**Neolithic Information Seeking:**

**Designing Information Systems for our Inner Hunter-Gatherer**

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[SLIDE 1]

[SLIDE 2]

Thanks for inviting me to speak...

Today I want to challenge our usual assumptions about the way we think about searching online, and the way we design for search. Google is so powerful and effective as it is that it blots out our awareness of what it is not doing, the possibilities it is not exploring. (Now, of course, I have no idea of what Google is doing inside the company; I can only respond to what is publicly visible.)

One way to challenge these assumptions is to go back to the first principles of what information seeking was like in the early days of our new consciousness as homo sapiens, when most humans were hunter-gatherers. The late Paleolithic or the early Neolithic era is a good time to pick because about 12 to 15 thousand years ago, most people were still hunter-gatherers, though agriculture was just beginning to be developed. We had had language for tens of thousands of years, but had not yet invented writing, and spent most of our days either in camps processing food and clothing, or out hunting for animals and fruits and roots to eat. In fact, moving around in a terrestrial environment to find food, mates, and so on, is what all our terrestrial forbears, all land animals, had done since time immemorial.

[SLIDE 3 camp]

It is helpful to start at such a point, because it’s very easy to be captured by our very recent history. We have lived all our lives in a highly literate, very dense, media-drenched environment. It is hard to recapture even the more recent time when an illiterate Renaissance farmer gasped with astonishment when he first saw paintings by Giotto in his local church.

So, starting with some thinking about natural hunter-gatherer information interaction, I am going to go on to sketch how we might make searching much more stimulating, fun, and natural-feeling.

So what was this more original state that we lived for so many millennia? In those days, people spent their lives either in camp, or out in the surrounding area hunting for food—animals, plants, roots, etc.

[SLIDE 4 Four men]

So let’s start with our hunter-gatherer. To avoid male/female stereotypes, I’ll give our hunter/gatherer an ambiguous name—Glorg.

[SLIDE 5 empty forest path]

Now, let us suppose Glorg goes out on the trail one morning. Glorg’s people have had language for tens of thousands of years, and these are the thoughts that go through Glorg’s mind while walking through the forest.

...Ummm, beautiful morning. Oh, look at that little white mushroom over there. Are there any more like it, or is that just the first early one? [Goes over to where the mushroom is, bends over and looks at it.]

Oooh, didn’t we get some of those during the last moon? And there aren’t any more around here. I think this is probably the *last* of that breed of mushroom for the year. [Goes back to the trail.]

[There’s some rustling on the other side of the trail. Glorg looks that way.]

Ooh, that’s some little animal. If we are lucky, that will be a rabbit; if not, it may just be a squirrel. [Glorg peers in that direction, looking closely at the underbrush.]

Ooh good. That’s rabbit droppings. I’ll tell Gleenk back at the camp that there is a rabbit in this part of the forest.

[Glorg moves on down the path.] Ooh, there’s a bear paw print.

[SLIDE 6 bear print] Forgive the 21st century accoutrements on this image.

Oh no! That’s that big old nasty bear that had the injured paw. You can still see the scar in the paw print. Darn. We thought we had gotten rid of him.

[Glorg continues down the trail. Off to the left, a large patch of berry bushes is visible. Some humans are over by them.]

[SLIDE 7 berries]

“Hey,” says Glorg, “what are you doing picking berries there? My Turtle clan is the one that dug that trench from the stream down to the berry patch to keep it watered.”

“Yes, yes” the other responds. We gave you those reindeer furs in exchange for a big basket of berries, remember? See? Now we are picking the berries.”

“OK” says Glorg. “But just to the top of the basket, and no more.”

During all this process, Glorg is glancing around every which way, looking for signs that might be informative about the availability of animals and plants to eat, about whether humans are impinging on their territory, and so on.

Now let us suppose we have a modern equivalent. Someone named G.L. Org. Suppose G.L. is going to a conference such as this one. G.L. hopes to pick up new ideas, find out the latest happenings with competing companies, and so on.

Here’s a CHI2017 reception hall.

[SLIDE 8 CHI]

Here’s another view of it.

[SLIDE 9 2nd CHI]

Here’s a pathway through the exhibits of a conference.

[SLIDE 10 local exhibit sight]

Here is a reception designed to make it easy for people to meet each other.

[SLIDE 11 reception]

Here’s an even larger exhibit hall.

[SLIDE 12 big exhibits]

Everywhere G.L. goes, there are people and displays. It has long been said—and also well-established through research—that it is the conversations in the hallways that are the most important part of conferences, not just the conference presentations.

