content analysis) seeks statistical accounts of selected features of digitized texts without human involvement.

- Its features are selected for their relevance to particular stakeholders.
  Often these features are implicit (not articulated) in a chosen application
- It is blind to contextual and creative intelligence and cannot process meaning and information, often falsely assumed to reside in texts but actually arising in use
- Sentiment analysis and opinion mining are misnomers. The mined texts are merely read by the researcher and their clients alike – as representations of sentiments or opinions
- Reliance on words or simple expressions severely limits the claims of this research:
  - Sentiment analysis – computes distributions of bipolar emotion words or simple expressions (readable as opinions) in a body of documents
  - Profiles – categorizing the linguistic environments of targeted concept words
  - Co-occurrence analysis – CATPAC – clustering word proximities
  - Ecological and epidemiological models have been applied to texts

Brief comments on content analysis and data mining in cyberspace

Content analysis *provides replicable and valid inferences from texts (and other meaningful matter) to the context of their use*

- It relies on established analytical constructs to justify the inferences it provides
- While widely practiced in the social sciences, content analysis has produced only a few proven analysis types, best seen as computer aids, not as complete content analysis systems, e.g.:
    - Attention analysis in conceptual categories (dictionaries) for selected topics
    - Analysis of the attributions of selected expressions
    - Semantic network analysis of kernelized propositions
    - Evaluative assertion analysis of kernelized propositions, one evaluative
    - Contingency analysis of associations
    - WORDNET to obtain word usages
    - KWIC tabulations and concordance software for analyzing word contexts
    - Search engines to sample relevant documents
    - Qualitative data analysis (QDA) software for human coding, then computationally tracking assigned codes and developing models of texts
- Although computer aids have vastly expanded the analyzable volumes of text, sample sizes are limited by the costs of using human coders
- Coding reliability assured, content analysis exceeds text mining in social validity

Thanks for listening

I welcome a discussion of the issues raised

Three references

Cyberspace: Klaus Krippendorff, *On Communicating, Otherness, Meaning, and Information*. Fernando Bermejo (Ed.) . New York, Routledge, 2009.

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