So, let us suppose G.L. is wandering through all the spaces shown in these images, the exhibits, the hallways, and so on, and this is what goes through G.L.’s mind:

[SLIDE 13 small exhibits again]

“Oh, there’s that book by so-and-so. Is that a new edition, or is it the one I saw at the last conference? No, it’s not a new edition. Good to be reminded of it though. I should look at it again.”

G.L. moves into a reception.

[SLIDE 14 reception]

“What an interesting doctoral student I’m talking to at this reception. Looks really promising—very sharp. I’ll have to tell the recruitment committee to keep an eye out.”

[SLIDE 15 big exhibits]

{moving on to the exhibits...} “Oh lordie! There’s old Dave Jones. He had that massive heart attack, and we all thought we’d gotten rid of that old so-and-so. He’s a clever guy, contributed a lot to the field, but he’s so aggressive. He’d just as soon wipe out a little fledgling startup for breakfast, as play fair.” I’ll have to tell everybody back at work that he’s returned.”

[G.L. continues down the row of exhibits.]

“Oh, here’s the exhibit by our frenemy in the next industrial park over. We got some useful code from them, but we always have to worry about them stealing our good stuff too. It’s kind of tricky to negotiate. Let’s see how their new software works.”

Are we noticing any similarities here between these two scenarios? The old bear with the injured paw, and Dave Jones with the heart attack, and so on.... Both Glorg and G.L. Org are using the same fundamental capabilities and inclinations. They are both looking to promote and enhance their survival in a competitive and ever-changing world. They are collecting and assessing information continuously.

This guy

[SLIDE 16 local exhibit]

is doing the same thing as these guys are:

[SLIDE 17 Four men]

I would argue that these patterns of hunting/gathering behaviors have developed over the millennia; the ineffective behaviors have been culled, and the effective behaviors reinforced.

[SLIDE 18 of key text in last ¶]

These modes of coping with an unpredictable world are very deeply embedded in our behaviors, and are the first that we resort to when exploring generally or when needing some particular information.

There’s an old Peanuts cartoon in which Charlie Brown’s sister says she has to write a report on George Washington. However, she’s sitting watching TV and Charlie asks her, isn’t she going to write the paper? She says, “Oh, yes, maybe there will be something about Washington on TV tonight.”

Charlie Brown’s sister is just doing what comes naturally. Now that we live on our mobile phones, and have ludicrously easy access to information, why not make the pursuit of the information feel as close as possible to these natural tendencies? There is a vast literature in information behavior research that shows that the single most confirmed result is that people use the principle of least effort. I think it’s not that they are being lazy; rather, they are just doing what comes naturally. Letting information come to them, when moving through the appropriate environments.

Most of what humans have learned during their lives comes through their daily activities as a matter of course. Going out hunting and gathering, we look this way and that, and things catch our eye. We go up, check them out, take them or not, and move on to the next part of the forest.

So, what does walking through the woods have to do with searching at a computer? Not enough, is my answer.

We are all familiar with the graphical user interface and the desktop metaphor, which originated in the 1980’s. The desktop metaphor as a guiding concept for computer interface design is pretty much passe these days, in an age of mobile phone access and the Internet of Things. But it still lingers far more in our computer environment than it really should these days. Especially, in systems for finding information.

There always was a problem with the desktop metaphor.

[SLIDE 19 of top of desk.]

The physical desktop is horizontal, and the computer desktop is vertical. I remember when I was first exposed to the concept of the desktop. I understood what they meant and all, but the metaphor never really “took.” I never really felt that the computer screen was like a desktop.

[SLIDE 20 of book cover]

On this book cover, here’s another photo of a real, old-fashioned wooden desktop, with the indentation for the pen and the hole for the inkwell. I couldn’t resist including this. I lived in Honolulu for four years as a kid, and maybe they were a bit behind the mainland, because I actually had a desk like this, complete with inkwell and nib pen.

[SLIDE 21 nib pen]

We had to dip the tip of the pen in the inkwell each couple of words to keep it inked for our handwriting practice.

Anyway, so back to our friends Glorg and G.L. Org. They are most definitely not staring at a flat desktop, when they are living their lives, and picking up information as they go along.

[SLIDE 22 Google entry screen]

Oops! Maybe they are staring at a blank desktop. This isn’t the most native way to find information.

In fact, in real life we pick up a lot of information through implicit absorption, or, what I call “wallpapering.”

[SLIDE 23 Wallpapering]

**[Implicit absorption, or, “wallpapering.”** In other words, the information is in the environment one is immersed in and one picks it up inattentively, but effectively.]

We also pick up information in a lot of ways that Google-type command input is not well-adapted for. Here are five of these alternative modes of information pick-up.

[SLIDE 24 forms of info acquisition]

“Running across” wanted information accidentally or serendipitously.

Running across “unrelated” information that we suddenly recognize as relevant.

“Noodling around” by casually examining informative materials without a purpose.

“Keeping an eye out” for certain information, but not actively searching for it.

“Monitoring” streams of information that often prove productive.

One can do most of these things through Google, but the interaction mode is not well-suited to these modes of information seeking, and I think there are much better ways to enable people to do these things—ways that feel natural and fun.

Here, James Gibson’s work on perception and attention is relevant. Gibson got his start teaching pilots to fly in a simulated way in World War II. He was surprised at how difficult it was to teach them, unless he was able to reproduce the real-world experience of seeing the ground below and the sky above.

This was the root of his whole theory of perception—that we are animals, and like other animals we move around on the earth. The ground below and the sky above is the universal land animal environment; it is how we orient fundamentally. We not only perceive the specific things we are attending to, we also always have the global context in mind, the world housing what we see, and providing the anchoring understanding of the world as sky above and earth below.

[SLIDE 25 p. 112]

This drawing is from Gibson, where he demonstrates what we actually see when sitting in a chair. Likewise,

[SLIDE 26 near exhibits]

as we move through the conference, we are noticing people and places of interest, attending to them, interacting with them, and then moving on, picking up information all along the way.

What a contrast between this

[SLIDE 27 Google]

and this

[SLIDE 28 four men]

So, the question I raise is how can we make the experience at a computer or mobile phone or whatever feel more like this world that we have lived in for most of the entire history of our species?

Notice that one of the most popular forms of entertainment on the planet—video games—is based on this earth-below, sky-above model.

[SLIDE 29–video game scene]

So, instead of the desktop, can “walking through the world” be our metaphor instead?

[SLIDE 30]

The irony of the Google start page is that they cleverly seized the high ground by making their page into a sharp contrast with all other pages by keeping it bare of almost any decoration. The difference between this

[google SLIDE 30] and this, for example

[sears SLIDE 31] is dramatic.

I say “ironic” because in real world interaction with information, we are almost never confronted with such a sterile landscape.

[SLIDE 32 Google]

The problem is, that the use of this screen real estate is seen almost entirely as an opportunity to sell, not to search for information.

What if, instead, we started with a “walking through life” environment,

[SLIDE 33 woods]

and added functional icons representing various types of search moves that we could engage in—a classification tree showing relationships, word clouds and clusters, thumbnail visuals to browse, sliders for date ranges, and so on.

Here are some of the icons we could have, each leading to a search technique and design feature.

[SLIDE 34 icons]

[SLIDE 35 duplicate]

But now suppose we see ourselves actually moving along a search trail, and able to take side trips, or add overlays to our search so far.

Here is Charlie Brown’s sister’s George Washington quest

[SLIDES 36-39 Geo Wash]

Here is anotheer quest related to a topic closer to the heart of this conference.

[SLIDES 40-43 VR prototyping]

My visualization here is very crude, but there are many talents in the industry who could realize this in a far more exciting and stimulating way. There are tremendous possibilities with this approach—far more interesting ones than I am able to suggest here. Video game designers could make this search very interesting, and do it in a way that still enables the searcher to feel rooted in an environment, and not lost. However this is implemented, it should always be possible for the searcher to pull back and see the whole route they have taken to this point.

[SLIDE 44] GG park

The fundamental approach that I am arguing for is to create an *immersive* experience, rather than a *command* experience for the searcher.

[SLIDE 45] immersive vs. command experience

***Command searching***: Ordering the system to get information on the topic you name.

***Immersive searching***: “Moving-through-life” searching, immersed in an information-rich world, with ingeniously designed paths to explore, learn, and extract information. Ideally, moving through this environment would enable one to meet one’s actual needs, even if not yet fully articulated or understood.

Google is a command experience. Anything that goes into the system, you must produce with a consciously-labeled term. Then Google goes off and does its black-box thing, and returns with a set of results. Command-fetch-return result. But what if you hardly know how to articulate what you want at this point? Or, suppose the results don’t feel quite right; what do you do now? You really have no clues, and none of the context that you have in the real world.

Suppose instead, you experience your search as moving through an environment that provides various possibilities as you go along, various alternative paths to take. It could instead be a looking-things-over, a looking-at experience, and picking and choosing what you like, on a tentative basis, until you are confident that you have found just what you really want.

In such a case, you should always be able to keep track of where you are in this imaginary real world. You could back up to see the overall route you have taken, see a list in the corner of the screen of the things you have already explored, or whatever, but you see the whole picture, physically, geographically, rendered.

[Chris slides 46-49 [repeat 40-43]???

My points so far:

• Let’s tap into and use the ground truth of human experience of having the ground below and the sky above. We don’t always have to portray a physical environment, but on the other hand, why not? However, that orientation to the physical world should always be at least implicit. The searcher is moving into the world along a path.

The searcher might then proceed down the path, with the ground below and the sky above, with various markers and indicators along the way, suggesting other paths and search devices they might try. Couldn’t that make this, actually, an interesting search?

Having made the general point about giving the searcher an orientation that feels like moving though the real world, in the remainder of my talk, I want to make four more specific points about interface and search design for information systems.

[SLIDE 46 four points]

I’ll talk in some detail about the first point, and then do a hand-wave for the last three and give you some references where you can read more about them.

1. Design for true browsing, not scanning
2. Docking
3. Simple vs. complex questions
4. Cuing search to density of information in the search landscape

**Design for True Browsing, not Scanning**

• First, let us design for true browsing, not just scanning. What is generally called a browsing capability in most online systems is actually only a scanning capability. You see a page with entries on it; you can then scan down the page. Scanning is actually a physically distinct visual operation from browsing. Scanning is a disciplined, fast, overview. Your eyes don’t land anywhere; they skim.

That’s not how we browse. Think of standing in front of a magazine stand at the airport.

[SLIDE 47]

You do not scan systematically left to right, or up to down. This fellow doesn’t go up to the magazine stand and scan left to right or top to bottom. That’s the way you do it online, but that’s not the way you do it in the real world. In real life, at the magazine stand, you walk up. Something catches your eye over to the left. You see that it is a magazine with a cover story that interests you. You pick up the magazine and flip to the page where the story starts. Ummm, not so interesting after all. You put it back down, and then notice a mystery by one of your favorite authors. You grab it. This will be great for the plane. You look around a bit more, but don’t see anything particularly interesting, so you walk away to pay for the book.

Normal browsing, I argue, consists of four stages in miniature. They can all happen very quickly, but we go through them repeatedly.

[SLIDE 48 how we browse]

• Acquire a field of vision.

• Notice something within the field of vision that interests us.

• Pick the thing up, and/or view it more closely. Just like Glorg looked at the mushroom, or G.L. Org noticed a book of interest.

• Keep the object (physically or conceptually) or abandon it, then move on...

That’s what Glorg and G.L. Org are doing in their worlds. Ah, there’s a mushroom. Oh, there’s that book. We move on, and acquire another field of vision, and so on, ad infinitum. Humans now and in time past, are viewing the world from the standpoint of affordances, both positive and negative. Affordances are the things the environment affords to us, good and bad. A bit of food over there, a scary enemy over here, a cliff we could fall off of—that’s a REALLY negative affordance. Those mushrooms are edible; that bear with the scar on its paw is dangerous.

Current information systems, on the other hand, are not really designed for browsing. They are full of one-dimensional lists, instead of the two- and three-dimensional experience we have in life. In real life, we just relax and let the “environment” speak to us, because we have subliminal awareness of many potential physical and social affordances all the time, as we go through life. What if we could design an information system in the computer that would speak to us, the way the world often does in real life?

In my paper on browsing, I drew from the psychological research literature to argue that actual vision is two-stage. This is what the psychologists say, not I. In the first stage, we process very generally and crudely. We can do this fast and can sense objects likely to be of interest to us. Then we process in a second stage where we use much more brain power on a much narrower field of vision to figure out what we are actually looking at.

The first stage is massively parallel; that is, a wide area is viewed *all at once,* not in a smooth scan from one side to the other. The output from this initial glimpse, namely detection of possible points of interest in the visual scene, leads to a second stage where a point or points of interest is processed more intensely and with more sophisticated mental capabilities, such as the ability to recognize faces, or to read language. These latter capabilities take up lots of processing space in the brain. “There is not enough room in the skull for all of the neural hardware that would be required to perform all visual functions at all locations in the visual field at the same time...” (Wolfe, 1994, p. 202) In other words, the sophisticated cognitive processing takes up so much processing power that it can be applied to only a small segment of the visual field at a time.

Being able to carry out this two-stage vision is obviously crucial for survival. You can’t focus intensely on a little slice of your visual field, then another little slice of your visual field, twenty times over until you have scanned the whole field. You’d be eaten by a wild animal long before you reached the other side in your viewing. Instead, you have the big glance, with just enough crude processing power to cue you to things of possible interest, possible affordances. The output from this initial glimpse, namely detection of possible points of interest in the visual scene, leads to a second stage where a point or points of interest is processed more intensely and with more sophisticated mental capabilities, such as the ability to recognize faces, or read language.

So, the first two stages in my description of browsing actually correspond to the first two stages of human vision of a scene. Next, we interact with what we are looking at (third stage), then make a decision whether to keep or move on (fourth stage).

We walk through life; we notice something, we take a look at it; we notice something else, and so on. That’s how real browsing works. Why can’t we do that in an information system?

[SLIDE 49] video game

Video game players do it all the time. If they don’t notice the sniper over in the upper right-hand corner, they are shot down.

**Docking**

What we discover when searching for information is that there is frequently not a perfect match between what we want to know and what is actually out there. Obviously, if we knew all that we want to know, we wouldn’t need to search for the information. So, there is something we don’t know, and we have to specify the edges around that gap. Those edges can be pretty rough. We have to say what is IN the gap—but we don’t know what is in the gap, or we wouldn’t be searching. So, by definition, we are not able to perfectly specify in advance what it is that we want in many cases. As designers, we’ve got to think through the implications of this for actual search.

Instead, there needs to be a process I call “docking.” You can’t drive the boat at 80 miles an hour up to the dock and then hit the brakes, ending up precisely two inches from the dock.

Tackling questions of any complexity is more like penetrating a mysterious tangle of ideas, words, and thoughts—like this on the cover of one of my books.

[SLIDE 50] Bates book cover

[SLIDE 51] Docking references

I’ve picked these names because they show that over 50 years of research in this matter, we keep bumping into the docking problem again and again and again. Each of these references tackles the problem from a different perspective, but they each reinforce each other.

Each of these references tackles this docking question in a different way, but the core problem is still the same. *Anyone who has even studied information seeking in any detail makes this same discovery*. Trust us! It’s true! It is an ILLUSION to think that we are correct in our initial assumptions about what it is that we actually need to know. For questions of any complexity, you’ve got to negotiate or interact your way to the actual information you want.

**Simple vs. Complex Questions**

I haven’t the time to develop the argument in full, but there is, in fact, a difference between simple and complex questions. The data suggest that about 55-60 percent of the questions people have are what we can call simple questions, and can be readily answered without problems. The Google interface is well-suited for responding to these simple questions.

[SLIDE 52 Google interface]

On the other hand, the other 40-45 percent of questions people have are of the complex kind—like this.

[SLIDE 53] Bates book cover.

Here is where you can read about the simple vs. complex question issue.

[SLIDE Simple vs. complex]

I believe that the immersive approach that I’m proposing here will allow people, by interacting

with various interconnected elements of the question they are interested in, to be better able to find their way to the true answer that they need, not just the superficially isomorphic answer.

Because Google works most of the time, we don’t recognize the underlying failures and inadequacies in, roughly, 40-45 percent of the queries. I make this argument in more detail in this source.

[SLIDE 54 simple vs. complex]

**Matching Search Techniques to Information Densities in the Landscape**

One of the ironies of the vast literature on searching and information system design for searching is that we almost never talk about *where the information is in the information landscape, namely, its distribution, and its densities in different locations.* We do say things like trying to “pick the low-hanging fruit” for dense areas, and searching for a “needle in a haystack” in sparse areas. But these are never connected to any underlying theory about how information is distributed, and therefore, how best to search for it. For some ideas, see this reference:

[SLIDE 55 Matching search method]

**SUMMARY**

I could say so much more about all of this, but I’ll stop now and summarize what I have been saying today, so we can have some discussion:

[SLIDE 56 Summary]

* Make full use of our inborn propensity to browse our environment and learn through “wallpapering.”
* Design *immersive* walking-through-life search model rather than, or in addition to. a desktop *command* model for information searching.
* Design for docking for the 40-45 percent of questions that are complex and often answered erroneously without a “docking” process.

• Design to make it easy to use various search techniques that each match the actual information densities in resources.

[SLIDE 57 books]

[SLIDE 58 end of road]